Nutrition and Well-Being A to Z

Nutrition and Well-Being A to Z

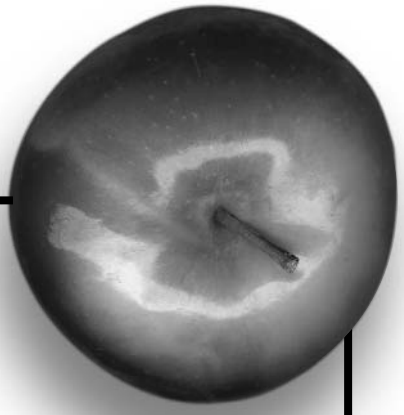
EDITORIAL BOARD

EDITORIAL AND PRODUCTION STAFF

Ray Abruzzi, Mark Drouillard, *Project Editors*
Peter Jaskowiak, *Copyeditor*
Dorothy Bauhoff, Jessica Hornik Evans, *Proofreaders*
Wendy Allex, *Indexer*
Marc Borbely, Justin Crawford, Tom Crippen, Victor Inzunza, Paula Kepos, Richard Robinson, *Editorial Support*
Michelle Dimercurio, *Senior Art Director*
Wendy Blurton, *Senior Manufacturing Specialist*
Shalice Shah-Caldwell, *Permissions Specialist*
Denay Wilding, *Image Acquisition Editor*, *Imaging and Multimedia Content*
Lezlie Light, *Imaging Coordinator*, *Imaging and Multimedia Content*
Randy Bassett, *Imaging Supervisor*, *Imaging and Multimedia Content*

Macmillan Reference USA

Frank Menchaca, *Vice President and Publisher*
Hélène Potter, *Director*, *New Product Development*



Nutrition and Well-Being A to Z

VOLUME 1 A–H

Delores C. S. James, Editor in Chief

Nutrition and Well-Being A to Z

Delores C. S. James, Editor in Chief

For more information contact
The Gale Group, Inc.
27500 Drake Rd.
Farmington Hills, MI 48331-3535
Or you can visit our Internet site at
http://www.gale.com

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Nutrition and well being A to Z / Delores C.S. James, editor in chief.
p. cm.
Includes bibliographical references and index.
ISBN 0-02-865707-1 (set hardcover)—ISBN 0-02-865708-X (volume 1)—
ISBN 0-02-865709-8 (volume 2)
1. Nutrition—Encyclopedias. 2. Health—Encyclopedias.
I. James, Delores C.S., 1961–

RA784.N838 2004
613.2'03—dc22 2004006088

This title is also available as an e-book
ISBN 0-02-865990-2 (set)
Contact your Gale sales representative for ordering information

Printed in the United States of America
10 9 8 7 6 5 4 3 2 1

Some images contained in the original version of this book are not available for inclusion in the eBook.

Table of Contents

Volume 1

Table of Contents v
Preface ix
Topical Outline xi
For Your Reference xv
Contributors xxi

Addiction, Food 1
Additives and Preservatives 1
Adolescent Nutrition 4
Adult Nutrition 7
African Americans, Diet of 10
Africans, Diets of 15
Aging and Nutrition 20
Alcohol and Health 23
Allergies and Intolerances 26
Alternative Medicines and Therapies 30
American Dietetic Association 34
American Public Health Association 35
American School Food Service Association 35
American School Health Association 35
Amino Acids 36
Anemia 38
Anorexia Nervosa 41
Anthropometric Measurements 42
Antioxidants 42
Appetite 44
Arteriosclerosis 45
Artificial Sweeteners 46
Asian Americans, Diets of 48
Asians, Diets of 52
Atherosclerosis 59
Baby Bottle Tooth Decay 59
Battle Creek Sanitarium, Early Health Spa 60
Beikost 62
Beriberi 62
Beta-Carotene 62
Bezoars 63
Binge Eating 63
Bioavailability 64
Biotechnology 64
Body Fat Distribution 68
Body Image 69
Body Mass Index 71
Breastfeeding 74
Brillat-Savarin, Jean Anthelme 78
Bulimia Nervosa 79
Caffeine 80
Calcium 83
Calorie 87
Cancer 87
Carbohydrates 93
Cardiovascular Diseases 99
Careers in Dietetics 104
Caribbean Islanders, Diet of 107
Carotenoids 112
Central Americans and Mexicans, Diets of 113
Central Europeans and Russians, Diets of 117
Childhood Obesity 121
College Students, Diets of 123
Commodity Foods 127
Comprehensive School Health Program 130
Convenience Foods 132
Corn- or Maize-based Diets 133
Cravings 136
Cultural Competence 139
Dehydration 142

Diabetes Mellitus 143
Diarrhea 149
Diet 151
Dietary Assessment 152
Dietary Guidelines 153
Dietary Reference Intakes 155
Dietary Supplements 155
Dietary Trends, American 159
Dietary Trends, International 162
Dietetic Technician, Registered (DTR) . . 166
Dietetics 166
Dieting 167
Dietitian 168
Digestion and Absorption 169
Disaster Relief Organizations 173
Eating Disorders 176
Eating Disturbances 182
Eating Habits 186
Emergency Nutrition Network 189
Ergogenic Aids 189
Exchange System 193
Exercise 198
Exercise Addiction 201
Expanded Food and Nutrition Education Program 202
Fad Diets 203
Failure to Thrive 206
Famine 207
Fast Foods 209
Fasting 210
Fat Substitutes 211
Fats 214
Female Athlete Triad 219
Fetal Alcohol Syndrome 220
Fiber 221
Food Aid for Development and the World Food Programme 223
Food and Agriculture Organization (FAO) 224
Food Guide Pyramid 225
Food Insecurity 228
Food Labels 231
Food Safety 235
Fortification 239
French Paradox 239
Functional Foods 240
Funk, Casimir 244
Generally Recognized as Safe (GRAS) . . . 245
Genetically Modified Foods 245
Glisson, Francis 249
Global Database on National Nutrition Policies and Programs 249
Glycemic Index 250
Goiter 252
Goldberger, Joseph 253
Graham, Sylvester 254
Grazing 256
Greeks and Middle Easterners, Diet of . . . 256
Green Revolution 261
Growth Charts 262
Growth Hormone 262
Health 263
Health Claims 263
Health Communication 266
Health Education 266
Health Promotion 267
Healthy Eating Index 267
Healthy People 2010 Report 269
Heart Disease 271
Hispanics and Latinos, Diet of 275
HIV/AIDS 279
Homelessness 282
Hunger 287
Hyperglycemia 287
Hypertension 288
Hypoglycemia 292

Glossary 293
Index 309

Volume 2

Table of Contents v
Preface ix
Topical Outline xi
For Your Reference xv
Contributors xxi

Illnesses, Food-Borne 1
Immune System 4
Inborn Errors of Metabolism 4
Infant Mortality Rate 7
Infant Nutrition 8
Infection 12
Insulin 12
Irradiation 13
Isoflavones 14

Johnson, Howard 14
Kellogg, John Harvey 16
Kroc, Ray 18
Kwashiorkor 20
Lactose Intolerance 21
Lay Health Advisor 23
Lead Poisoning 23
Legumes 27
Life Expectancy 28
Lipid Profile 28
Low Birth Weight Infant 31
Macrobiotic Diet 31
Malnutrition 33
Marasmus 36
Marketing Strategies 37
Mastitis 41
Maternal Mortality Rate 42
Meals On Wheels 42
Meat Analogs 42
Medical Nutrition Therapy 43
Mellanby, Edward 46
Menopause 47
Men's Nutritional Issues 51
Metabolism 54
Minerals 58
Mood-Food Relationships 64
National Academy of Sciences (NAS) 67
National Health and Nutrition Examination Survey (NHANES) 68
National Institutes of Health (NIH) 73
Native Americans, Diet of 78
Nongovernmental Organization (NGO) 82
Northern Europeans, Diet of 83
Nutrient Density 87
Nutrient-Drug Interactions 88
Nutrients 90
Nutrition 95
Nutrition Education 96
Nutrition Programs in the Community . . . 96
Nutritional Assessment 99
Nutritional Deficiency 102
Nutritionist 104
Obesity 105
Omega-3 and Omega-6 Fatty Acids 108
Oral Health 110
Oral Rehydration Therapy 113
Organic Foods 113
Organisms, Food-Borne 117
Osteomalacia 122
Osteopenia 122
Osteoporosis 123
Overweight 125
Pacific Islander Americans, Diet of 126
Pacific Islanders, Diet of 128
Pasteur, Louis 132
Pasteurization 133
Pauling, Linus 133
Pellagra 135
Pemberton, John S. 135
Pesticides 137
Phenylketonuria (PKU) 137
Phytochemicals 138
Pica 138
Plant-Based Diets 138
Popular Culture, Food and 139
Pregnancy 142
Premenstrual Syndrome 147
Preschoolers and Toddlers, Diet of 150
Probiotics 154
Protein 155
Quackery 160
Recommended Dietary Allowances 164
Refugee Nutrition Information System (RNIS) 164
Regional Diets, American 166
Regulatory Agencies 170
Religion and Dietary Practices 174
Rice-based Diets 179
Rickets 183
Rosenstein, Nils Rosén von Satiety 187
Scandinavians, Diet of 187
School-Aged Children, Diet of 190
School Food Service 194
Scurvy 197
Small for Gestational Age 197
Smoking 198
Society for Nutrition Education 200
South Americans, Diet of 200
Southern Europeans, Diet of 204
Soy 207
Space Travel and Nutrition 210
Sports Nutrition 215
Stark, William 219
Sustainable Food Systems 220
Toxemia 223

Tulp, Nicholaas 223
Underweight 225
United Nations Children's Fund (UNICEF) 225
Vegan 229
Vegetarianism 229
Vitamins, Fat-soluble 232
Vitamins, Water-soluble 238
Waist-to-Hip Ratio 245
Water 245
Weight Loss Diets 248
Weight Management 250
Wellness 253
White, Ellen G. 254
Whole Foods Diet 255
WIC Program 255
Wilson, Owen 258
Women's Nutritional Issues 259
World Health Organization (WHO) 262
Xerophthalmia 264
Yo-Yo Dieting 264

Glossary 267
Index 283

Preface

Nutrition is one of the most important factors that impact health in all areas of the lifecycle. Pregnant women need adequate food and health care to deliver a healthy baby who has a good birth weight and a fighting chance for survival. In many regions of the world, the infant mortality rate is very high, meaning that many infants will not live to see their first birthday. Breastfeeding is the ideal method of feeding and nurturing infants, because breast milk contains many immunologic agents that protect the infant against bacteria, viruses, and parasites. Yet, less than 40 percent of infants worldwide are exclusively breastfed (no other food or drink, not even water) for the first four months of life. Children need adequate nutrition to develop and grow to their full potential.

Malnutrition, both undernutrition and overnutrition, is at an all time high, with close to one-third of the world's children suffering from it. The number of undernourished people in the world continues to increase because of little or no progress to reduce poverty. Thousands of children die daily from hunger and its effects, even in technologically advanced countries. Without adequate nutrition, a person's cognitive ability is diminished, which adversely affects their ability to get a good paying job and contribute to their local economy. Paradoxically, childhood and adult obesity in many parts of the developed world are also near epidemic proportions. There are 300 million obese people in the world. In the United States, about 34 percent of Americans are overweight and 30.5 percent are obese.

Life expectancy has increased in many countries and the population of older adults is growing at an unprecedented rate in the United States and other technologically advanced countries. In the United States the average life expectancy is 70, while globally, the average rose to 67 years in 1998, up from 61 in 1980. These countries are unsure of how they will provide adequate health care for this growing segment of the population. Cardiovascular disease (coronary heart disease, hypertension, stroke) and cancer are top killers in many countries and HIV/AIDS continue to ravage our societies, taking individuals in the productive years of their lives.

Arrangement of the Material

Nutrition and Well-Being A to Z is a two-volume set that provides timely information on the personal, cultural, and global issues that affect (or have an impact on) health and nutritional status. Users will find detailed coverage of topics covered in general nutrition, food science, and personal and

family courses. This encyclopedia explains fundamental concepts such as amino acids, cutting-edge ideas such as functional foods, social issues such as food insecurity, and political issues such as bioterrorism.

The set was also designed to meet consumer needs. Users will be able to spot a quack health-care provider, discriminate between reliable and unreliable health claims, as well as understand the role of government in keeping food safe. The set also profiles individuals who have made a social, historical, or scientific impact on health, nutrition, and food trends. Most entries are written from a global perspective, and dietary patterns from different regions of the world are discussed. Many professional health organizations are described.

The information in *Nutrition and Well-Being A to Z* is clearly presented and easy to find. Professionals in the field of nutrition, dietetics, food science, agriculture, medicine, health education, and public health wrote with the student in mind. Students and teachers can use the set to reinforce classroom topics on food, nutrition, and health, and to expand discussions on special or new topics. The extensive use of illustrations enhances the learning of the material. Entries are arranged alphabetically and an extensive cross-referencing system encourages the user to further explore other entries. All topics in a volume can be found in the index at the back of the book.

Acknowledgements and Thanks

A project of this magnitude would not be possible without the dedication and hard work of many people. I wish to thank the associate editors, Dr. Catherine Christie and Dr. Ranjita Misra, for the many hours they spent recruiting authors and editing entries. Thank you for your timely turnaround of the materials. The project would not have been possible without the many authors who wrote, and sometimes rewrote, the entries. Thank you for sharing your expertise and time. Amanda Foote, Senior Secretary in the Department of Health Science Education, was extremely valuable in copying and mailing the edited materials to the publishers. I wish to thank the many people at Macmillan Reference USA and the Gale Group for conceiving the project and providing direction throughout the entire project, especially the copyeditors and illustrators. I also send special thanks to Mr. Raymond Abruzzi.

Delores C. S. James

Topical Outline

American Dietary Habits

African Americans, Diet of
Asian Americans, Diets of
Dietary Trends, American
Hispanics and Latinos, Diet of
Native Americans, Diet of
Pacific Islander Americans, Diet of
Regional Diets, American

Biographies

Battle Creek Sanitarium
Brillat-Savarin, Jean Anthelme
Funk, Casimir
Glisson, Francis
Goldberger, Joseph
Graham, Sylvester
Johnson, Howard
Kellogg, John Harvey
Krock, Ray
Mellanby, Edward
Pasteur, Louis
Pauling, Linus
Pemberton, John S.
Rosenstein, Nils Rosén von
Stark, William
Tulp, Nicholaas
White, Ellen G.
Wilson, Owen

Body Function and Processes

Digestion and Absorption
Immune System
Insulin
Metabolism

Dieting, Weight Management, Exercise, Eating Disorders

Addiction, Food
Anorexia Nervosa
Appetite
Binge Eating
Body Image
Bulimia Nervosa
Cravings
Diet
Dieting
Eating Disorders
Eating Disturbances
Eating Habits
Ergogenic Aids
Exercise
Exercise Addiction
Fad Diets
Female Athlete Triad
Grazing
Mood-Food Relationships
Pica
Satiety
Sports Nutrition
Weight Loss Diets
Weight Management
Yo-Yo Dieting

Diseases and Disorders

Arteriosclerosis
Atherosclerosis
Bezoars
Cancer
Cardiovascular Disease
Diabetes Mellitus
Heart Disease
HIV/AIDS
Hyperglycemia
Hypertension
Hypoglycemia
Obesity

Food Habits, Trends, and Alternative Choices

Alternative Medicines and Therapies
Fat Substitutes
Legumes
Macrobiotic Diet
Plant-Based Diets
Popular Culture, Food and
Quackery
Soy
Vegan
Vegetarianism
Whole Foods Diet

Food Industry, Technology, and Food Safety

Additives and Preservatives
Artificial Sweeteners
Biotechnology
Commodity Foods
Convenience Foods
Fast Foods
Fat Substitutes
Food Safety
Fortification
Generally Recognized as Safe
Genetically Modified Foods
Green Revolution
Illnesses, Food-Borne
Irradiation
Marketing Strategies
Meat Analogs
Organic Foods
Organisms, Food-Borne
Pasteurization
Pesticides
Probiotics
Regulatory Agencies

Space Travel and Nutrition
Sustainable Food Systems

Health Programs and Organizations

American Dietetic Association
American Public Health Association
American School Food Service Association
American School Health Association
Comprehensive School Health Program
Disaster Relief Organizations
Emergency Nutrition Network
Expanded Food and Nutrition Education Program (EFNEP)
Food Aid for Development and the World Food Programme
Food and Agriculture Organization (FAO)
Global Database on National Nutrition Policies and Programmes
Meals On Wheels
National Academy of Sciences (NAS)
National Institutes of Health (NIH)
Nongovernmental Organization (NGO)
Nutrition Programs in the Community
Refugee Nutrition Information System (RNIS)
School Food Service
Society for Nutrition Education
United Nations Children's Fund (UNICEF)
WIC Program
World Health Organization (WHO)

Health Risks and Health Assessment

Alcohol and Health
Allergies and Intolerances
Anthropometric Measurement
Body Fat Distribution
Body Mass Index
Caffeine
Dehydration
Diarrhea
Dietary Assessment
Fasting
Food Insecurity
Growth Charts
Homelessness
Hunger
Infection
Lead Poisoning
Lipid Profile
Malnutrition
Nutrient-Drug Interactions
Nutritional Assessment
Nutrient Density
Nutritional Deficiency
Oral Rehydration Therapy
Overweight
Smoking
Underweight
Waist-to-Hip Ratio

International Dietary Habits

Africans, Diets of
Asians, Diets of
Caribbean Islanders, Diets of
Central Americans and Mexicans, Diets of
Central Europeans and Russians, Diets of
Corn- or Maize-based Diets
Dietary Trends, International
Famine
French Paradox
Greeks and Middle Easterners, Diet of
Northern Europeans, Diet of
Pacific Islanders, Diet of
Religion and Dietary Practices
Rice-based Diets
Scandinavians, Diet of
South Americans, Diet of
Southern Europeans, Diet of

Nutrients and Chemical Properties of Food

Amino acids
Antioxidants
Beta-Carotene
Bioavailability
Carbohydrates
Calcium
Calorie
Carotenoids
Fats
Fiber
Functional foods
Glycemic Index
Isoflavones
Minerals
Nutrients
Omega-3 and Omega-6 Fatty Acids
Phytochemicals
Protein
Vitamins, Fat-Soluble
Vitamins, Water-Soluble
Water

Nutritional Deficiencies

Anemia
Beriberi
Goiter
Kwashiorkor
Lactose Intolerance
Marasmus
Osteoporosis
Osteomalacia
Osteopenia
Pellagra
Rickets
Scurvy
Xerophthalmia

Nutrition and the Life Cycle

Adolescent Nutrition
Adult Nutrition
Aging and Nutrition
Baby Bottle Tooth Decay
Beikost
Breastfeeding
Childhood Obesity
College Students, Diets of
Failure to Thrive
Fetal Alcohol Syndrome
Growth Hormone
Inborn Errors of Metabolism
Infant Mortality Rate
Infant Nutrition
Life Expectancy
Low Birth Weight Infant
Mastitis
Maternal Mortality Rate
Menopause
Men's Nutritional Issues
Phenylketonuria (PKU)
Pregnancy
Premenstrual Syndrome
Preschoolers and Toddlers, Diet of
School-Aged Children, Diet of
Small for Gestational Age
Toxemia
Women's Nutritional Issues

Nutrition, Health, and Professional Issues

Careers in Dietetic
Cultural Competence
Dietetics

Dietetic Technician, Registered (DTR)
Dietitian
Health
Health Communication
Health Education
Health Promotion
Lay Health Advisor
Medical Nutrition Therapy
Nutrition
Nutrition Education
Nutritionist
Oral Health
Wellness

Nutrition Standards, Guidelines, Reports

Dietary Guidelines
Dietary Reference Intakes
Dietary Supplements
Exchange System
Food Guide Pyramid
Food Labels
Health Claims
Healthy Eating Index
Healthy People 2010 Report
National Health and Nutrition Examination Survey (NHANES)
Recommended Dietary Allowances (RDA)

This page intentionally left blank

For Your Reference

TABLE 1. SELECTED METRIC CONVERSIONS

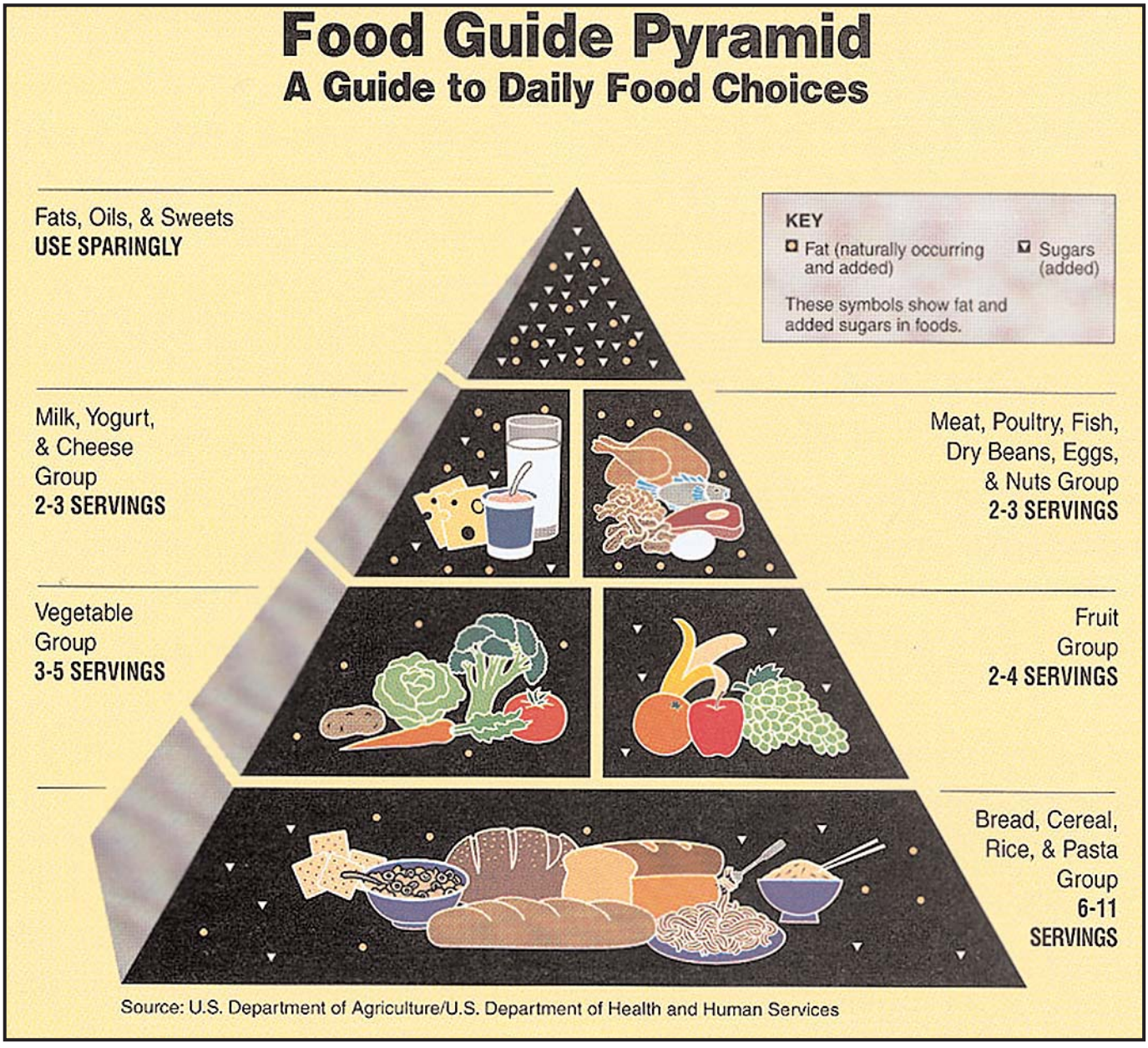
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Temperature		
Celsius (˚C)	1.8 (˚C) +32	Fahrenheit (˚F)
Celsius (˚C)	˚C +273.15	Kelvin (K)
degree change (Celsius)	1.8	degree change (Fahrenheit)
Fahrenheit (˚F)	[(˚F) −32] / 1.8	Celsius (˚C)
Fahrenheit (˚F)	[(˚F −32) / 1.8] +273.15	Kelvin (K)
Kelvin (K)	K −273.15	Celsius (˚C)
Kelvin (K)	1.8(K −273.15) +32	Fahrenheit (˚F)

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Distance/Length		
centimeters	0.3937	inches
kilometers	0.6214	miles
meters	3.281	feet
meters	39.37	inches
meters	0.0006214	miles
microns	0.000001	meters
millimeters	0.03937	inches

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Capacity/Volume		
cubic kilometers	0.2399	cubic miles
cubic meters	35.31	cubic feet
cubic meters	1.308	cubic yards
cubic meters	8.107×10^{-4}	acre-feet
liters	0.2642	gallons
liters	33.81	fluid ounces

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Area		
hectares (10,000 square meters)	2.471	acres
hectares (10,000 square meters)	107,600	square feet
square meters	10.76	square feet
square kilometers	247.1	acres
square kilometers	0.3861	square miles

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Weight/Mass		
kilograms	2.205	pounds
metric tons	2205	pounds
micrograms (μg)	10^{-6}	grams
milligrams (mg)	10^{-3}	grams
nanograms (ng)	10^{-9}	grams


Food Guide Pyramid
A Guide to Daily Food Choices
Fats, Oils, & Sweets
USE SPARINGLY
KEY
Fat (naturally occurring and added)
Sugars (added)
These symbols show fat and added sugars in foods.
Milk, Yogurt, & Cheese Group
2-3 SERVINGS
Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts Group
2-3 SERVINGS
Vegetable Group
3-5 SERVINGS
Fruit Group
2-4 SERVINGS
Bread, Cereal, Rice, & Pasta Group
6-11 SERVINGS
Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

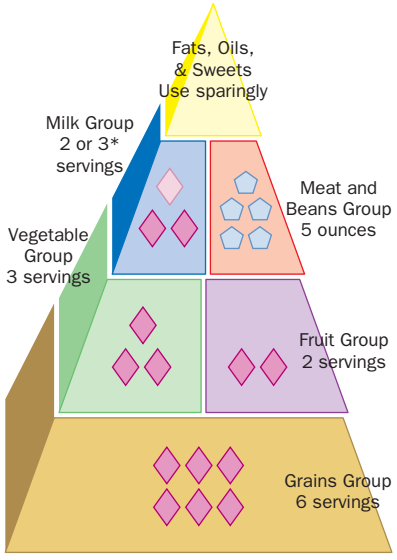
VITAMINS IN FOODS

Vitamin A	liver, carrots, kale, red peppers, milk, spinach, eggs, butter
Vitamin B_6	meat, whole grains, cabbage, peanuts, potatoes, soybeans, liver, fish, beans, milk
Vitamin B_{12}	liver, fish, eggs, milk
Vitamin B_9 (Folate)	tomatoes, spinach, beets, asparagus, potatoes, liver, wheat germ, soybeans, cabbage, whole grains, eggs, milk, meats
Vitamin C	tomatoes, potatoes, most fruits and vegetables
Vitamin D	milk, liver, fatty fish like herring, chicken skin, egg yolks
Vitamin E	most vegetable oils
Vitamin K	broccoli, turnip greens, lettuce, liver, cauliflower, spinach, cabbage, asparagus, Brussels sprouts
Thiamin	meats, whole grains, potatoes, fish, liver, legumes (like beans and peas)
Biotin	liver, soybeans, egg yolks, peanuts, cauliflower, carrots, oatmeal
Riboflavin	eggs, asparagus, liver, milk, fish, meat, whole grains
Pantothenic Acid	liver, fish, eggs, milk, whole grains, meats, legumes (like beans and peas)
Niacin	meats, whole grains, eggs, fish, milk, legumes (like beans and peas)

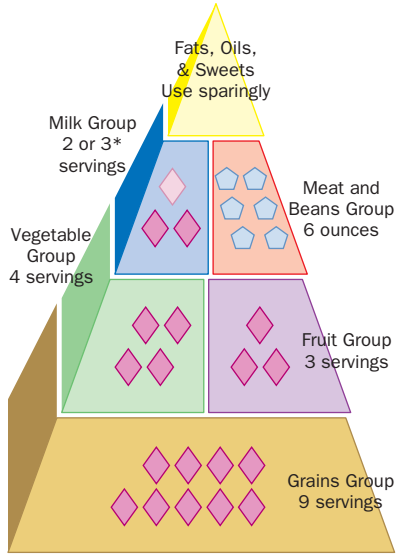
SOURCE: Adapted from "The Vitamins" by G. F. Coombs Jr.

RECOMMENDED PYRAMID SERVINGS FOR INDIVIDUALS

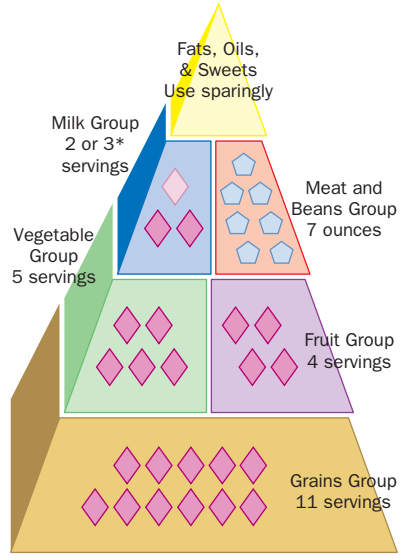
Children 2 to 6, most women, some older adults (about 1,600 calories)



Older children, teen girls, active women, most men (about 2,200 calories)



Teen boys, active men (about 2,800 calories)



=1 serving *=1 ounce*

*Older children and teens 9 to 18 and adults over 50 need 3 servings from the Milk group. Others need 2 servings daily.

WHAT COUNTS AS A PYRAMID SERVING?

Grains Group
- 1 slice of bread
- About 1 cup of ready to eat cereal flakes
- ½ cup of cooked cereal, rice, or pasta

Vegetable Group
- 1 cup of raw leafy vegetables
- ½ cup of other vegetables—cooked or raw*
- ¾ cup of vegetable juice

Fruit Group
- 1 medium apple, banana, orange, pear
- ½ cup of chopped, cooked or canned fruit
- ¾ cup of fruit juice

Milk Group
- 1 cup of milk of yogurt
- 1½ ounces of natural cheese (such as Cheddar)
- 2 ounces of processed cheese (such as American)

Meat and Beans Group
The Pyramid recommends 2 to 3 servings for a total of 5 to 7 ounces. The following all count as 1 ounce equivalent:

- 1 ounce of cooked lean meat, poultry, or fish
- ½ cup of cooked, dry beans*
- ½ cup of tofu or 2½-ounce soyburger
- 1 egg
- 2 tablespoons of peanut butter
- ⅓ cup of nuts

*Dry beans, peas, and lentils can be counted as servings in either the Meat and Beans group of the Vegetable group. As a vegetable, ½ cup of cooked, dry beans counts as 1 serving. As a meat substitute, ½ cup of cooked, dry beans counts as 1 ounce of meat.

SOURCE: Adapted from *Home and Garden Bulletin* 267–3. USDA.

BODY MASS INDEX TABLE

	Normal						Overweight					Obese										Extreme Obesity															
BMI	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**
Height (inches)	**Body Weight (pounds)**																																			
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	282	299	306	313	320	327	334	341	348	355	362	369	376
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	381	399	407	415	423	431
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

SOURCE: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.*

This page intentionally left blank

Contributors

Karen Ansel
Walnut Creek, California

Katherine Beals
Ball State University
Muncie, Indiana

Mindy Benedict
Ponte Vedra Beach, Florida

Frances Berg
Healthy Weight Network and University of North Dakota School of Medicine
Hellinger, North Dakota

Linda B. Bobroff
University of Florida
Gainesville, Florida

Leslie Bonci
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania

Susan T. Borra
International Food Information Council Foundation
Washington, DC

Karen Bryla
University of Kentucky
Lexington, Kentucky

Lori Keeling Buhi
Bryan-College Station Community Health Center
Bryan, Texas

Slande Celeste
University of Florida
Gainesville, Florida

Nilesh Chatterjee
Texas A&M University
College Station, Texas

Sara Chelland
Department of Nutrition, Food and Exercise Science
Tallahassee, Florida

Catherine Christie
University of North Florida
Jacksonville, Florida

Sonja Connor
Portland, Oregon

William Connor
Oregon Health Sciences University
Portland, Oregon

Marilyn Dahl
Preferred Nutrition Services
Jacksonville Beach, Florida

Raju Das
University of Dundee
Dundee, UK

Ruth DeBusk
Private Practice
Tallahassee, Florida

Sharon Doughten
Cuyahoga Community College
Cleveland, Ohio

Karen Drummond
Yardley, Pennsylvania

M. Cristina Flaminiano Garces
University of North Carolina at Chapel Hill

Beth Fontenot
McNeese State University
Lake Charles, Louisiana

John P. Foreyt
Baylor College of Medicine
Houston, Texas

Mohammed Forouzesh
California State University at Long Beach
Long Beach, California

Marion J. Franz
Nutrition Concepts by Franz, Inc.
Minneapolis, Minnesota

Marjorie Freedman
San Jose, California

Keri M. Gans
New York, New York

Chandak Ghosh
Harvard Medical School
Boston, Massachusetts

Gita C. Gidwani
Johns Hopkins University
Baltimore, Maryland

Emil Ginter
Institute of Preventive and Clinical Medicine
Bratislava, Slovak Republic

Diane Golzynski
California State University
Fresno, California

Leslene E. Gordon
Pasco County Health Department Nutrition Division
New Port Ritchey, Florida

Marcus Harding
International Medical Volunteers Association
Woodville, Massachusetts

Karen Hare
Nutrition Services, Inc.
Fort Collins, Colorado

Beth Hensleigh
Texas A&M University
College Station, Texas

Kirsten Herbes
University of Florida
Gainesville, Florida

Susan Himburg
Florida International University
Miami, Florida

Lenore S. Hodges
Florida Hospital
Orlando, Florida

Steve Hohman
Ohio University
Athens, Ohio

Elissa M. Howard-Barr
Coastal Carolina University
Conway, South Carolina

Delores C. S. James
University of Florida
Gainesville, Florida

Sunitha Jasti
University of North Carolina,
Chapel Hill, North Carolina

Warren B. Karp
The Medical College of Georgia
Augusta, Georgia

Susan Kim
Williams College
Williamstown, Massachusetts

Seema Pania Kumar
Alexandria Primary Care Associates
Alexandria, Virginia

M. Elizabeth Kunkel
Clemson University
Clemson, South Carolina

Julie Lager
Texas A&M University
College Station, Texas

Jens Levy
University of North Carolina
Chapel Hill, North Carolina

Kheng Lim
University of Medicine and Dentistry of New Jersey
Camden, New Jersey

Nadia Lugo
University of Florida
Gainesville, Florida

Teresa Lyles
University of Florida
Gainesville, Florida

Carole Mackey
Agency for Health Care Administration
St. Petersburg, Florida

Amy N. Marlow
New York, New York

Cindy Martin
Texas A&M University
College Station, Texas

Toni Martin
Duval County Health Department
Jacksonville, Florida

Kiran Misra
Texas A&M University
College Station, Texas

Ranjita Misra
San Diego State University
San Diego, California

Braxton D. Mitchell
University of Maryland
Baltimore, Maryland

Susan Mitchell
Practicalories, Inc.
Winter Park, Florida

Robert J. Moffatt
Florida State University
Tallahassee, Florida

Melissa Morris
University of Florida
Gainesville, Florida

Kweethai C. Neill
University of North Texas
Denton, Texas

Laura Nelson
Texas A&M University
College Station, Texas

Virginia Noland
University of Florida
Gainesville, Florida

Neelima Pania
New York University Hospital
New York, New York

Mary Parke
Duval County Health Department, UIC and Nutrition Program
Jacksonville, Florida

Isabel Parraga
Case Western Reserve University
Cleveland, Ohio

Gita Patel
Nutrition Consultant
Etna, New Hampshire

Nadine Pazder
Morton Plant Hospital
Clearwater, Florida

Judy E. Perkin
University of North Florida
Jacksonville, Florida

Jeffrey Radecki
Robert Wood Johnson Medical School
Piscataway, New Jersey

Sheah Rarback
University of Miami School Medicine
Miami, Florida

Catherine Rasberry
Texas A&M University
College Station, Texas

Barbara L. Rice
Enterprise Advisory Services, Inc.
Houston, Texas

Carlos Robles
University of the Virgin Islands

Judy Rodriguez
University of North Florida
Jacksonville, Florida

Kim Schenck
Colorado Springs, Colorado

Claire D. Schmelzer
Virginia Polytechnic Institute and State University
Blacksburg, Virginia
University of Kentucky
Lexington, Kentucky

Louise Schneider
Lorna Linda University
Lorna Linda, California

Jessica Schulman
University of Florida
Gainesville, Florida

Kyle Shadix
Art Institute of New York City

Jackie Shank
Southeast Nutrition Consultants
St. Augustine, Florida

Heidi J. Silver
National Policy and Resource Center on Nutrition and Aging
Miami, Florida

Donna Staton
International Medical Volunteers Association

Tanya Sterling
Duval County Health Department
Jacksonville, Florida

Milton Stokes
New York, New York

Lisa A. Sutherland
University of North Carolina
Chapel Hill, North Carolina

Marie Boyle Struble
College of Saint Elizabeth
Morristown, New Jersey

D. Michelle Swords
Gainesville, Florida

Patricia Thomas
San Antonio, Texas

Delores Truesdell
Florida State University
Tallahassee, Florida

Katherine Tucker
USDA/HNRCA at Tufts University
Boston, Massachusetts

Simin Vaghefi
University of North Florida
Jacksonville, Florida

Pauline Vickery
Suwannee River Area Health Education Center

Ruth Waibel
Ohio University
Athens, Ohio

Daphne C. Watkins
Texas A&M University
College Station, Texas

Sally Weerts
University of North Florida
Jacksonville, Florida

Paulette Weir
Elmont, New York

Katherine Will
Ohio University
Athens, Ohio

Heidi Williams
Gainesville, Florida

Addiction, Food

Food addiction is a nonmedical term that refers to a compulsion to eat specific foods, usually those that are high in sugar or starch. Although this term is used to describe intense cravings to seek out specific foods, these foods are not, in and of themselves, physically addictive in the way a drug might be. Instead, the need to pursue and consume these foods may be representative of a **psychological** disturbance, extreme **anxiety**, or emotional distress. SEE ALSO EATING DISORDERS; EATING DISTURBANCES.

Karen Ansel

psychological: related to thoughts, feelings, and personal experiences

anxiety: nervousness

Bibliography

Cassell, Dana, and Gleaves, David (2000). *The Encyclopedia of Eating Disorders*, 2nd edition. New York: Facts on File.

Additives and Preservatives

Additives are defined by the United States Food and Drug Administration (FDA) as "any substance, the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food." In other words, an additive is any substance that is added to food. Direct additives are those that are intentionally added to foods for a specific purpose. Indirect additives are those to which the food is exposed during processing, packaging, or storing. Preservatives are additives that inhibit the growth of **bacteria**, yeasts, and molds in foods.

bacteria: single-celled organisms without nuclei, some of which are infectious

Additives and preservatives have been used in foods for centuries. When meats are smoked to preserve them, compounds such as butylated hydroxyanisole (BHA) and butyl gallate are formed and provide both **antioxidant** and **bacteriostatic** effects. Salt has also been used as a preservative for centuries. Salt lowers the water activity of meats and other foods and inhibits bacterial growth. Excess water in foods can enhance the growth of bacteria, yeast, and fungi. Pickling, which involves the addition of acids such as vinegar, lowers the **pH** of foods to levels that retard bacterial growth. Some herbs and spices, such as curry, cinnamon, and chili pepper, also contain antioxidants and may provide **bactericidal** effects.

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

bacteriostatic: a state that prevents growth of bacteria

pH: level of acidity, with low numbers indicating high acidity

bactericidal: a substance that kills bacteria

Uses of Additives and Preservatives in Foods

Additives and preservatives are used to maintain product consistency and quality, improve or maintain nutritional value, maintain palatability and wholesomeness, provide **leavening**, control pH, enhance flavor, or provide color. **Food additives** may be classified as:

leavening: yeast or other agents used for rising bread

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

microorganisms: bacteria and protists; single-celled organisms

oxygen: O_2, atmospheric gas required by all animals

1. *Antimicrobial agents*, which prevent spoilage of food by mold or **microorganisms**. These include not only vinegar and salt, but also compounds such as calcium propionate and sorbic acid, which are used in products such as baked goods, salad dressings, cheeses, margarines, and pickled foods.
2. *Antioxidants*, which prevent rancidity in foods containing fats and damage to foods caused by **oxygen**. Examples of antioxidants include vitamin C, vitamin E, BHA, BHT (butylated hydroxytolene), and propyl gallate.
3. *Artificial colors*, which are intended to make food more appealing and to provide certain foods with a color that humans associate with a particular flavor (e.g., red for cherry, green for lime).
4. *Artificial flavors and flavor enhancers*, the largest class of additives, function to make food taste better, or to give them a specific taste. Examples are salt, sugar, and vanilla, which are used to complement the flavor of certain foods. Synthetic flavoring agents, such as benzaldehyde for cherry or almond flavor, may be used to simulate natural flavors. Flavor enhancers, such as monosodium glutamate (MSG) intensify the flavor of other compounds in a food.
5. *Bleaching agents*, such as peroxides, are used to whiten foods such as wheat flour and cheese.
6. *Chelating agents*, which are used to prevent discoloration, flavor changes, and rancidity that might occur during the processing of foods. Examples are citric acid, malic acid, and tartaric acid.
7. ***Nutrient** additives*, including **vitamins** and **minerals**, are added to foods during **enrichment** or **fortification**. For example, milk is **fortified** with **vitamin D**, and rice is enriched with thiamin, riboflavin, and **niacin**.
8. *Thickening and stabilizing agents*, which function to alter the texture of a food. Examples include the emulsifier lecithin, which, keeps oil and vinegar blended in salad dressings, and carrageen, which is used as a thickener in ice creams and low-calorie jellies.

nutrient: dietary substance necessary for health

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

fortification: addition of vitamins and minerals to improve the nutritional content of a food

fortified: altered by addition of vitamins or minerals

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

niacin: one of the B vitamins, required for energy production in the cell

Regulating Safety of Food Additives and Preservatives

Based on the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic (FD&C) Act of 1938, the FDA must approve the use of all additives. The manufacturer bears the responsibility of proving that the additive is safe for its intended use. The Food Additives Amendment excluded additives and preservatives deemed safe for consumption prior to 1958, such as salt, sugar, spices, vitamins, vinegar, and monosodium glutamate. These substances are considered "generally recognized as safe" (GRAS) and may be used in any food, though the FDA may remove additives from the GRAS list if safety concerns arise. The 1960 Color Additives Amendment to the FD&C Act required the FDA to approve synthetic coloring agents used in

The legendary longevity of some packaged foods such as Twinkies, is attributable in part to food additives that stabilize ingredients and prevent spoilage. Additives also enhance the nutrition, flavor, and consistency of foods. *[Photograph by Orlin Wagner. AP/Wide World Photos. Reproduced by permission.]*

foods, **drugs**, cosmetics, and certain medical devices. The Delaney Clause, which was included in both the Food Additives Amendment and Color Additives Amendment, prohibited approval of any additive that had been found to cause **cancer** in humans or animals. However, in 1996 the Delaney Clause was modified, and the commissioner of the FDA was charged with assessing the risk from consumption of additives that may cause cancer and making a determination as to the use of that additive.

drugs: substances whose administration causes a significant change in the body's function

cancer: uncontrolled cell growth

The FDA continually monitors the safety of all food additives as new scientific evidence becomes available. For example, use of erythrosine (FD&C Red No. 3) in cosmetics and externally applied drugs was banned

in 1990 after it was implicated in the development of thyroid tumors in male rats. However, the cancer risk associated with FD&C Red No. 3 is about 1 in 100,000 over a seventy-year lifetime, and its use in some foods, such as candies and maraschino cherries, is still allowed. Tartrazine (FD&C Yellow No. 5) has been found to cause dermatological reactions ranging from itching to hives in a small population subgroup. Given the mild nature of the reaction, however, it still may be used in foods.

Nitrites are also a controversial additive. When used in combination with salt, nitrites serve as antimicrobials and add flavor and color to meats. However, nitrite salts can react with certain **amines** in food to produce nitrosamines, many of which are known **carcinogens**. Food manufacturers must show that nitrosamines will not form in harmful amounts, or will be prevented from forming, in their products. The flavoring enhancer MSG is another controversial food additive. MSG is made commercially from a natural **fermentation** process using starch and sugar. Despite anecdotal reports of MSG triggering headaches or exacerbating **asthma**, the Joint Expert Committee on Food Additives of the United Nations Food and Agriculture Organization, the World Health Organization, the European Community's Scientific Committee for Food, the American Medical Association, and the National Academy of Sciences have all affirmed the safety of MSG at normal consumption levels.

In the United States, food additives and preservatives play an important role in ensuring that the food supply remains the safest and most abundant in the world. A major task of the FDA is to regulate the use and approval of thousands of approved food additives, and to evaluate their safety. Despite consumer concern about use of food additives and preservatives, there is very little scientific evidence that they are harmful at the levels at which they are used.

In Europe, food additives and preservatives are evaluated by the European Commission's Scientific Committee on Food. Regulations in European Union countries are similar to those in the United States. The Food and Agricultural Organization (FAO) of the United Nations and the World Health Organization (WHO) Expert Committee on Food Additives work together to evaluate the safety of food additives, as well as contaminants, naturally occurring **toxicants**, and residues of veterinary drugs in foods. Acceptable Daily Intakes (ADIs) are established on the basis of toxicology and other information. SEE ALSO ARTIFICIAL SWEETENERS; FAT SUBSTITUTES.

M. Elizabeth Kunkel
Barbara H. D. Luccia

nitrite: NO_2^-, used for preservatives

amine: compound containing nitrogen linked to hydrogen

carcinogen: cancer-causing substance

fermentation: reaction performed by yeast or bacteria to make alcohol

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

toxicant: harmful substance

The Discovery of Canning

During the late eighteenth century the French army was suffering from scurvy, malnourishment, and outright starvation, and the French government offered a prize of 12,000 francs to anyone who could discover a way to preserve food for the troops. Nicholas Appert, a candymaker, brewer, and baker, reasoned that he should be able to preserve food in bottles, like wine. After fourteen years of experimentation, he finally discovered that if he put food in glass jars reinforced with wire, sealed them with wax, and applied heat, the food didn't spoil. Appert was presented with the 12,000-franc prize by Napoleon himself. However, the secret of preserved food soon leaked to the English, who proceeded to invent the can, and the armies that faced off at Waterloo were both fortified by preserved rations.

—Paula Kepos

Bibliography

Branen, A. Larry (2002). *Food Additives*, 2nd edition. New York: Marcel Dekker.

Clydesdale, Fergus M. (1997). *Food Additives: Toxicology, Regulation, and Properties.* Boca Raton, FL: CRC Press.

Potter, Norman N., and Hotchkiss, Joseph H. (1995) *Food Science*, 5th edition. New York: Chapman & Hall.

Adolescent Nutrition

Adolescence is the transition period between childhood and adulthood, a time of life that begins at **puberty**. For girls, puberty typically occurs be-

puberty: time of onset of sexual maturity

tween ages 12 and 13, while for boys it occurs between ages 14 and 15. It is one of the fastest growth periods of a person's life. During this time, physical changes affect the body's nutritional needs, while changes in one's lifestyle may affect eating habits and food choices. Nutritional health during adolescence is important for supporting the growing body and for preventing future health problems.

Increased Nutritional Needs

The physical changes of adolescence have a direct influence on a person's nutritional needs. Teenagers need additional **calories**, **protein**, **calcium**, and **iron**.

calorie: unit of food energy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

tofu: soybean curd, similar in consistency to cottage cheese

Calories.

Adolescents need additional calories to provide **energy** for growth and activity. Boys ages 11 to 18 need between 2,500 and 2,800 calories each day. Adolescent girls need approximately 2,200 calories each day. This is a significant increase from childhood requirements. To meet these calorie needs, teens should choose a variety of healthful foods, such as lean protein sources, low-fat dairy products, whole grains, fruits, and vegetables.

Protein.

Protein is important for growth and maintenance of muscle. Adolescents need between 45 and 60 grams of protein each day. Most teens easily meet this requirement with their intake of beef, pork, chicken, eggs, and dairy products. Protein is also available from certain vegetable sources, including **tofu** and other soy foods, beans, and nuts.

Calcium.

Adequate calcium intake is essential for development of strong and dense bones during the adolescent growth spurt. Inadequate calcium intake during adolescence and young adulthood puts individuals at risk for developing **osteoporosis** later in life. In order to get the required 1,200 milligrams of calcium, teens are encouraged to consume three to four servings of calcium-rich foods each day. Good sources include milk, yogurt, cheese, calcium-fortified juices, and calcium-fortified cereals.

osteoporosis: weakening of the bone structure

Iron.

As adolescents gain muscle mass, more iron is needed to help their new muscle cells obtain **oxygen** for energy. A deficiency of iron causes **anemia**, which leads to **fatigue**, confusion, and weakness. Adolescent boys need 12 milligrams of iron each day, while girls need 15 milligrams. Good sources of iron include beef, chicken, pork, **legumes** (including beans and peanuts), enriched or whole grains, and leafy green vegetables such as spinach, collards, and kale.

oxygen: O_2, atmospheric gas required by all animals

anemia: low level of red blood cells in the blood

fatigue: tiredness

legumes: beans, peas, and related plants

Eating and Snacking Patterns

Adolescents tend to eat differently than they did as children. With afterschool activities and active social lives, teens are not always able to sit down for three meals a day. Busy schedules may lead to meal skipping, snacking throughout the day, and more eating away from home. Many teens skip breakfast, for example, but this meal is particularly important for getting enough energy to make it through the day, and it may even lead to better academic performance. When teens skip meals, they are more likely to grab fast food from a restaurant, vending machine, or convenience store. These foods are high in fat and sugar and tend to provide little nutritional value. In addition, eating too many fast foods can lead to weight gain and, in some cases, **diabetes** and **heart disease**.

diabetes: inability to regulate level of sugar in the blood

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Dietary decisions made in adolescence may have lasting health effects. For example, in the United States, more than 85 percent of teen girls and about 65 percent of teen boys do not include enough calcium in their diets. Such deficiency increases their chances of developing osteoporosis as adults. *[AP/Wide World Photos. Reproduced by permission.]*

Eating meals and snacking away from home puts the responsibility for good food choices right in adolescents' hands. Snacks should be low in both fat and added sugar. Some healthful snack ideas include fresh fruit, sliced vegetables with low-fat dip, low-fat yogurt, low-fat string cheese, peanut butter and crackers, baked chips, granola bars, and graham crackers. Juices, fruit drinks, and sodas are usually very high in calories from natural or added sugar, so they should be consumed in moderation. The Food Guide Pyramid is an appropriate guide for adolescents' food choices, even when snacking.

Potential Nutrition-Related Problems

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

Adolescents are at risk for **obesity**, obesity-related **chronic** diseases, and eating disorders.

Obesity, Diabetes, and Heart Disease.

All over the world, adolescent obesity is on the rise. This has led to an increase in obesity-related diseases like diabetes and heart disease. Experts believe this rise in obesity is due to lack of physical activity and an increase in the amount of fast food and "junk food" available to adolescents. Staying active and eating foods that are low in fat and sugar promote a healthy weight for teens.

Eating Disorders.

Adolescents tend to be very conscious of appearances and may feel pressure to be thin or to look a certain way. Fear of gaining weight may lead to overly restrictive eating habits. Some teens resort to self-induced vomiting or laxative use to control their weight. Both boys and girls are affected by eating disorders. Teens who suspect they have a problem with body image or eating habits should talk to a trusted adult.

High-Risk Groups

Certain groups of adolescents may be at risk for nutritional inadequacies.

Pregnant Teens.

When a teenager becomes pregnant, she needs enough **nutrients** to support both her baby and her own continued growth and physical development. If her nutritional needs are not met, her baby may be born with low birth weight or other health problems. For the best outcome, pregnant teens need to seek prenatal care and nutrition advice early in their pregnancy.

nutrient: dietary substance necessary for health

Athletes.

Adolescents involved in athletics may feel pressure to be at a particular weight or to perform at a certain level. Some young athletes may be tempted to adopt unhealthful behaviors such as crash dieting, taking supplements to improve performance, or eating unhealthful foods to fulfill their hearty appetites. A balanced nutritional outlook is important for good health and athletic performance.

Vegetarians.

A vegetarian **diet** can be a very healthy option. However, adolescents who follow a vegetarian diet, whether for religious or personal reasons, need to carefully plan their intake to get the protein and **minerals** they need. Strict vegetarians (those who do not eat eggs or dairy products), also known as **vegans**, may need nutritional supplements to meet their needs for calcium, vitamin B_{12}, and iron.

diet: the total daily food intake, or the types of foods eaten

mineral: an inorganic (non-carbon-containing) element, ion, or compound

vegan: person who consumes no animal products, including milk and honey

Conclusion

Adolescence is a time of growing up both physically and socially. During these years, the nutrition choices people make will affect not only their current health, but their future health as well. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; SCHOOL-AGED CHILDREN, DIET OF.

Amy N. Marlow

Bibliography

Bode, Janet (1999). *Food Fight: A Guide to Eating Disorders for Preteens and Their Parents.* New York: Aladdin Paperbacks.

Duyff, Roberta Larson (2002). *American Dietetic Association Complete Food and Nutrition Guide.* New York: Wiley.

Krizmanic, Judy (1999). *The Teen's Vegetarian Cookbook.* New York: Viking.

Adult Nutrition

The science of **nutrition** is dedicated to learning about foods that the human body requires at different stages of life in order to meet the nutritional needs for proper growth, as well as to maintain health and prevent disease. A baby is born with a very high requirement for **energy** and **nutrient** intake per unit of body weight to provide for rapid growth. The rate of growth is the highest during the first year and declines slowly after the age of two, with a corresponding decrease in nutrient and energy requirements. During **puberty**, however, **nutritional requirements** increase sharply until this period of fast growth is completed. Adulthood begins at about the age of fourteen or fifteen for girls, and eighteen or nineteen for boys.

nutrition: the maintenance of health through proper eating, or the study of same

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

nutrient: dietary substance necessary for health

puberty: time of onset of sexual maturity

nutritional requirements: the set of substances needed in the diet to maintain health

An adult individual needs to balance energy intake with his or her level of physical activity to avoid storing excess body **fat**. Dietary practices and food choices are related to **wellness** and affect health, fitness, weight

fat: type of food molecule rich in carbon and hydrogen, with high energy content

wellness: related to health promotion

management, and the prevention of **chronic** diseases such as **osteoporosis**, **cardiovascular** diseases, **cancer**, and **diabetes**.

For adults (ages eighteen to forty-five or fifty), weight management is a key factor in achieving health and wellness. In order to remain healthy, adults must be aware of changes in their energy needs, based on their level of physical activity, and balance their energy intake accordingly.

As teenagers reach adulthood, the basal energy needs for maintaining the body's **physiological** functions (**basal metabolic rate**, or BMR) stabilize, and so energy requirements also stabilize. BMR is defined as the energy required by the body to keep functioning. These functions include the pumping of blood by the heart, respiration, kidney function, and maintaining muscle tone and a constant body temperature, among others. BMR is directly related to the amount of lean body muscle mass, size, and gender. Physical activity, especially weight-training exercises, help increase and maintain lean body mass.

It is very important to reduce one's energy intake at the onset of adulthood, and to make sure that all of one's nutritional needs are met. This can be accomplished by making sure that an adequate amount of energy is consumed (this will vary by body weight, degree of physical fitness, and muscle vs. body fat), and that this amount of energy is adjusted to one's level of physical activity. Foods that are chosen to provide the energy must be highly nutritious, containing high amounts of essential nutrients such as **vitamins**, **minerals**, and essential **proteins**.

It is usually at this age that young adults start gaining body fat and reducing their physical activity, resulting in an accumulation of fat in the abdominal areas. This is an ever-increasing risk factor in the population of the United States, where **obesity** is not only a problem in adults, but also in children. It is believed that the high level of obesity in the United States is mostly due to bad dietary practices such as eating a high-fat, low-complex **carbohydrate** (low **fiber**) **diet**, including excessive amounts of meat. The indulgence in fast foods and a lack of regular physical activity are major factors. Obesity is a risk factor for other degenerative diseases, such as type II (adult onset) diabetes, diseases of heart and circulation, and certain cancers. Another nutritional problem related to eating such a diet is **constipation**, due to low-fiber diets. This may result in **hemorrhoids**, **diverticulosis**, **appendicitis**, and other more serious diseases of the lower intestine. Increasing the number of servings of fruits, vegetables, and whole grains in the diet will prevent these diseases. In the United States, the Dietary Guidelines for Americans (as summarized in the Food Guide Pyramid) provide practical guidelines for healthful eating.

At the onset of adulthood, energy requirements usually reach a plateau that will last until one's mid-forties, after which they begin to decline, primarily because activity levels and lean muscle mass (amount of muscle vs. body fat), which represents the BMR, decrease. It is believed that the changes in body composition and reduced lean muscle mass occur at a rate of about 5 percent per decade, and energy requirements decrease accordingly. However, these changes in body composition and decreased energy requirements can be prevented by maintaining regular physical activity, including resistance training, which helps maintain lean muscle mass and prevent deposition of excess body fat.

chronic: over a long period

osteoporosis: weakening of the bone structure

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

physiological: related to the biochemical processes of the body

basal metabolic rate: rate of energy consumption by the body during a period of no activity

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

obesity: the condition of being overweight, according to established norms based on sex, age, and height

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material that aids digestion by providing bulk

diet: the total daily food intake, or the types of foods eaten

constipation: difficulty passing feces

hemorrhoids: swollen blood vessels in the rectum

diverticulosis: presence of abnormal small sacs in the lining of the intestine

appendicitis: inflammation of the appendix

The basal metabolic rate—the number of calories a person's body uses while at rest—generally decreases with age. Good health requires adults to adapt their diets to the body's changing needs by eating low-fat and nutrient-rich foods. *[Photograph by Michael Keller. Corbis. Reproduced by permission.]*

By preventing normal age-related decline in lean muscle mass, one can prevent obesity and prolong one's physiological age. The result is that a person is less vulnerable to degenerative diseases, such as cardiovascular diseases, cancer, and diabetes, and can usually perform at a higher level than his or her chronological age would otherwise allow.

Older adults who are not physically active or who have poor nutritional practices will have a decline in BMR, a change in body composition, an increasing percentage of body fat, and a decrease in lean body muscle mass. In addition, they will show the signs of aging and will be more likely to develop degenerative diseases.

hypertension: high blood pressure

absorption: uptake by the digestive tract

calcium: mineral essential for bones and teeth

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

menopause: phase in a woman's life during which ovulation and menstruation ends

Many older adults need to take medications to control the advance of diabetes, **hypertension**, and cardiovascular disease. Medications can interfere with proper nutrition, however, as they affect appetite, the digestion and **absorption** of nutrients, and normal function of the digestive system.

As women age, they may develop osteoporosis if they have not built up strong bones by eating foods high in **calcium** and adequate **vitamin D**. Women start losing calcium from bones during and after the onset of **menopause** at the rate of 1 percent per year for about five years, after which the rate of calcium loss is reduced until about age seventy-five or eighty. Therefore, it is important for women to eat foods high in calcium up to the age of thirty-five. The recommended daily intake of calcium is 1,200 milligrams. This requirement can be met by consuming four servings of dairy products and two servings of green vegetables each day. It is well established that calcium from foods is much better absorbed than calcium from supplements. It is beneficial, therefore, to choose foods with a high calcium content, such as low-fat or skim dairy products. This regimen builds a bone density high enough so that, at menopause, losing approximately 5 percent of bone density in five years does not place a woman in the "fracture zone," where bones can break as a result of osteoporosis. SEE ALSO AGING AND NUTRITION; NUTRIENT-DRUG INTERACTIONS; OSTEOPOROSIS.

Simin B. Vaghefi

Bibliography

Poehlman, E. T., and Horton, E. S. (1999). "Energy Needs: Assessment and Requirements in Humans." In *Modern Nutrition in Health and Disease*, 9th edition, edited by M. E. Shils, J. A. Olson, M. Shike, and A. C. Ross. Baltimore, MD: Williams & Wilkins.

Pi-Suunyer, F. X. (1999). "Obesity." In *Modern Nutrition in Health and Disease*, 9th edition, edited by M. E. Shils, J. A. Olson, M. Shike, and A. C. Ross. Baltimore, MD: Williams & Wilkins.

Internet Resources

National Institutes of Health (2000). "Osteoporosis Prevention, Diagnosis, and Therapy." NIH Consensus Statement. Available from <http://odp.od.nih.gov>

U.S. Department of Agriculture. "The Food Guide Pyramid." Available from <http://www.nal.usda.gov>

African Americans, Diet of

The 2000 U.S. Census revealed that there were almost 35 million African Americans, or about 13 percent of the total U.S. population. This small percentage of the populace has had a significant influence on American cuisine, not only because African-American food is diverse and flavorful, but also because of its historical beginnings. Despite their cultural, political, economic, and racial struggles, African Americans have retained a strong sense of their culture, which is, in part, reflected in their food.

Origins of the African-American Diet: The Aftereffects of Slavery

diversity: the variety of cultural traditions within a larger culture

The roots of the **diversity** of African-American cuisine may be traced back to 1619, when the first African slaves were sold in the New World. In a

quest to build new cities in America, Europeans actively transported Africans and West Indians (people from the West Indies) to the new land. The West Indies (in the Caribbean Sea) was part of the slave route to America. Because the West Indians' skin color was similar to that of Africans, they were not treated any differently. As a result, some West Indian food traditions are similar to those of African Americans.

It is not surprising that African-American food has a distinctive culinary heritage with diverse flavors, as it includes traditions drawn from the African continent, the West Indies, and from North America. While the European nations were busy establishing new societies, they did not realize that the African and West Indian slaves who worked for them brought their own vibrant and and rich culture—a culture that would withstand and adapt to the harsh centuries of slavery.

Food historian Karen Hess writes about the struggle of African Americans to maintain some of their original culture through food. "The only thing that Africans brought with them [from Africa] was their memories." Slave traders attempted to craft culturally sensitive rations for the Africans by including yams, rice, corn, plantains, coconuts, and scraps of meat in the slaves' provisions.

Southern slaves established their own cooking culture using foods that were similar to foods that were part of their African and West Indian heritages, and many popular foods in the African-American diet are directly associated with foods in Africa. For instance, the African yam is similar to the American sweet potato. White rice is also popular because it was a major part of the diet in West Africa. African Americans infuse plain rice dishes with their own savory ingredients (popular rice dishes include gumbo and "hoppin' John," a dish made with rice, black-eyed peas, and salt pork or bacon).

A major ingredient in cuisine of African origin, okra traveled to the eastern Mediterranean, Arabia, and India long before it came to the New World with African slaves. The thickening characteristic of its sticky substance is put to good use in the preparation of gumbos and stews. *[Photograph by Robert J. Huffman/Field Mark Publications. Reproduced by permission.]*

The Legacy of African-American Cuisine

Popular southern foods, such as the vegetable okra (brought to New Orleans by African slaves), are often attributed to the importation of goods from Africa, or by way of Africa, the West Indies, and the slave trade. Okra, which is the principal ingredient in the popular Creole stew referred to as gumbo, is believed to have spiritual and healthful properties. Rice and seafood (along with sausage or chicken), and filé (a sassafras powder inspired by the Choctaw Indians) are also key ingredients in gumbo. Other common foods that are rooted in African-American culture include black-eyed peas, benne seeds (sesame), eggplant, sorghum (a grain that produces sweet syrup and different types of flour), watermelon, and peanuts.

Though southern food is typically known as "soul food," many African Americans contend that soul food consists of African-American recipes that have been passed down from generation to generation, just like other African-American **rituals**. The legacy of African and West Indian culture is imbued in many of the recipes and food traditions that remain popular today. The staple foods of African Americans, such as rice, have remained largely unchanged since the first Africans and West Indians set foot in the New World, and the southern United States, where the slave population was most dense, has developed a cooking culture that remains true to the African-American tradition. This cooking is aptly named *southern cooking*,

ritual: ceremony or frequently repeated behavior

the food, or *soul food*. Over the years, many have interpreted the term *soul food* based on current social issues facing the African-American population, such as the civil rights movement. Many civil rights advocates believe that using this word perpetuates a negative connection between African Americans and slavery. However, as Doris Witt notes in her book *Black Hunger* (1999), the "soul" of the food refers loosely to the food's origins in Africa.

In his 1962 essay "Soul Food," Amiri Baraka makes a clear distinction between southern cooking and soul food. To Baraka, soul food includes chitterlings (pronounced chitlins), pork chops, fried porgies, potlikker, turnips, watermelon, black-eyed peas, grits, hoppin' John, hushpuppies, okra, and pancakes. Today, many of these foods are limited among African Americans to holidays and special occasions. Southern food, on the other hand, includes only fried chicken, sweet potato pie, collard greens, and barbecue, according to Baraka. The idea of what soul food is seems to differ greatly among African Americans.

General Dietary Influences

In 1992 it was reported that there is little difference between the type of foods eaten by whites and African Americans. There have, however, been large changes in the overall quality of the diet of African Americans since the 1960s. In 1965, African Americans were more than twice as likely as whites to eat a diet that met the recommended guidelines for **fat**, **fiber**, and fruit and vegetable intakes. By 1996, however, 28 percent of African Americans were reported to have a poor-quality diet, compared to 16 percent of whites, and 14 percent of other racial groups. The diet of African Americans is particularly poor for children two to ten years old, for older adults, and for those from a low socioeconomic background. Of all racial groups, African Americans have the most difficulty in eating diets that are low in fat and high in fruits, vegetables, and whole grains. This represents an immense change in diet quality. Some explanations for this include: (1) the greater market availability of packaged and **processed foods**; (2) the high cost of fresh fruit, vegetables, and lean cuts of meat; (3) the common practice of frying food; and (4) using fats in cooking.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fiber: indigestible plant material that aids digestion by providing bulk

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Regional differences.

Although there is little overall variability in diets between whites and African Americans, there are many notable regional influences. Many regionally influenced **cuisines** emerged from the interactions of Native American, European, Caribbean, and African cultures. After emancipation, many slaves left the south and spread the influence of soul food to other parts of the United States. Barbecue is one example of African-influenced cuisine that is still widely popular throughout the United States. The Africans who came to colonial South Carolina from the West Indies brought with them what is today considered signature southern cookery, known as *barbacoa*, or barbecue. The original barbecue recipe's main ingredient was roasted pig, which was heavily seasoned in red pepper and vinegar. But because of regional differences in livestock availability, pork barbecue became popular in the eastern United States, while beef barbecue became popular in the west of the country.

cuisine: types of food and traditions of preparation

Other Ethnic Influences.

Cajun and Creole cooking originated from the French and Spanish but were transformed by the influence of African

cooks. African chefs brought with them specific skills in using various spices, and introduced okra and native American foodstuffs, such as crawfish, shrimp, oysters, crabs, and pecans, into both Cajun and Creole cuisine. Originally, Cajun meals were bland, and nearly all foods were boiled. Rice was used in Cajun dishes to stretch out meals to feed large families. Today, Cajun cooking tends to be spicier and more robust than Creole. Some popular Cajun dishes include pork-based sausages, jambalayas, gumbos, and coush-coush (a creamed corn dish). The symbol of Cajun cooking is, perhaps, the crawfish, but until the 1960s crawfish were used mainly as bait.

More recently, the immigration of people from the Caribbean and South America has influenced African-American cuisine in the south. New spices, ingredients, combinations, and cooking methods have produced popular dishes such as Jamaican jerk chicken, fried plantains, and bean dishes such as Puerto Rican *habichuelas* and Brazilian *feijoada*.

Holidays and Traditions.

African-American meals are deeply rooted in traditions, holidays, and celebrations. For American slaves, after long hours working in the fields the evening meal was a time for families to gather, reflect, tell stories, and visit with loved ones and friends. Today, the Sunday meal after church continues to serve as a prime gathering time for friends and family.

Kwanzaa, which means "first fruits of the harvest," is a holiday observed by more than 18 million people worldwide. Kwanzaa is an African-American celebration that focuses on the traditional African values of family, community responsibility, commerce, and self-improvement. The Kwanzaa Feast, or Karamu, is traditionally held on December 31. This symbolizes the celebration that brings the community together to exchange and to give thanks for their accomplishments during the year. A typical menu includes a black-eyed pea dish, greens, sweet potato pudding, cornbread, fruit cobbler or compote dessert, and many other special family dishes.

Folk beliefs and remedies.

Folk beliefs and remedies have also been passed down through generations, and they can still be observed today. The majority of African-American beliefs surrounding food concern the medicinal uses of various foods. For example, yellow root tea is believed to cure illness and lower blood sugar. The bitter yellow root contains the antihistamine berberine and may cause mild low **blood pressure**. One of the most popular folk beliefs is that excess blood will travel to the head when one eats large amounts of pork, thereby causing **hypertension**. However, it is not the fresh pork that should be blamed for this rise in blood pressure, but the salt-cured pork products that are commonly eaten. Today, folk beliefs and remedies are most often held in high regard and practiced by the elder and more traditional members of the population.

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

hypertension: high blood pressure

Effects of Socioeconomic Status: Poverty and Health

Many of the foods commonly eaten by African Americans, such as greens, yellow vegetables, **legumes**, beans, and rice, are rich in **nutrients**. Because of cooking methods and the consumption of meats and baked goods, however, the diet is also typically high in fat and low in fiber, **calcium**, and

legumes: beans, peas, and related plants

nutrient: dietary substance necessary for health

calcium: mineral essential for bones and teeth

Diet-Related Disease by Race	Obesity (%)	Diabetes (%)	Hypertension (%)
African Americans			
Male	21.1	7.6	36.7
Female	37.4	11.2	36.6
Total	**33.4**	**10.8**	**36.6**
Whites			
Male	20.0	4.7	24.6
Female	22.4	5.4	20.5
Total	**21.3**	**7.8**	**22.1**
Hispanics			
Male	23.1	8.1	NA
Female	33.0	11.4	NA
Total	**26.2**	**9.0**	**NA**

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics (2002).

potassium. In 1989, 9.3 million of the black population (30.1%) had incomes below the poverty level. Individuals who are economically disadvantaged may have no choice but to eat what is available at the lowest cost. In comparison to other races, African Americans experience high rates of **obesity**, hypertension, **type II diabetes**, and **heart disease**, which are all associated with an unhealthful diet.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

type II diabetes: Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

prevalence: describing the number of cases in a population at any one time

Obesity and hypertension are major causes of heart disease, **diabetes**, kidney disease, and certain cancers. African Americans experience disproportionately high rates of obesity and hypertension, compared to whites.

High blood pressure and obesity have known links to poor diet and a lack of physical activity. In the United States, the **prevalence** of high blood pressure in African Americans is among the highest in the world. The alarming rates of increase of obesity and high blood pressure, along with the deaths from diabetes-related complications, heart disease, and kidney failure, have spurred government agencies to take a harder look at these problems. As a result, many U.S. agencies have created national initiatives to improve the diet quality and the overall health of African Americans.

Looking Forward to a Healthier Tomorrow

African-American food and its dietary evolvement since the beginning of American slavery provide a complicated, yet extremely descriptive, picture of the effects of politics, society, and the economy on culture. The deep-rooted dietary habits and economic issues that continue to affect African Americans present great challenges regarding changing behaviors and lowering disease risk. In January 2000, the U.S. Department of Health and Human Services launched Healthy People 2010, a comprehensive, nationwide health promotion and disease prevention agenda. The overarching goal of this program is to increase quality and years of healthy life and eliminate health disparities between whites and minority populations, specifically African Americans. As national health initiatives and programs continue to improve and target African Americans and other populations in need, preventable diseases will be lowered, creating a healthier U.S. society. SEE ALSO AFRICANS, DIETS OF; CARIBBEAN ISLANDERS, DIET OF; DIETARY TRENDS, AMERICAN.

M. Cristina F. Garces
Lisa A. Sutherland

Bibliography

Basiotis, P. P.; Lino, M; and Anand, R. S. (1999). "Report Card on the Diet Quality of African Americans." *Family Economics and Nutrition Review* 11:61–63.

de Wet, J. M. J. (2000). "Sorghum." In *The Cambridge World History of Food*, Vol. 1, ed. Kenneth F. Fiple and Kriemhil Conee Ornelas. Cambridge, UK: Cambridge University Press.

Dirks, R. T., and Duran, N. (2000). "African American Dietary Patterns at the Beginning of the 20th Century." *Journal of Nutrition* 131(7):1881–1889.

Foner, Eric, and Garraty, John A., eds. (1991). *The Reader's Companion to American History*. Boston: Houghton Mifflin.

Genovese, Eugene D. (1974). *Roll, Jordan, Roll: The World the Slaves Made*. New York: Vintage.

Harris, Jessica (1995). *A Kwanzaa Keepsake: Celebrating the Holiday with New Traditions and Feasts*. New York: Simon & Schuster.

Harris, Jessica (1999). *Iron Pots and Wooden Spoons: Africa's Gift to the New World Cooking*. New York: Simon & Schuster.

Kittler, Pamela Goyan, and Sucher, Kathryn, eds. (1989). "Black Americans." In *Food and Culture in America*. New York: Van Nostrand and Reinhold.

Popkin, B. M.; Siega-Riz, A. M.; and Haines, P. S. (1996). "A Comparison of Dietary Trends among Racial and Socioeconomic Groups in the United States." *New England Journal of Medicine* 335:716–720.

Thompson, Becky W. (1994). *A Hunger So Wide and So Deep: American Women Speak Out on Eating Problems*. Minneapolis: University of Minnesota Press.

Wilson, C. R., and Ferris, W. (1989). *The Encyclopedia of Southern Culture*. Chapel Hill: University of North Carolina Press.

Witt, Doris (1999). *Black Hunger*. New York: Oxford University Press.

Zinn, Howard (1980). "Drawing the Color Line." In *A People's History of the United States*. New York: HarperCollins.

Internet Resources

Centers for Disease Control and Prevention, National Center for Health Statistics (2002). "Monitoring the Nation's Health." Available from <http://www.cdc.gov/nchs/>

U.S. Census Bureau (2001). "General Demographic Characteristics for the Black or African American Population." Available from <http://www.census.gov>

U.S. Census Bureau (2001). "Profile of General Demographic Characteristics." Available from <http://factfinder.census.gov>

U.S. Department of Health and Human Services. *Healthy People 2010*. Available from <http://health.gov/healthypeople>

Africans, Diets of

Africa, the second largest continent in the world, is rich in geographic and cultural **diversity**. It is a land populated by peoples with histories dating to ancient times and cultures shaped by innumerable tribes, languages, and traditions. Because it is the birthplace of *Homo sapiens* and the land of origin for much of the world's population, the culture of food and eating in the different regions of Africa is important to people throughout the world.

diversity: the variety of cultural traditions within a larger culture

Early History of Africa

The early history of man is the story of food in Africa. *Homo sapiens* evolved apart from other apes in Africa, and the adaptation of humans has been shaped by adaptations to **diet**. For example, some anthropologists believe

diet: the total daily food intake, or the types of foods eaten

that the selection pressure that led to bipedalism (walking on two legs) was an adaptation to changing environments that involved travel in search of tubers (rounded underground plant stems, such as potatoes). Africa's history includes some of humankind's earliest food production, with one of the most fertile centers located in Northern Africa, the Nile Valley. The Nile Valley historically was and continues to be a rich source of fish, animal, and plant food. In the drier African savannas, especially after the Sahara region became arid after 6000 B.C.E., nomad tribes raised cattle, goats, or sheep, which served as part of the tribes' food source. Crops that were less affected by extreme weather like cereals (such as wheat, barley, millet, and sorghum) and tubers (such as yams) slowly became popular throughout the continent and have remained important **staples** in the African diet today.

staples: essential foods in the diet

The African Climate and Terrain. The historic influences on the African diet began in ancient times and continue to the present day. Great geographic differences across the African continent caused much of the variety in the African diet. In addition, many tribes and peoples migrated or traded, bringing spices and foods from each other's culture into their own. However, though each region of Africa has its distinct **cuisines**, African food has its basic staples.

cuisine: types of food and traditions of preparation

The African Diet

Throughout Africa, the main meal of the day is lunch, which usually consists of a mixture of vegetables, **legumes**, and sometimes meat. However, though different meats are considered staples in many areas, many Africans are not able to eat meat often, due to economic constraints. Beef, goat, and sheep (mutton) are quite expensive in Africa, so these foods are reserved for special days. However, fish is abundant in coastal regions and in many lakes.

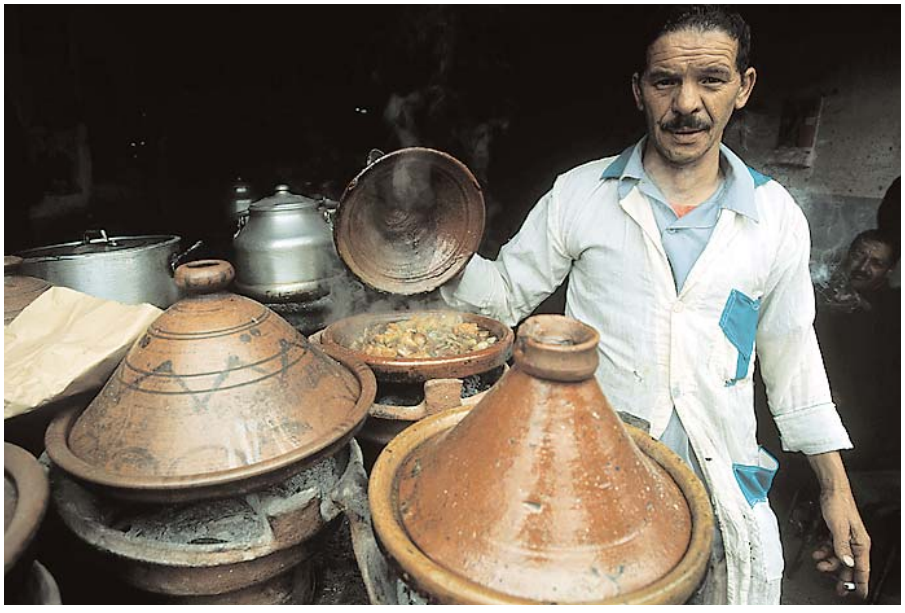
legumes: beans, peas, and related plants

The combination of various foods is called stew, soup, or sauce, depending on the region. This mixture is then served over a porridge or mash made from a root vegetable such as cassava or a grain such as rice, corn, millet, or teff. Regional differences are reflected in variations on this basic meal, primarily in the contents of the stew. The greatest variety of ingredients occurs in coastal areas and in the fertile highlands. Flavorings and spiciness have varied principally due to local histories of trade. In the traditional African diet, meat and fish are not the focus of a meal, but are instead used to enhance the stew that accompanies the mash or porridge. Meat is rarely eaten, though it is well-liked among carnivorous (meat-eating) Africans.

Traditional Cooking Methods. Traditional ways of cooking involve steaming food in leaf wrappers (banana or corn husks), boiling, frying in oil, grilling beside a fire, roasting in a fire, or baking in ashes. Africans normally cook outdoors or in a building separate from the living quarters. African kitchens commonly have a stew pot sitting on three stones arranged around a fire. In Africa, meals are normally eaten with the hands.

North Africa

The countries of North Africa that border the Mediterranean Sea are largely Muslim countries. As a result, their diet reflects Islamic traditions. The religion of Islam does not permit eating pork or any animal product that has



North African cuisine reflects the Islamic traditions of the region. Here, a man cooks with traditional Moroccan *tajines,* conical clay pots used for lamb stews and curries. *[Photograph by Owen Franken. Corbis. Reproduced by permission.]*

not been butchered in accordance with the traditions of the faith. Like other regions of Africa, much of the diet is based on grains. However, cooking with olive oil, onions, and garlic is more common in the countries of North Africa. Notable spices include cumin, caraway, clove, and cinnamon. Flat breads are a common staple and can accompany any meal, including breakfast, which is usually porridge prepared from millet or chickpea flour. *Couscous* (made from hard wheat and millet) is often the main dish at lunch, which is the primary meal. This may be accompanied by vegetable salads. Other main dishes include *tajine*, named for the conical clay pot in which a whole meal is prepared. Lamb is cooked in tajines as well as on kabobs (roasted on a skewer). Vegetables include okra, meloukhia (spinach-like greens), and radishes. Common fruits are oranges, lemons, pears, and mandrakes. Legumes such as broad beans (fava beans), lentils, yellow peas, and black-eyed peas are also important staples. Alcoholic drinks are forbidden by Islamic tradition. Mint tea and coffee are very popular beverages in this region.

West Africa

Within West Africa, there is considerable variation in the staple food. Rice is predominant from Mauritania to Liberia and across to the Sahel, a region that stretches across the continent between the Sahara and the southern savannas. Couscous is the prevalent dish in the Sahara. Along the coast from Côte d'Ivoire (Ivory Coast) to Nigeria and Cameroon, root crops, primarily varieties of yam and cassava, are common. Cassava, imported from Brazil by the Portuguese, is boiled and then pounded into a nearly pure starch. Yam is the chief crop in West Africa and is served in a variety of dishes, including *amala* (pounded yam) and *egwansi* (melon) sauce. Millet is also used for making porridge or beer.

Palm oil is the base of stew in the Gambia, southern, and eastern regions. In the Sahalian area, groundnut paste (peanut butter) is the main ingredient for stew. Other stews are based on okra (a vegetable native to the

Biotechnology and Africa

Many scientists believe that biotechnology is the most promising route to fighting and possibly eradicating chronic malnutrition among the 800 million people in the developing world who live in poverty. Researchers are working to develop improved versions of African staples, including a strain of sweet potato that is resistant to a virus that regularly devastates the crop, cassava that is resistant to the cassava mosaic virus, and corn that is resistant to the maize streak virus. Also under development is cotton that is less susceptible to insect infestation. However, genetically modified crops are controversial in some African countries. Zambia has banned donations of genetically modified food, and Zimbabwe has raised concerns about donations of corn from the United States that is not certified to be free of genetic modifications.

—Paula Kepos

rainforests of Africa), beans, sweet potato leaves, or cassava. Other vegetables are eggplant, cabbage, carrots, chilies, french beans, lettuce, okra, onions, and cherry tomatoes. All the stews in this territory tend to be heavily spiced, often with chilies.

West African Fruit.

Plantain, a variety of banana, is abundant in the more tropical West Africa. Sweet plantains are normally fried, while hard plantains are boiled or pounded into *fufu.* Dates, bananas, guava, melons, passionfruit, figs, jackfruit, mangos, pineapples, cashews, and wild lemons and oranges are also found here.

Protein Sources.

Meat sources of protein include cattle, sheep, chicken, and goat, though beef is normally reserved for holidays and special occasions. Fish is eaten in the coastal areas. Because of the Islamic influence, pork is localized to non-Muslim areas. In these regions, "bush meat" is widely eaten, including bush rat, a large herbivorous rodent, antelope, and monkey. Giant snails are also eaten in various parts of West Africa.

East Africa

Extensive trade and migrations with Arabic countries and South Asia has made East African culture unique, particularly on the coast. The main staples include potatoes, rice, *matake* (mashed plantains), and a maize meal that is cooked up into a thick porridge. Beans or a stew with meat, potatoes, or vegetables often accompany the porridge. Beef, goat, chicken, or sheep are the most common meats. Outside of Kenya and the horn of Africa, the stew is not as spicy, but the coastal area has spicy, coconut-based stews. This is quite unique in comparison to the central and southern parts of Africa.

Two herding tribes, the Maasai and Fulbe, have a notably different eating pattern. They do not eat very much meat, except for special occasions. Instead, they subsist on fresh and soured milk and butter as their staples. This is unusual because very few Africans consume milk or dairy products, primarily due to **lactose intolerance**.

lactose intolerance: inability to digest lactose, or milk sugar

iron: nutrient needed for red blood cell formation

nutrient: dietary substance necessary for health

The horn of Africa, which includes modern-day Somalia and Ethiopia, is characterized by its remarkably spicy food prepared with chilies and garlic. The staple grain, teff, has a considerably higher **iron** and **nutrient** content than other grain staples found in Africa. A common traditional food here is *injera*, a spongy flat bread that is eaten by tearing it, then using it to scoop up the meat or stew.

Southern Africa

temperate zone: region of the world between the tropics and the arctic or Antarctic

Outside of the **temperate zones**, in the southern part of the continent, a greater variety of fruits and vegetables are available. Fruits and vegetables in southern Africa include bananas, pineapples, pau-pau (papaya), mangoes, avocadoes, tomatoes, carrots, onions, potatoes, and cabbage. Nonetheless, the traditional meal in southern Africa is centered on a staple crop, usually rice or maize, served with a stew. The most common dish made from cornmeal is called *mealie meal*, or *pap* in South Africa. Also known as *nshima* or *nsima* further north, it is usually eaten with stew poured over it. The stew may include a few boiled vegetables, such as cabbage, spinach, or turnips, or on more special occasions, fish, beans, or chicken.

Nutrition and Disease

White South Africans (Dutch descendants called Afrikaaners), Europeans, and Asian Indians in Africa have diets similar to their countries of origin. In urban areas, however, the diet of (black) Africans is increasingly dependent on meat, much like the diet of some West African pastoral tribes, as well as on empty **calories** from prepackaged foods similar to those found in the West. The result is an unbalanced diet. In many parts of Africa, the traditional diets of indigenous peoples are often inadequate in essential **vitamins**, **minerals**, and protein, which can lead to a variety of diseases. **Micronutrient** deficiencies, particularly vitamin A, iodine, and iron deficiencies, which can result in vision impairment, goiter, and **anemia**, respectively, are prevalent throughout much of Africa, particularly in the arid areas where the soil is deficient either naturally or due to overuse.

calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

micronutrient: nutrient needed in very small quantities

anemia: low level of red blood cells in the blood

Food Security

A far greater threat comes from increasingly insecure food sources (a lack of consistent and affordable food staples) arising from adverse weather (drought and floods) and war. During the late 1900s, **famine** became increasingly frequent in Africa. In addition, a new threat to the food supply emerged due to the worsening HIV/AIDS epidemic. As adults fall ill and die, agricultural production declines. Rural communities are the hardest hit, and women are particularly at risk given their unique physiologic needs tied to their roles as mothers, as well as their vulnerability due to lower economic and social status.

famine: extended period of food shortage

With its immense population, resources, and growing population, Africa is a continent that struggles to keep its people and cultures healthy. African history, the proliferation of foods and spices across the land, and the preservation of land that can still be farmed, will continue to be important. Weather, geography, politics, culture, and religion are forces that have caused strife within Africa for centuries, and will continue to do so. A land that was once pure and fertile can only be restored through land preservation and food availability. SEE ALSO AFRICAN AMERICANS, DIET OF; CARIBBEAN ISLANDERS, DIET OF.

Jens Levy
M. Cristina F. Garces

Bibliography

Carr, Marilyn, ed. (1991). *Women and Food Security: The Experience of the SADCC Countries.* London: IT Publications.

Eles, Dale, and Fitzpatrick, Mary. (2000). *Lonely Planet West Africa.* Singapore: Lonely Planet.

Finlay, Hugh (2000). *Lonely Planet East Africa.* Singapore: Lonely Planet.

Fiple, Kenneth F., and Ornelas, Kriemhil Coneè, eds. (2000). *The Cambridge World History of Food*, Volumes 1 and 2. Cambridge, UK: Cambridge University Press.

Harris, Jessica B. (1998). *The Africa Cookbook: Tastes of a Continent.* New York: Simon & Schuster.

Lentz, Carola, ed. (1999). *Changing Food Habits: Case Studies from Africa, South America, and Europe.* Sydney, Australia: Harwood Academic Publishers.

Von Braun, Joachim; Teklue, Tesfaye; and Webb, Patrick (1999). *Famine in Africa: Causes, Responses, and Prevention.* Baltimore: Johns Hopkins University Press.

Internet Resource

Haslwimmer, Martina (1996). "AIDS and Agriculture in Sub-Saharan Africa." Available from <http://www.fao.org>

Aging and Nutrition

Aging Americans will make up an unprecedented proportion of the population as the 78 million baby boomers reach age 50. The baby boomers, those born between 1946 and 1964, will first reach age 65 in 2011, transforming the 35 million people over age 65 in 2000 to an estimated 69 million by 2030. With improved health care, **socioeconomic status**, and health behaviors, people 85 and over are expected to be the fastest-growing group of elderly persons, tripling from 4 million in 2000 to about 14 million by 2040. Growth in the elderly population has led to two subgroups: the young-old (55 to 74 years) and the old-old (75 and older). Still, elderly people remain the most diverse segment of American society.

socioeconomic status: level of income and social class

A nutritious daily **diet** is one factor that can assist people who are 55 and older in maintaining optimal levels of health and preventing or delaying the onset of disease. The **Dietary Reference Intakes** (DRI) are the quantities of **nutrients** that form the basis for planning and assessing diets. The DRIs include the **Recommended Dietary Allowances** (RDA), the nutrient levels that meet the requirement for nearly all (97–98%) healthy people. Two sets of RDAs exist for elderly individuals, one for those 51 to 70 years of age, and one for those over 70 years of age.

diet: the total daily food intake, or the types of foods eaten

Dietary Reference Intakes: set of guidelines for nutrient intake

nutrient: dietary substance necessary for health

Recommended Dietary Allowances: nutrient intake recommended to promote health

According to the RDAs, elderly people have the same nutrient requirements as their younger counterparts, yet most need fewer **calories**. **Vitamins** D and B_6, and **calcium**, are exceptions and are needed in greater amounts for those 51 years old and older. Therefore, a nutrient-dense diet, with fewer calorie-laden foods, becomes more crucial at older ages of the life cycle. In general, women have nutrient requirements similar to men, though they require fewer calories. Therefore, elderly women must be especially careful to select nutrient-dense foods.

calorie: unit of food energy

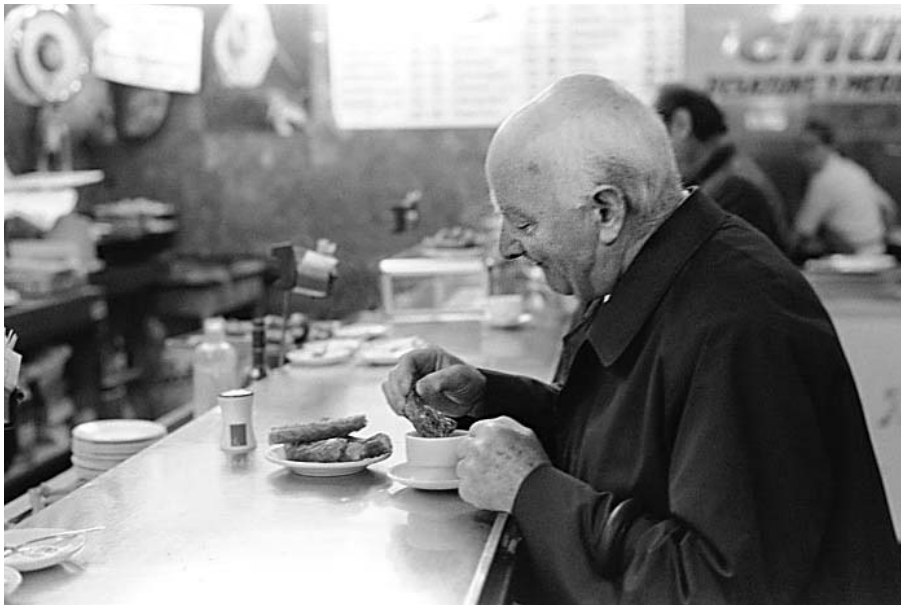
vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

calcium: mineral essential for bones and teeth

The best way to establish a nutrient-dense diet is to balance a variety of food choices (in moderation) that are adequate to meet nutritional and caloric needs. The Food Guide Pyramid (FGP) is helpful to guide food selection and daily serving totals. An FGP specifically for those over 70 years of age recommends 1,200–1,600 calories from whole-grain foods, a variety of colored fruits and vegetables, low-fat dairy products, lean meats, fish and poultry, and eight glasses of fluid daily. Food labels help put single servings of food into the FGP. Results of national dietary surveys have led some experts to recommend calcium supplements and a one-a-day type of multiple vitamin. Other health food supplements are not generally needed and can be very expensive for those on fixed incomes.

Nutrition Screening Initiative

Elderly individuals are at increased risk for problems that affect their nutritional status. The nationwide Nutrition Screening Initiative (NSI) categorizes these problems as those affecting functional, social, or financial status and access to food and drink. These problems can affect quality of life and the



Elderly people face unique nutritional challenges. Although age can diminish appetite and physical mobility, the body still requires as many nutrients as a younger adult's. *[Photograph by Owen Franken. Corbis. Reproduced by permission.]*

ability to perform activities of daily living, including eating. The **DETERMINE** checklist is the NSI tool used by physicians, registered dietitians, other health care providers and social service agencies to assess the impact of various dietary, medical, or physical and social problems:

DETERMINE: checklist used to identify nutritionally at-risk individuals

Disease
Eating poorly
Tooth loss/mouth pain
Economic hardship
Reduced social contact
Multiple medications
Involuntary weight loss/gain
Needs assistance in self care
Elder years above age 80

Recognizing the risk posed by these factors can result in interventions to improve the quality of life and the ability to perform activities of daily living.

Dietary Problems

Some elderly individuals encounter dietary problems, making them less able to select, purchase, prepare, eat, digest, absorb, and use food. An inability to consume an adequate daily diet places the elderly person at increased risk for medical, physical, and functional problems. Therefore, it is important to intervene to correct any dietary problems that may exist. Examples of dietary problems, and interventions to improve the problems, are described below.

Difficulty Chewing or Swallowing.

Choose more fruit and vegetable juices, soft canned fruits, and creamed or mashed cooked vegetables; eggs, milk dishes (like creamed soups), cheese, and yogurt; and cooked cereals when chewing meat or fresh fruits and vegetables are difficult. Chop, stew, steam, or grate hard foods.

Difficulty Digesting. Choose more fruit and vegetable juices, soft canned fruits, and non-gas-forming vegetables rather than gas-producing vegetables like cabbage or broccoli. If digesting milk is a problem, use cultured dairy products like yogurt or add lactaid to milk. If milk continues to be problematic, consider a daily calcium supplement.

Difficulty Shopping. Shop by phone to find grocery stores that deliver in your area. Find volunteer or paid help in your area. Ask family or neighbors to help. See yellow pages under "Home Health Services" for assistance.

Difficulty Cooking. Use a microwave. Cook and freeze in batches. Relocate to a facility where other's cook, such as a family member's home or an **assisted-living** home **environment**.

assisted-living: facility that provides aid in meal preparation, cleaning, and other activities to help maintain independent living

environment: surroundings

Appetite Difficulties. Increase the flavor of food by adding spices and herbs, lemon juice, or meat sauces. Discuss medications with your physician, particularly if they are causing appetite or taste changes.

Financial Difficulty. Use coupons, unit pricing, and shopping lists. Plan and prepare ahead, freezing several meals at once. Buy more generic or store-brand foods and foods on sale. Find food assistance programs or sources for free and reduced-price meals, such as churches, Meals On Wheels, **Congregate Dining**, and Food Stamps. Buy more low-cost foods, such as dried beans and peas, rice, pasta, canned tuna, and peanut butter.

Congregate Dining: a support service that provides a meal at a central location on a specified day

Social Problems

Loneliness. Invite a friend or neighbor over or have a standing date to eat out with friends or family. Buy smaller sizes to avoid the repetition of leftovers. Set the table attractively and play music softly. Participate in Congregate Dining in your area.

Living Alone. Research has shown a correlation between living alone and having lower quality diets. Men may be at greater risk because they are less experienced with planning, shopping, and preparing meals. Women may feel less motivated to prepare meals when there is no one to share them with. Ways to improve social interaction during meals and improve the experience of dining alone include: participating with others, such as at churches or Congregate Dining sites, eating by a window, using good china, eating in a park or on one's porch, garnishing meals, and trying various frozen or prepared dinners.

When living alone challenges an elderly person's health, he or she can investigate the continuum of care, including adult day care, in-home care, retirement communities, residential care or assisted living, intermediate care, and nursing homes or convalescent hospitals.

Medical, Physical, and Functional Problems

Many **chronic** medical conditions, such as **osteoporosis**, **arthritis**, **depression**, and **diabetes** have nutritional consequences. Loss of body water, lean body mass, and bone mass; decline of the immune response; over- and underweight; **malnutrition**; and declining taste, smell, and thirst are among the problems that affect physical strength, functional ability, and vitality. At times, specialized diets or medical nutrition therapy are needed; these are

chronic: over a long period

osteoporosis: weakening of the bone structure

arthritis: inflammation of the joints

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

diabetes: inability to regulate level of sugar in the blood

malnutrition: chronic lack of sufficient nutrients to maintain health

Many elderly people live alone and may have less nutritious diets than those living with a partner. Programs such as Meals On Wheels can help prevent poor nutrition caused by loneliness. *[Photo by Ken Hammond. © USDA Photography Center.]*

best planned with a registered dietitian. In addition, medications can affect the **absorption** and use of nutrients. Lists of food and drug interactions are available from a pharmacist or from a registered dietitian who can coordinate advice about medications with specialized dietary information. SEE ALSO DIETARY REFERENCE INTAKES; MEALS ON WHEELS; MENOPAUSE; NUTRIENT-DRUG INTERACTIONS; OSTEOPOROSIS; RECOMMENDED DIETARY ALLOWANCES.

absorption: uptake by the digestive tract

Sally Weerts

Bibliography

Davis, M. (2000). "Living Arrangements Affect Dietary Quality for U.S. Adults Aged 50 Years and Older: NHANES III 1988–1994." *The Journal of Nutrition* 130(9): 2256–2264.

Fletcher, R. H. (2002). "Vitamins for Chronic Disease Prevention in Adults: Clinical Applications." *Journal of the American Medical Association* 287(23): 3127–3129.

Alcohol and Health

Alcohol is a central-nervous-system depressant that affects judgment, coordination, and inhibition. Mild alcohol intoxication causes a relaxed and carefree feeling, as well as the loss of inhibitions. After several drinks a person will exhibit impaired judgment, poor coordination, and slurred speech, while consumption of alcohol in large amounts can lead to coma and even death. Blood alcohol concentration (BAC) is a measurement of the amount of alcohol in a person's blood. Most states consider a person to be legally drunk at a BAC between .08 and .10. At a BAC level of .40 to .50, a person may go into a coma, while a BAC level of .60 to .70 will cause death.

Alcoholic beverages can be divided into three categories: beer, wine, and distilled spirits. Beer includes beer, ale, and malt liquor; wine includes wine,

CALORIES IN ALCOHOLIC BEVERAGES AND MIXERS

Beverage	Number of Calories
Beer, 12 oz.	150
Martini, 3 oz.	145
Rum, 1 oz.	73
Sherry, 3 oz.	150
Wine, 5 oz.	100
Scotch, 1 oz.	73

champagne, wine coolers, and vermouth; and examples of distilled spirits are gin, rum, vodka, and whiskey. Alcohol provides no **vitamins** or **minerals**, only **calories**. Small amounts of alcohol are absorbed from the mouth, approximately 20 percent is absorbed in the stomach, and the remaining 80 percent is absorbed in the small intestine.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calorie: unit of food energy

About 7 percent of Americans abuse alcohol or suffer from alcoholism. Alcoholism can be identified through four symptoms: (1) a craving or strong urge to drink alcohol, (2) not being able to stop drinking, (3) physical **dependence**, and (4) **tolerance**. Physical dependence occurs when an individual depends on the presence of alcohol to function normally. Tolerance occurs when the same amount of alcohol results in a lesser effect; therefore, more alcohol must be consumed in order to feel the same effect. Alcohol abuse differs from alcoholism in that it does not include a strong craving for alcohol, the loss of control over one's drinking, or physical dependence. Individuals may have a problem with alcohol abuse if they exhibit one or more of the following symptoms: work and money problems, drinking while driving, being arrested due to drinking, exhibiting violent or aggressive behaviors, or continuing to drink despite the problems that result from drinking.

dependence: a condition in which attempts to stop use leads to withdrawal symptoms, including irritability and insomnia

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

Alcoholism

Although there is a debate among experts over whether alcoholism should be considered a disease, the National Institute on Alcohol Abuse and Alcoholism recognizes alcoholism as a disease. The risk for developing alcoholism is influenced by a person's **genes** and **lifestyle** behaviors. Alcoholism is a **chronic** disease that lasts for a lifetime. If diagnosed and treated early, however, alcoholism may be completely cured and severe complications prevented. Chronic alcohol abuse increases a person's risk for developing serious health problems, such as liver disease, **high blood pressure**, **heart disease**, **stroke**, **cancer** (especially cancer of the esophagus, mouth, and throat), and pancreatitis.

gene: DNA sequence that codes for proteins, and thus controls inheritance

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

chronic: over a long period

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

cancer: uncontrolled cell growth

Approximately two million Americans suffer from liver damage caused by alcohol abuse. About 10 to 20 percent of heavy drinkers will develop cirrhosis of the liver, which is characterized by scarring of the liver and causes irreversible damage. If heavy drinkers do not stop drinking, cirrhosis can cause poor health and, ultimately, death. In addition to cirrhosis, heavy drinkers may suffer from chronic liver disease or alcoholic **hepatitis**.

hepatitis: liver inflammation

Damage to the liver can lead to problems with blood sugar levels. When alcohol is present in the body, the liver works to **metabolize** it. Because the liver is busy metabolizing alcohol, it is often not able to adequately maintain blood sugar levels, which may result in **hypoglycemia** (low levels of blood sugar). Hypoglycemia is most likely to occur in individuals who have not maintained an adequate **diet**. When it occurs, the brain is not able to receive the **energy** it needs to function, and symptoms such as hunger, weakness, headache, tremor, and even coma (in severe cases) may occur.

metabolize: processing of a nutrient

hypoglycemia: low blood sugar level

diet: the total daily food intake, or the types of foods eaten

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Chronic alcohol abuse can lead to poor nutritional status. Chronic heavy drinkers do not eat adequate amounts of food because of the high caloric content of alcohol. This prevents them from getting the required vitamins and minerals to maintain health and well-being. Furthermore, when a person consumes large amounts of alcohol, it impedes or halts the digestion of food, as alcohol decreases the secretion of digestive **enzymes** from the pan-

enzyme: protein responsible for carrying out reactions in a cell

College Binge Drinking

Alcohol abuse is considered the most significant public health problem facing college students in the United States. It is estimated that more than 500,000 injuries and 70,000 cases of sexual assault a year result from alcohol abuse among students, and more than 1,400 students die each year as a result of their injuries. Two out of every five students report an episode of binge drinking—which is usually defined as five or more drinks in a row—in any given two-week period. During the 1990s, as government and health organizations began to recognize the magnitude of the problem, the U.S. Surgeon General set a goal of reducing binge drinking by 50 percent by the year 2010, and colleges sharply increased alcohol education programs and penalties for excessive or underage drinking. Nevertheless, the rate of binge drinking on college campuses remained virtually unchanged between 1993 and 2001, the year of the last comprehensive study.

—Paula Kepos

creas. Alcohol also inhibits the **absorption** of **nutrients** into the blood. This decrease in digestion and absorption over a long period of time can lead to **malnutrition**.

absorption: uptake by the digestive tract

nutrient: dietary substance necessary for health

malnutrition: chronic lack of sufficient nutrients to maintain health

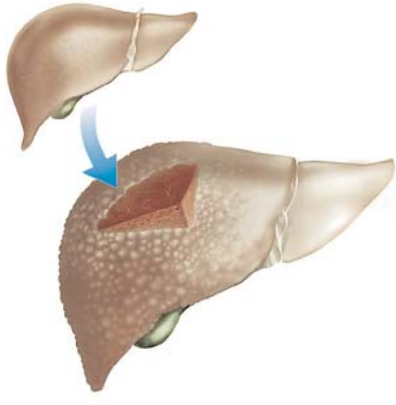
High-Risk Groups

While alcohol abuse and alcoholism affect virtually every segment of the population, certain groups are at greater risk. Young adults between the ages of eighteen and twenty-nine have the highest **prevalence** of alcohol abuse, and persons who begin to drink at an early age, especially before the age of fourteen, have a greater risk for developing problems with alcohol. Persons with a family history of alcohol abuse or alcoholism are also more likely to experience alcohol-related problems. In the United States, American Indians and Alaska Natives (AI/ANs) have the highest rates of current and heavy drinking of all racial or ethnic groups. Deaths from chronic liver disease and cirrhosis are nearly four times greater among AI/ANs compared to the general U.S. population. They also have a higher prevalence of drunk driving compared to the general U.S. population.

prevalence: describing the number of cases in a population at any one time

The U.S. Department of Health and Human Services and the U.S. Department of Agriculture recommend that alcohol be consumed in moderation only. Moderation is considered two drinks per day for men and one drink per day for women (one drink is defined as twelve ounces of beer, five ounces of wine, or 1.5 ounces of a distilled spirit). Drinking alcohol is inappropriate for recovering alcoholics, persons under the age of twenty-one, persons taking medication, those who plan to drive, and women who are pregnant or plan to become pregnant.

There is no known safe level of alcohol consumption during pregnancy, as it could injure the fetus. Alcohol consumption during pregnancy may result in fetal alcohol syndrome (FAS) or fetal alcohol effects (FAE). FAS is characterized by growth retardation, facial abnormalities, and central-nervous-system dysfunction. FAS is irreversible and will affect children their entire life. If a fetus's exposure to alcohol during pregnancy is not severe enough to cause FAS, it may result in fetal alcohol effects (FAE), alcohol-related developmental disabilities (ARDD), or alcohol-related neurodevelopmental disabilities (ARND).



This illustration shows a healthy liver above, and a diseased liver below. Liver disease in alcoholics progresses from an enlargement of the liver to cirrhosis, which is characterized by liver scarring and is usually fatal unless alcohol consumption ceases. *[Custom Medical Stock Photo, Inc. Reproduced by permission.]*

In conclusion, knowing the effects of alcohol on the body and the consequences of alcohol abuse and misuse is very important. When consumed in large amounts or irresponsibly, alcohol can cause extensive damage to health and well-being, including liver damage, poor nutritional status, birth defects, and death. Therefore, if alcohol is consumed, it should be done so responsibly and in moderation only. SEE ALSO FETAL ALCOHOL SYNDROME; FRENCH PARADOX; MALNUTRITION; PREGNANCY.

Laura Nelson

Bibliography

Kinney, Jean (2000). *Loosening the Grip: A Handbook of Alcohol Information*, 6th edition. Boston: McGraw-Hill Higher Education.

Leone, Bruno, ed. (1998). *Alcohol: Opposing Viewpoints.* San Diego, CA: Greenhaven Press.

Marshall, Ronald (2001). *Alcoholism: Genetic Culpability or Social Irresponsibility?* New York: University Press of America.

Internet Resources

Centers for Disease Control and Prevention. "Fetal Alcohol Syndrome." Available from <http://www.cdc.gov/ncbddd>

National Institute on Alcohol Abuse and Alcoholism. "Alcohol and Minorities: An Update." Available from <http://www.niaaa.nih.gov/publications>

National Institute on Alcohol Abuse and Alcoholism. "Alcohol and Nutrition." Available from <http://www.niaaa.nih.gov/publications>

National Institute on Alcohol Abuse and Alcoholism. "Frequently Asked Questions on Alcohol Abuse and Alcoholism." Available from <http://www.niaaa.nih.gov/>

Robert Wood Johnson Foundation. "Substance Abuse: The Nation's Number One Health Problem." Available from <http://www.rwjf.org/resourcecenter>

U.S. Department of Health and Human Services, and U.S. Department of Agriculture. "Dietary Guidelines for Americans, 2000." Available from <http://www.health.gov/dietaryguidelines>

Allergies and Intolerances

allergy: immune system reaction against substances that are otherwise harmless

Food **allergies** affect approximately 3 percent of children and 1 percent of adults in the United States. It is estimated that an even larger percentage of the population experiences problems with food intolerance. Worldwide, adverse reactions to food constitute a significant public health issue.

Definitions

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

allergen: a substance that provokes an allergic reaction

lactose intolerance: inability to digest lactose, or milk sugar

enzyme: protein responsible for carrying out reactions in a cell

The term *adverse reaction* is used to describe health problems linked to food. Food allergy and food intolerance are two types of adverse food reactions (food-borne illnesses caused by bacterial, viral, or other forms of contamination are also adverse reactions). A food allergy is said to exist when the health problem is linked to a malfunction of the **immune system**. It is believed that this malfunctioning occurs when the body identifies a food **protein** (**allergen**) as a harmful substance. *Food intolerance* occurs when the underlying problem causing the adverse reaction is not related to a malfunction of the immune system. One example of a food intolerance is **lactose intolerance**, a condition affecting people who cannot digest milk due to a deficiency of the **enzyme** lactase, which breaks down milk sugar (lactose).

Food allergies can be triggered by almost any food. The most common food allergies are caused by wheat, nuts, fish, eggs, milk, and soy. Wheat, milk, and soy are also common causes of food intolerance. *[Erik Freeland/Corbis. Reproduced by permission.]*

Common Foods Associated with Food Allergy

Almost any food can cause an allergy, though the foods most commonly associated with an **allergic reaction** are those frequently consumed by a population. For example, an allergy to rice is common in Southeast Asia, while fish allergy is a problem in the Scandinavian countries, where fish is frequently consumed (even at breakfast). Age is also a factor influencing the types of foods to which a person might be allergic. In the United States, common foods to which adults are allergic include eggs, shrimp, lobster, peanuts, other nuts, and fish. U.S. children who have food allergies find their problems are most frequently linked to milk, soy, eggs, and peanuts. Infants may be allergic to cow's milk or soy formulas. Some food allergies may be outgrown, but allergies to peanuts, shrimp, and fish tend to last throughout life. In addition, some individuals are only allergic to one food, whereas some are allergic to several foods.

allergic reaction: immune system reaction against a substance that is otherwise harmless

An allergic reaction can be triggered by a very small amount of a food. Persons with food allergies need to read food labels carefully and ask restaurant workers about food ingredients, and the food industry needs to ensure that **processed foods** are appropriately prepared so that people are not exposed to food allergens unknowingly. This may happen when improperly cleaned food equipment is used to prepare multiple types of food.

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Food Allergy: Clinical Presentation and Diagnosis

Health problems associated with food allergies can involve the **gastrointestinal** system, the **respiratory system**, the skin, and the eyes. Persons with a food allergy may have difficulty breathing, or they may have problems with itching, rashes, swelling, **nausea**, or vomiting. A food allergy may also be a cause of **asthma**.

gastrointestinal: related to the stomach and intestines

respiratory system: the lungs, throat, and muscles of respiration, or breathing

nausea: unpleasant sensation in the gut that precedes vomiting

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

Antihistamines can give some relief of minor allergic reactions, such as skin irritation. For more severe reactions, administering a dose of epinephrine may halt life-threatening anaphylactic shock. *[Erik Freeland/Corbis. Reproduced by permission.]*

The symptoms of food allergy vary widely from person to person. Food allergies can also cause a severe clinical reaction known as **anaphylaxis**, which can result in death. Anaphylaxis may be characterized by throat and lip swelling, shortness of breath, sweating, itching, and feeling very faint.

Diagnosis of a food allergy usually involves a careful examination of the patient's symptom history. Other causes of symptoms must be ruled out, and in some instances the suspected food or foods will be eliminated from the **diet** to see if symptoms stop. Blood tests or skin tests may also be performed. One test sometimes used to diagnose food allergy is the double-blind, placebo-controlled food challenge. This test involves giving a patient a capsule containing a suspected food allergen and a capsule without the allergen (the placebo) and seeing if either causes symptoms in a controlled clinical setting. The test is called *double-blind* because neither the patient nor the physician evaluating the symptoms is aware of which capsule contains the allergen at the time the testing occurs.

Common Foods Associated with Intolerance

Foods associated with intolerance include: preserved foods, foods containing monosodium glutamate (MSG, a flavor enhancer), and specific foods such as milk, pickled herring, soy sauce, chili peppers, and nutmeg. Intolerance to lactose is a major problem for many populations. In the United States, lactose intolerance is common among those of African and Asian descent. The Native American population also has a high **prevalence** of lactose intolerance.

For many food intolerances, including those listed above, specific chemicals or enzyme abnormalities have been identified as being associated with the intolerance. Lactose intolerance is associated with problems with the enzyme lactase. Chemicals associated with food intolerance include sulfite (in preserved foods), tyramine (in pickled herring and soy sauce), capsaicin (in chili peppers), and myristicin (in nutmeg).

Food Intolerance: Clinical Presentation and Diagnosis

Health problems caused by food intolerance vary depending upon the food and chemical involved. The amount of a food eaten may also play a role. Lactose intolerance is usually characterized by gastrointestinal problems such as bloating and diarrhea. Sulfite intolerance is typically characterized by difficulty in breathing. Those sensitive to MSG may experience a variety of symptoms, such as headache, numbness, and rapid heartbeat. Tyramine, found in pickled herring, soy sauce, red wine, and other foods, has been linked to migraine headache. Capsaicin can cause a "burning" pain in the mouth and other problems, such as nausea and vomiting. Myristicin has been associated with **anxiety**, chest pressure, hallucinations, fever, and skin redness.

Diagnostic techniques for food intolerances vary depending upon the specific intolerance suspected. Symptom history and **elimination diets** are tools that are used, and the double-blind, placebo-controlled food challenge may also be helpful. Diagnosis of lactose intolerance in adults may involve measuring the blood to see if lactose is being broken down and showing up as blood sugar (**glucose**), or by measuring the level of hydrogen in the breath, which is increased in persons who are lactose intolerant (lactose produces hydrogen gas in the colon).

anaphylaxis: life-threatening allergic reaction, involving drop in blood pressure and swelling of soft tissues especially surrounding the airways

diet: the total daily food intake, or the types of foods eaten

prevalence: describing the number of cases in a population at any one time

anxiety: nervousness

elimination diet: diet in which particular foods are eliminated to observe the effect

glucose: a simple sugar; the most commonly used fuel in cells

Peanut Allergies

Peanut allergies, which are among the most widespread food allergies, affect more than 1.5 million people in the United States. Symptoms of an allergic reaction may include a flushed face, hives, difficulty breathing or swallowing, vomiting, dizziness, chills, and loss of consciousness. The reaction of an allergic person to peanuts can be rapid and dramatic, sometimes causing death within minutes. The incidence of peanut allergies among children doubled in the United States between 1997 and 2002, prompting some schools to consider banning peanuts and peanut products from their premises. Proponents of a ban note that as little as half a peanut can be fatal in an allergic child, and that the risk of shared lunches or other accidental exposure is too great. Others argue that a peanut ban provides a false sense of security for children who inhabit a peanut-ridden world, and that educating students and school personnel about the problem, and preparing for the occasional incident, are more appropriate responses.

—Paula Kepos

Controversies Related to Food Allergies and Intolerances

Controversial issues in this area include the diagnosis of **brain allergy**, the diagnosis of **environmental illness** related to food allergy, and the diagnosis of **yeast allergy**. The connection of these problems to food allergies is not universally recognized. Some have also linked hyperactivity to food allergy or intolerance. Hyperactivity in children, in some instances, may be related to eating large amounts of **food additives**, but it is not accepted to be an allergic condition by the majority of the scientific community.

Other controversies relate to testing for food allergies. One controversial test is *cytotoxic* testing, which involves testing blood in the presence of the suspected food allergen to see if the blood cells are killed.

brain allergy: allergy whose symptoms affect brain function

environmental illness: illness due to substances in the environment

yeast allergy: allergy to yeasts used in baking or brewing

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

Treatment of Food Allergies and Intolerances

The major mode of treatment for food allergies and intolerances is for the person to avoid consuming the food or foods that seem to cause health problems. This involves a high degree of dietary awareness and careful food selection. When foods are eliminated from the diet, it is important to ensure the nutritional adequacy of the diet, and some individuals may need to take dietary supplements. There are some food intolerances, such as lactose intolerance, where individuals may be able to reduce the amount of the food consumed and not totally eliminate it from the diet. People with lactose intolerance do not have to completely eliminate milk products, though they must reduce their intake of lactose (milk sugar) to a manageable level. SEE ALSO ADDITIVES AND PRESERVATIVES.

Judy E. Perkin

Bibliography

Koerner, Celide B., and Munoz-Furlong, Anne (1998). *Food Allergies.* Minneapolis, MN: Chronimed.

Metcalfe, Dean D.; Sampson, Hugh A.; and Simon, Richard A. (1997). *Food Allergy: Adverse Reactions to Foods and Food Additives.* Cambridge, MA: Blackwell Science.

Trevino, Richard J., and Dixon, Hamilton S., eds. (1997). *Food Allergy.* New York, NY: Thieme Medical.

Internet Resources

American Academy of Allergy, Asthma, and Immunology. "Media Resources: Position Statement 14." Available from <http://www.aaaai.org/media>

National Digestive Diseases Information Clearinghouse. "Lactose Intolerance." Available from <http://www.niddk.nih.gov>

National Institute of Allergy and Infectious Diseases, and the National Institutes of Health. "Food Allergy and Intolerances Fact Sheet." Available from <http://www.niaid.nih.gov>

Alternative Medicines and Therapies

Alternatives to conventional medical care are increasingly popular in the United States, and their growing use by consumers represents a major trend in Western medicine. Alternative therapies appear to be used most frequently for medical conditions that are **chronic**, such as back pain, **arthritis**, sleep disorders, headache, and digestive problems. Surveys of U.S. consumers have shown that more people visit alternative practitioners each year than visit conventional primary-care physicians. Consumers do not necessarily reject conventional medicine, however. Many simply feel that alternative modalities offer complementary approaches that are more in line with their personal health philosophies.

chronic: over a long period

arthritis: inflammation of the joints

Alternative Medicine, Complementary Medicine, and Integrative Medicine

The terms *alternative medicine* and *alternative therapies* refer to those medical practices that are not considered to be conventional medicine, as practiced in the United States. Other cultures, however, may use one or more of these approaches regularly, and, in fact, many have done so for thousands of years. Most people in the United States who use alternative medicine do so to complement conventional approaches. For example, in addition to using anti-inflammatory **drugs** to ease muscle pain, they may also use massage, **chiropractic**, and/or **osteopathic** manipulation. This practice of complementing conventional medicine with alternative approaches has given rise to the term *complementary medicine*. Presently, alternative medicine is most commonly referred to as *complementary and alternative medicine* (CAM). As conventional medical practitioners become familiar with alternative approaches, these approaches are being integrated into conventional medicine, which is giving rise to *integrative medicine*, in which a combination of therapies representing the best of conventional and alternative medicine is used.

drugs: substances whose administration causes a significant change in the body's function

chiropractic: manipulation of the spine and other bones for healing

osteopathic: related to the practice of osteopathy, which combines standard medical therapy with manipulation of the skeleton to correct problems

Types of CAM Modalities

The National Center for Complementary and Alternative Medicine divides the various CAM *modalities* into five categories: (1) alternative medical systems, (2) mind-body interventions, (3) biologically-based treatments, (4) manipulative and body-based methods, and (5) **energy** therapies. These modalities include a wide variety of approaches, from **acupuncture** to **nutrition** to **meditation** to chiropractic.

Alternative medical systems include medical practices that are traditional in other cultures, such as the **ayurvedic** medical system of India, Chinese traditional medicine, and traditional Native American and Hawaiian medicine.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

acupuncture: insertion of needles into the skin at special points to treat disease

nutrition: the maintenance of health through proper eating, or the study of same

meditation: stillness of thought, practiced to reduce tension and increase inner peace

ayurvedic: an Indian healing system

COMPLEMENTARY AND ALTERNATIVE THERAPIES POPULAR IN THE UNITED STATES

CAM Category	Examples
Alternative medical systems	Acupuncture, Ayurveda, homeopathy, naturopathy, traditional medical systems, such as aboriginal, African, Middle Eastern, Native American, Chinese, Tibetan, Central and South American
Mind-body interventions	Art therapy, dance therapy, hypnosis, meditation, mental healing, music therapy, prayer
Biologically-based treatments	Special diets and nutrition therapy, such as macrobiotic diet; herbal (botanical) therapy, vitamin/mineral therapy, orthomolecular therapy
Manipulative and body-based methods	Chiropractic, massage therapy, osteopathic manipulation
Energy therapies	Biofield therapies, such as Qi gong, Reiki, and Therapeutic Touch; bioelectromagnetic therapies, which involve the unconventional use of electromagnetic fields, such as pulsed fields, magnetic fields, or alternating current or direct current fields

SOURCE: National Center for Complementary and Alternative Medicine

Mind-body interventions recognize the connection between the physical body and the spiritual self, and include practices such as meditation, prayer, and music therapy. Biologically-based modalities are primarily nutrition-related and vary from special diets such as the **macrobiotic diet** to the inclusion of dietary supplements in the diet. Body-based methods involve hands-on manipulation of the body, and include such modalities as massage and chiropractic. The energy therapies are based on the concept that the body has an energy field that can be manipulated to promote healing.

Included among the nutrition approaches that make up the biologically-based modalities is the use of dietary supplements. Dietary supplements may be **botanical** (**herbal**) supplements or nutritional supplements, which include **vitamins**, **minerals**, **antioxidants**, **enzymes**, **metabolites**, nonprescription **hormones**, glandular extracts, and various **amino acids**, **fatty acids**, and other **nutrients**.

macrobiotic: related to a specific dietary regimen based on balancing of vital principles

diet: the total daily food intake, or the types of foods eaten

botanical: related to plants

herbal: related to plants

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

enzyme: protein responsible for carrying out reactions in a cell

metabolite: the product of metabolism, or nutrient processing within the cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

amino acid: building block of proteins, necessary dietary nutrient

fatty acids: molecules rich in carbon and hydrogen; a component of fats

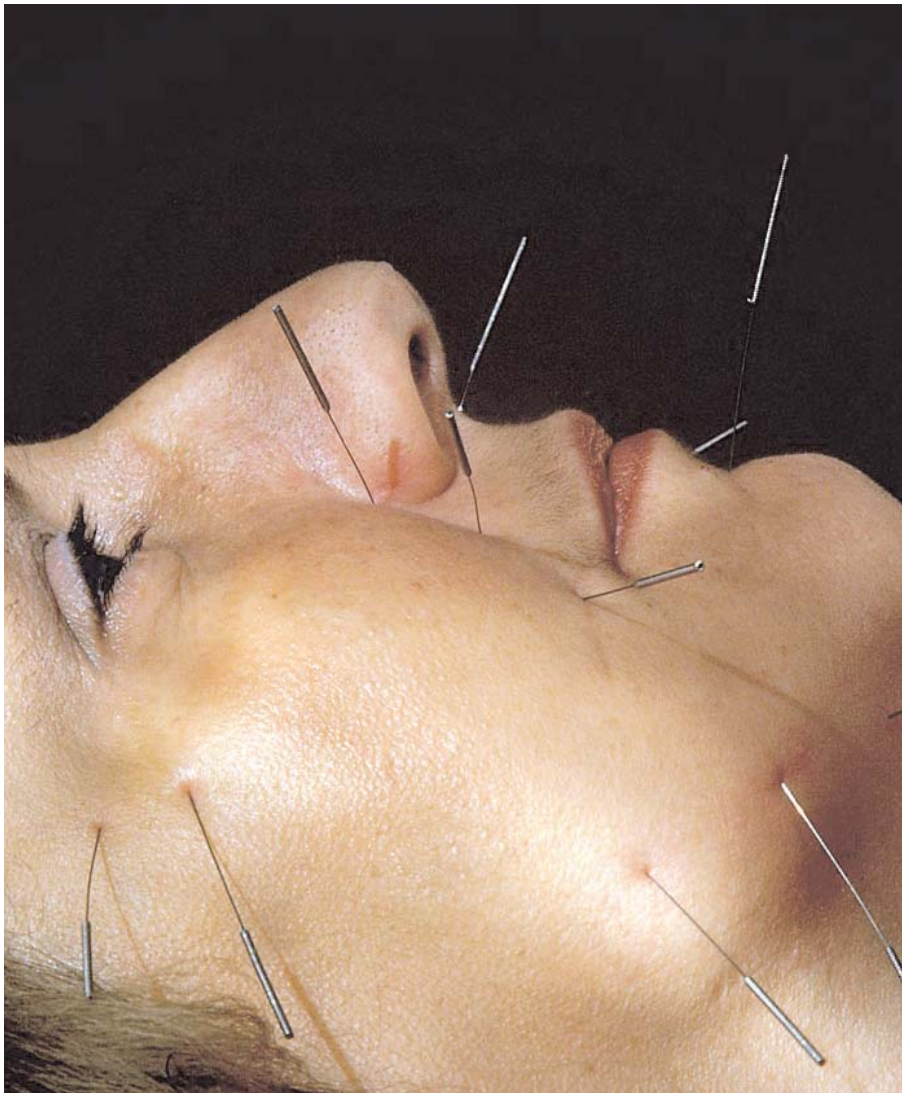
nutrient: dietary substance necessary for health

over-the-counter: available without a prescription

The Dietary Supplement Health and Education Act of 1994

Dietary supplement usage in the United States has increased significantly since the passage in 1994 of the Dietary Supplement Health and Education Act (DSHEA, pronounced Dee-shay). This legislation defined *dietary supplements* as distinct from food and drugs, and it allowed them to be sold without a prescription. The passage of DSHEA provided consumers with the right to purchase dietary supplements that they felt would help them attain their personal health goals. At the same time, DSHEA transferred to consumers the responsibility for making informed choices about the supplements that they used. In contrast to prescription and **over-the-counter** drugs, where effectiveness and safety must be demonstrated prior to marketing of the drugs, premarket approval is not required of manufacturers of dietary supplements. As a result, there is a greater potential risk that dietary supplements may be ineffective, or even harmful, as compared with drugs.

The dietary supplements industry is not unregulated, it is just not regulated to the extent that U.S. consumers have come to expect for prescrip-



The rising popularity of alternative medicine has revived ancient techniques such as acupuncture. In the United States, the requirements for acupuncture licensure may vary from state to state. *[Photograph by Yoav Levy. Phototake NYC. Reproduced by permission.]*

tion drugs. Instead of the drug manufacturer and the physician working to insure that a drug meets the needs of the patient and that it is both safe and effective, consumers must provide these services for themselves with dietary supplements. It is, therefore, important to know the appropriate use of a dietary supplement, the dose at which it is effective, and whether it is likely to interfere with other medications or dietary supplements being taken. It is also important to know that the manufacturer adheres to high quality standards in the preparation of its products.

Supplement Facts Label

To help consumers make informed choices, dietary supplements now contain a supplement facts panel that clearly labels the product as a dietary supplement and gives information such as the amount of a standard dose, the number of recommended doses per day, the list of components (and how much of each is present in a standard dose), and, if the product is a botanical, the Latin name of the plant and the part of the plant used to prepare the product. This latter information is important because the components responsible for a certain health effect may be in one part of the plant but

not in other parts. For example, a consumer purchasing ginger to protect against seasickness would want a product prepared from the roots of the plant, where the active components are, and not the leaves.

In addition, DSHEA established standards for terms, such as **high potency** and antioxidant, and for the types of claims that could be made for a product. Claims that a dietary supplement may help to prevent or cure a disease cannot be made. Such claims are considered health claims and must be reviewed by the Food and Drug Administration for scientific accuracy prior to approval for use on a product label. Manufacturers may, however, use structure/function claims that state that a product can, for example, "help to promote healthy blood levels of **cholesterol**," but they may not state that a product "helps to prevent **heart disease**." All structure/function claims must be accompanied by the following disclaimer: "This statement has not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease."

high potency: a claim about vitamin or mineral content, defined as 100% or more of the Recommended Daily Intake

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Selecting a CAM Modality

When selecting a CAM modality, it is important to have clearly defined health goals. In other words, what are you trying to accomplish, and is this modality an appropriate fit for you? If selecting a therapy, determine if the practitioner of the therapy being considered is a licensed health care practitioner. Licensure does not guarantee the modality will successfully meet one's needs, but it does provide some assurance of training and competency on the part of the practitioner. This information can usually be obtained from the various state boards of medicine, which are responsible for licensing health care professionals.

Selecting quality dietary supplements can be a bit more challenging. Both the natural products industry and the Food and Drug Administration are working to develop uniform standards of quality for dietary supplements. Until these standards are in place, however, consumers must be proactive in determining for themselves what supplements are consistent with their health goals and what manufacturers offer quality products. It is important not to be fooled by **hype**. Be wary of supplements that sound too good to be true or that promise to cure a medical condition.

hype: advertising and brash claims

Quality natural ingredients and responsible product testing can add significantly to the cost of a dietary supplement. The cheapest supplement is not always the best buy, though a high price does not necessarily guarantee high quality. It is important to investigate the supplement manufacturer whose products are being considered. Manufacturer contact information appears on the supplement facts label. One should inquire whether the manufacturer uses Good Manufacturing Practices, how they ensure the purity of their ingredients, and whether they have their products tested by independent laboratories to verify that the label accurately reflects the product in the supplement container.

Alternative therapies are increasingly being used to complement conventional medicine. The consumer should be knowledgeable of the modality chosen, its intended purpose, and whether it is appropriate for that purpose. In the case of dietary supplements, consumers should educate themselves about the appropriate application for the supplement and the

dose that is known to be safe and effective. Although many reputable CAM practitioners and dietary supplement manufacturers exist, consumers should educate themselves about the hallmarks of a quality practitioner or dietary supplement. With CAM modalities in general, and dietary supplements in particular, it is helpful to identify health care professionals who are knowledgeable about CAM and who can provide help in using CAM effectively. SEE ALSO DIETARY SUPPLEMENTS; MACROBIOTIC DIET.

Ruth M. DeBusk

Bibliography

Astin, John A. (1998). "Why Patients Use Alternative Medicine: Results of a National Study." *Journal of the American Medical Association* 279:1548–1553.

Eisenberg, David M.; Davis, Roger B.; Ettner, Susan L.; Appel, Scott; Wilkey, Sonja; Van Rompay, Maria; Kessler, Ronald C. (1998). "Trends in Alternative Medicine Use in the United States, 1990–1997: Results of a Follow-Up National Survey." *Journal of the American Medical Association* 280:1569–1575.

Eisenberg, David M.; Kessler, Ronald C.; Foster, Cindy; Norlock, Frances E.; Calkins, David R.; and Delbanco, Thomas L. (1993). "Unconventional Medicine in the United States: Prevalence, Costs, and Patterns of Use." *New England Journal of Medicine* 328:246–252.

Internet Resources

Center for Food Safety and Applied Nutrition. "Dietary Supplements." Available from <http://www.cfsan.fda.gov>

Federation of State Medical Boards. "Member Medical Boards." Available from <http://www.fsmb.org/members.htm>

National Center for Complementary and Alternative Medicine. <http://www.nccam.nih.gov>

Office of Disease Prevention and Health Promotion (1997). "Report of the Commission on Dietary Supplement Labels." Available from <http://web.health.gov/dietsupp>

U.S. Food and Drug Administration (1995). "Dietary Supplement Health and Education Act." Available from <http://www.fda.gov>

American Dietetic Association

nutrition: the maintenance of health through proper eating, or the study of same

The American Dietetic Association (ADA) was founded in 1917, and its stated mission is to "promote optimal **nutrition** and well-being for all people by advocating for its members" (ADA).

The majority of ADA members are registered dietitians (RDs) or dietetic technicians, registered (DTRs). Membership includes membership in a state dietetic association and an option to join an ADA dietetic practice group representing employment or dietetic interests. Through its annual Food and Nutrition Conference and Exhibition (FNCE), members, students, and interested professionals can network and receive continuing education credits. In addition to the FNCE, ADA provides various member services including promoting dietetic professionals to the public, advocating for the profession, and providing resources for career development.

The Association publishes and has available online the *Journal of the American Dietetic Association*, as well as an online newsletter, the *Courier*. SEE ALSO CAREERS IN DIETETICS; DIETITIAN; DIETETIC TECHNICIAN, REGISTERED.

Susan P. Himburg

American Public Health Association

The American Public Health Association (APHA) is an association of individuals and organizations working to improve the public's health and to achieve equity in health status for all. Founded in 1872, APHA is the oldest and largest organization of public health professionals in the world. APHA members represent over fifty occupations of public health, including physicians, nurses, health educators, community dietitians, social workers, environmentalists, epidemiologists, and others. Members advocate for policies and practices that assure a healthy global society, emphasize health promotion and disease prevention, and seek to protect environmental and community health by addressing issues such as pollution control, **chronic** and **infectious diseases**, and the availability of professional education in public health.

chronic: over a long period

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

Marie Boyle Struble

Internet Resource

American Public Health Association. <http://www.apha.org>

American School Food Service Association

The American School Food Service Association (ASFSA), founded in 1946, is dedicated to ensuring that "healthful meals and nutrition education are available to all children." Its stated mission is "to advance good nutrition for all children" (ASFSA).

The majority of ASFSA members are school food-service administrators, managers, educators, or personnel who advance the availability, quality, and acceptance of school nutrition programs as an integral part of education. Members can also join their state or local association, or pursue an option for professional certification. Through its annual national conference and state meetings, members, students, and interested professionals can network and receive continuing education credits. The association publishes *School Foodservice & Nutrition*. SEE ALSO SCHOOL FOOD SERVICE; SCHOOL-AGED CHILDREN, DIET OF.

Susan P. Himburg

Bibliography

Payne-Palacio, June, and Canter, Deborah D. (2000). *The Profession of Dietetics: A Team Approach*, 2nd edition. New York: Prentice Hall.

Internet Resource

American School Food Service Association. "About ASFSA." Available from <http://www.asfsa.org/>

American School Health Association

The American School Health Association (ASHA) was founded in 1927 by physicians who were members of the American Public Health Association. The main focus of the ASHA is to safeguard the health of school-age

children. Over the years it has evolved into a multidisciplinary organization of administrators, counselors, dentists, health educators, physical educators, school nurses, and school physicians that advocates high-quality school health instruction, health services, and a healthful school **environment**.

environment: surroundings

The association's stated mission "is to protect and promote the health of children and youth by supporting coordinated school health programs as a foundation for school success." As part of its mission, the ASHA publishes the *Journal of School Health*. SEE ALSO SCHOOL FOOD SERVICE; SCHOOL-AGED CHILDREN, DIET OF.

Susan P. Himburg

Internet Resource

American School Health Association. <http://www.ashaweb.org/>

Amino Acids

Amino acids are the building blocks of **protein**. The body has twenty different amino acids that act as these building blocks. Nonessential amino acids are those that the body can synthesize for itself, provided there is enough nitrogen, carbon, hydrogen, and **oxygen** available. Essential amino acids are those supplied by the **diet**, since the human body either cannot make them at all or cannot make them in sufficient quantity to meet its needs. Under normal conditions, eleven of the amino acids are nonessential and nine are essential.

amino acid: building block of proteins, necessary dietary nutrient

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

oxygen: O_2, atmospheric gas required by all animals

diet: the total daily food intake, or the types of foods eaten

Structure

All amino acids have a similar chemical structure—each contains an amino group (NH_2), an acid group (COOH), a hydrogen atom (H), and a distinctive side group that makes proteins more complex than either **carbohydrates** or **lipids**. All amino acids are attached to a central carbon atom (C).

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

lipid: fats, waxes, and steroids; important components of cell membranes

molecule: combination of atoms that form stable particles

pH: level of acidity, with low numbers indicating high acidity

The distinctive side group identifies each amino acid and gives it characteristics that attract it to, or repel it from, the surrounding fluids and other amino acids. Some amino acid side groups carry electrical charges that are attracted to water **molecules** (hydrophilic), while others are neutral and are repelled by water (hydrophobic). Side-group characteristics (shape, size, composition, electrical charge, and **pH**) work together to determine each protein's specific function.

TABLE OF ESSENTIAL AND NONESSENTIAL AMINO ACIDS

Essential amino acids	Nonessential amino acids
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartic acid
Methionine	Cysteine
Phenylalanine	Glutamic acid
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

The three-dimensional shape of proteins is derived from the sequence and properties of its amino acids and determines its function and interaction with other molecules. Each amino acid is linked to the next by a peptide bond, the name given to the link or attraction between the acid (COOH) end of one amino acid and the amino end (NH_2) of another. Proteins of various lengths are made when amino acids are linked together in this manner. A dipeptide is two amino acids joined by a peptide bond, while a tripeptide is three amino acids joined by peptide bonds.

The unique shapes of proteins enable them to perform their various tasks in the body. Heat, acid, or other conditions can disturb proteins, causing them to uncoil or lose their shape and impairing their ability to function. This is referred to as *denaturation.*

Functions of Proteins

Proteins act as **enzymes**, **hormones**, and **antibodies**. They maintain fluid balance and acid and base balance. They also transport substances such as oxygen, **vitamins**, and **minerals** to target cells throughout the body. Structural proteins, such as collagen and keratin, are responsible for the formation of bones, teeth, hair, and the outer layer of skin, and they help maintain the structure of blood vessels and other tissues. In contrast, motor proteins use **energy** and convert it into some form of mechanical work (e.g., dividing cells, contracting muscle).

Enzymes are proteins that facilitate chemical reactions without being changed in the process. The inactive form of an enzyme is called a proenzyme. Hormones (chemical messengers) are proteins that travel to one or more specific target tissues or organs, and many have important regulatory functions. **Insulin**, for example, plays a key role in regulating the amount of **glucose** in the blood. The body manufactures antibodies (giant protein molecules), which combat invading antigens. Antigens are usually foreign substances such as **bacteria** and **viruses** that have entered the body and could potentially be harmful. Immunoproteins, also called immunoglobulins or antibodies, defend the body from possible attack by these invaders by binding to the antigens and inactivating them.

Proteins help to maintain the body's fluid and **electrolyte** balance. This means that proteins ensure that the proper types and amounts of fluid and minerals are present in each of the body's three fluid compartments. These fluid compartments are *intracellular* (contained within cells), *extracellular* (existing outside the cell), and *intravascular* (in the blood). Without this balance, the body cannot function properly.

Proteins also help to maintain balance between acids and bases within body fluids. The lower a fluid's pH, the more acidic it is. Conversely, the higher the pH, the less acidic the fluid is. The body works hard to keep the pH of the blood near 7.4 (neutral). Proteins also act as carriers, transporting many important substances in the bloodstream for delivery throughout the body. For example, a *lipoprotein* transports **fat** and **cholesterol** in the blood.

Food Sources

Humans consume many foods that contain proteins or amino acids. One normally need not worry about getting enough protein or amino acids in

A diabetic child injects herself with insulin. Composed of 51 amino acids, insulin is a small protein used by the body to regulate glucose levels in the blood. *[Custom Medical Stock Photo. Reproduced by Permission.]*

enzyme: protein responsible for carrying out reactions in a cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

antibody: immune system protein that protects against infection

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

insulin: hormone released by the pancreas to regulate level of sugar in the blood

glucose: a simple sugar; the most commonly used fuel in cells

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

electrolyte: salt dissolved in fluid

fat: type of food molecule rich in carbon and hydrogen, with high energy content

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

the typical American diet. Foods from animal sources are typically rich in essential amino acids. These include chicken, fish, eggs, dairy products, beef, and pork. With the increasing emphasis on vegetarian diets, plant sources of protein are gaining in popularity. Such sources include dried beans (black, kidney, northern, red, and white beans), peas, soy, nuts, and seeds. Although plant sources generally lack one or more of the essential amino acids, when combined with whole grains such as rice, or by eating nuts or seeds with **legumes**, all the amino acids can be obtained. SEE ALSO DIET; FATS; MALNUTRITION; NUTRIENTS; PLANT-BASED DIETS; PROTEIN.

legumes: beans, peas, and related plants

Susan P. Himburg

Bibliography

Insel, Paul; Turner, R.; and Ross, Don (2001). *Nutrition.* Sudbury, MA: Jones and Bartlett.

Whitney, Eleanor N., and Rolfes, Sharon R. (2002). *Understanding Nutrition*, 9th edition. Belmont, CA: Wadsworth Group.

Anemia

Anemia affects more than 30 percent of the world's population, and it is one of the most important worldwide health problems. It has a significant **prevalence** in both developing and industrialized nations. Causes of anemia include **nutritional deficiencies**, particularly of **iron**, vitamin B_{12}, and **folate** (folic acid); excess blood loss from menstruation or **chronic** illness and infection; ingestion of toxic substances, such as lead, ethanol, and other compounds; and **genetic** abnormalities such as **thalassemia** and **sideroblastosis**.

anemia: low level of red blood cells in the blood

prevalence: describing the number of cases in a population at any one time

nutritional deficiency: lack of adequate nutrients in the diet

iron: nutrient needed for red blood cell formation

folate: one of the B vitamins, also called folic acid

chronic: over a long period

genetic: inherited or related to the genes

thalassemia: inherited blood disease due to defect in the hemoglobin protein

sideroblastosis: condition in which the blood contains an abnormally high number of sideroblasts, or red blood cells containing iron granules

Anemia is caused by a deficiency in the intake and **absorption** elements required to make red blood cells. The condition is defined as one in which the blood is deficient in red blood cells, in **hemoglobin**, or in total volume. This results in blood that is incapable of meeting the **oxygen** needs of the body's tissues. Anemia is characterized by changes in the size and color of red blood cells. Red blood cells, or erythrocytes, are primarily responsible for oxygen transport from the lungs to the body's many cells. Hemoglobin is an oxygen-carrying **protein** in the red blood cell that incorporates iron into its structure. Therefore, iron is an essential building block of blood erythrocytes. When red blood cells are larger than normal, the anemia is termed *macrocytic*, and when they are smaller than normal, it is called *microcytic*. Normal red cell color is termed *normochromic*, and if the red cells appear pale, the anemia is called *hypochromic*. When extensive lab testing is not available for diagnosis, the use of a portable colorimeter can be used to detect anemia.

absorption: uptake by the digestive tract

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

oxygen: O_2, atmospheric gas required by all animals

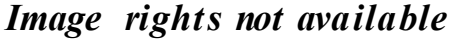
protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Iron-Deficiency Anemia

Anemia in the developing world is most commonly caused by an iron deficiency, which affects up to 50 percent of the population in some countries. Iron deficiency not only impairs the production of red cells in the blood, but also affects general cell growth and proliferation in tissues like the **nervous system** and the **gastrointestinal** tract. Red cells in a patient with iron-deficiency anemia are both microcytic and hypochromic.

nervous system: the brain, spinal cord, and nerves that extend throughout the body

gastrointestinal: related to the stomach and intestines



Sickle-cell anemia is a genetic disease that causes normal red blood cells (left) to become rigid and sickle-shaped (right). The misshapen cells can impede blood circulation, causing pain and possibly tissue damage. *[Photograph by Stanley Flegler. Visuals Unlimited. Reproduced by permission.]*

Iron deficiency affects young children, adolescents, and women of reproductive age—three periods of rapid growth during which the body's iron needs are higher than normal. In children, iron requirements are highest between the ages of six and eighteen months, and can be ten times the requirement of a normal adult. Iron is commonly absorbed from both human milk and cow's milk, and, if consumed in good quantities, these sources can meet the body's iron needs. A deficiency can result from inadequate intake, or it can occur if milk remains the sole source of a child's **nutrition** after the age of four months, when iron needs exceed that provided by milk alone. Research in Chile has shown that 40 percent of children whose main source of nutrition was breast milk developed iron-deficiency anemia. Such children can appear tired and inattentive, and they can suffer from delayed motor development. Some children can even develop mild to moderate mental retardation as a result of iron-deficiency anemia. Recent research has shown that iron-deficiency anemia can also contribute to emotional development problems, with **malnourished** children acting more irritable and fussy.

nutrition: the maintenance of health through proper eating, or the study of same

malnourished: lack of adequate nutrients in the diet

TYPES AND CAUSES OF ANEMIA

Type	Lab values	Causes
Macrocytic, normochromic	MCV: > 100fl MCHC: 34	Vitamin B_{12} deficiency, folate deficiency, vitamin C deficiency, chemotherapy (megaloblastic marrow); aplastic anemia, hypothyroidism (normoblastic marrow)
Microcytic, hypochromic	MCV: < 80 MCHC: < 30	Iron deficiency, thalassemia, sideroblastic anemia, chronic lead poisoning, anemia of chronic illness
Normocytic, normochromic	MCV: 80–99fl MCHC: 34 +/−2	Iron deficiency (early), chronic disease

MCV: mean corpuscular volume
MCHS: mean corpuscular hemoglobin concentration
fl: femtoliter (one quadrillionth of a liter)

Pregnant women can have up to double the requirement of iron for a normal adult, with the majority of the mother's iron being transferred to her growing fetus. Adult diets in most of the developing world tend to be iron-poor, and a low dietary intake can result in iron deficiency. Deficiency can also occur as a result of poor iron absorption due to gastrointestinal pathology, blood loss due to normal menstruation, blood loss from **parasitic** infections such as **hookworm** and **malaria**, and blood loss from chronic diarrhea—all of which are common in developing countries.

parasitic: feeding off another organism

hookworm: parasitic nematode that attaches to the intestinal wall

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

Other Causes

The two other primary causes of nutritional anemia are deficiencies in vitamin B_{12} and folic acid, both of which are necessary for the production of **DNA**, **RNA**, and protein. Without these necessary factors, red blood cells can develop abnormally, or even die prematurely in the **bone marrow** where they are made. This leads to what is known as *megaloblastic anemia*.

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

RNA: ribonucleic acid, used in cells to create proteins from genetic information

bone marrow: dividing cells within the long bones that make the blood

congenital: present from birth

Folate deficiency is most often caused by poor intestinal absorption or low intake of folate-rich foods, such as human milk, cow's milk, fruits, green vegetables, and certain meats. It is also caused by **congenital** defects in intestinal absorption. Just as with iron, folic acid requirements are highest during periods of rapid growth, particularly infancy and pregnancy. Folate-deficient children present with common symptoms of anemia, as well as chronic diarrhea. Folate deficiency can also occur with **kwashiorkor** or **marasmus**. If it occurs during pregnancy, folate deficiency can lead to **neural** tube defects, spontaneous abortions, and prematurity.

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

neural: related to the nervous system

Vitamin B_{12}, derived from a substance called *cobalamin*, is mainly found in meats and other animal products—humans cannot synthesize this vitamin on their own. A good amount of its absorption depends on the presence of a substance called *intrinsic factor* (see sidebar). It does not normally occur with kwashiorkor or marasmus. Both folate and vitamin B_{12} deficiencies have also been linked to **cardiovascular** disease, mood disorders, and increased frequency of chromosomal breaks (which may contribute to the development of **cancer**).

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

Treatment

Each of the important causes of nutritional anemia can be eradicated through prevention and treatment. Many countries have begun this process by instituting food supplementation programs in which grains and cereals are

Pernicious Anemia

Pernicious anemia is a common cause of cobalamin/vitamin B_{12} deficiency. It is primarily a disease of the elderly and caused by an abnormality in the immune system where the body creates antibodies to intrinsic factor (a substance that facilitates absorption of vitamin B_{12}) or to the cells in the stomach that secrete it. The lack of intrinsic factor B_{12} leads to vitamin B_{12} deficiency. It can also be caused by physiologic or anatomic disturbances of the stomach that might prevent intrinsic factor secretion. In children, an atypical and rare form of pernicious anemia can be inherited. It is an autosomal recessive disorder that results in an inability to secrete intrinsic factor, and it presents with anorexia, weakness, a painful red tongue, and neurologic abnormalities.

fortified with iron, folate, or vitamin B_{12}. Given adequate resources, these deficiencies can also be ameliorated with direct oral supplements of absorbable iron, vitamin B_{12}, and folic acid. Injectable forms of iron are also available. It has been found that the supplementation of vitamin A to at-risk populations improves anemia more efficiently than iron supplementation alone.

fortified: altered by addition of vitamins or minerals

Treatment plans must also focus on the causes of anemia and therefore must include sanitation, treatment of infections such as malaria and HIV, and, most important, treatment of intestinal **parasites**. Much work is needed to address general **malnutrition**—not only concerning these deficiencies, but also other commonly occurring ones (e.g., vitamin A, **zinc**, copper, **calcium**). Programs dedicated to decreasing the rates of infection and illness in developing countries—through health education, immunization, sanitation, and appropriate treatment—will also contribute to a lower **incidence** and prevalence of worldwide anemia. SEE ALSO KWASHIORKOR; MALNUTRITION; MARASMUS; NUTRITIONAL DEFICIENCY; VITAMINS, WATER SOLUBLE.

parasite: organism that feeds off of other organisms

malnutrition: chronic lack of sufficient nutrients to maintain health

zinc: mineral necessary for many enzyme processes

calcium: mineral essential for bones and teeth

incidence: number of new cases reported each year

Seema P. Kumar

Bibliography

Behrman, Robert E.; Kliegman, Robert M.; and Jenson, Hal B., eds. (2000). *Nelson Textbook of Pediatrics*, 16th edition. Philadelphia, PA: W. B. Saunders.

Hoffbrand, A. V., and Herbert, V. (1999). "Nutritional Anemias." *Seminars in Hematology* 36(4).

Isselbacher, Kurt J. (1994). *Harrison's Textbook of Internal Medicine*, 13th edition. New York: McGraw-Hill.

Pollitt, E. (2000). "Developmental Sequela from Early Nutritional Deficiencies: Conclusive and Probability Judgments." *Journal of Nutrition* 130.

Ramakrishnan, U., ed. (2001). *Nutritional Anemias.* Boca Raton, FL: CRC Press.

Rhoades, R. A., and Tanner, G. A. (1995). *Medical Physiology.* Boston: Little Brown.

Yip, R., and Ramakrishnan, U. (2002). "Experiences and Challenges in Developing Countries." *Journal of Nutrition* 132.

Anorexia Nervosa

Anorexia nervosa is an **eating disorder** characterized by an extreme reduction in food intake leading to potentially life-threatening weight loss. This syndrome is marked by an intense, irrational fear of weight gain or excess body fat, accompanied by a distorted perception of body weight and shape. The onset is usually in the middle to late teens and is rarely seen in females over age forty. Among women of menstruating age with this disorder, **amenorrhea** is common.

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

amenorrhea: lack of menstruation

A clinical diagnosis of anorexia nervosa necessitates body weight less than 85 percent of average for weight and height. Subtypes of this disorder include the **binge** eating/purging type (bingeing and purging are present) or the restricting type (bingeing and purging are absent). SEE ALSO ADDICTION, FOOD; BODY IMAGE; BULIMIA NERVOSA; EATING DISORDERS; EATING DISTURBANCES.

binge: uncontrolled indulgence

Karen Ansel

Bibliography

American Dietetic Association (1998). *Nutrition Intervention in the Treatment of Anorexia Nervosa, Bulimia Nervosa, and Eating Disorder Not Otherwise Specified (EDNOS).* Chicago: Author.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC: Author.

Escott-Stump, Sylvia, and Mahan, L. Kathleen (1996). *Krause's Food, Nutrition, and Diet Therapy*, 9th edition. Philadelphia: W. B. Saunders.

Olson, James A.; Shike, Moshe; Shils, Maurice E. (1994). *Modern Nutrition in Health and Disease*. Media, PA: Williams & Wilkins.

Anthropometric Measurements

anthropometric: related to measurement of characteristics of the human body

The term **anthropometric** refers to comparative measurements of the body. Anthropometric measurements are used in nutritional assessments. Those that are used to assess growth and development in infants, children, and adolescents include length, height, weight, weight-for-length, and head circumference (length is used in infants and toddlers, rather than height, because they are unable to stand). Individual measurements are usually compared to reference standards on a growth chart.

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

Anthropometric measurements used for adults usually include height, weight, **body mass index** (BMI), waist-to-hip ratio, and percentage of body fat. These measures are then compared to reference standards to assess weight status and the risk for various diseases. Anthropometric measurements require precise measuring techniques to be valid. SEE ALSO BODY MASS INDEX; NUTRITIONAL ASSESSMENT; WAIST-TO-HIP RATIO.

Delores C. S. James

Antioxidants

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

free radical: highly reactive molecular fragment, which can damage cells

oxygen: O_2, atmospheric gas required by all animals

metabolism: the sum total of reactions in a cell or an organism

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

carotenoid: plant-derived molecules used as pigments

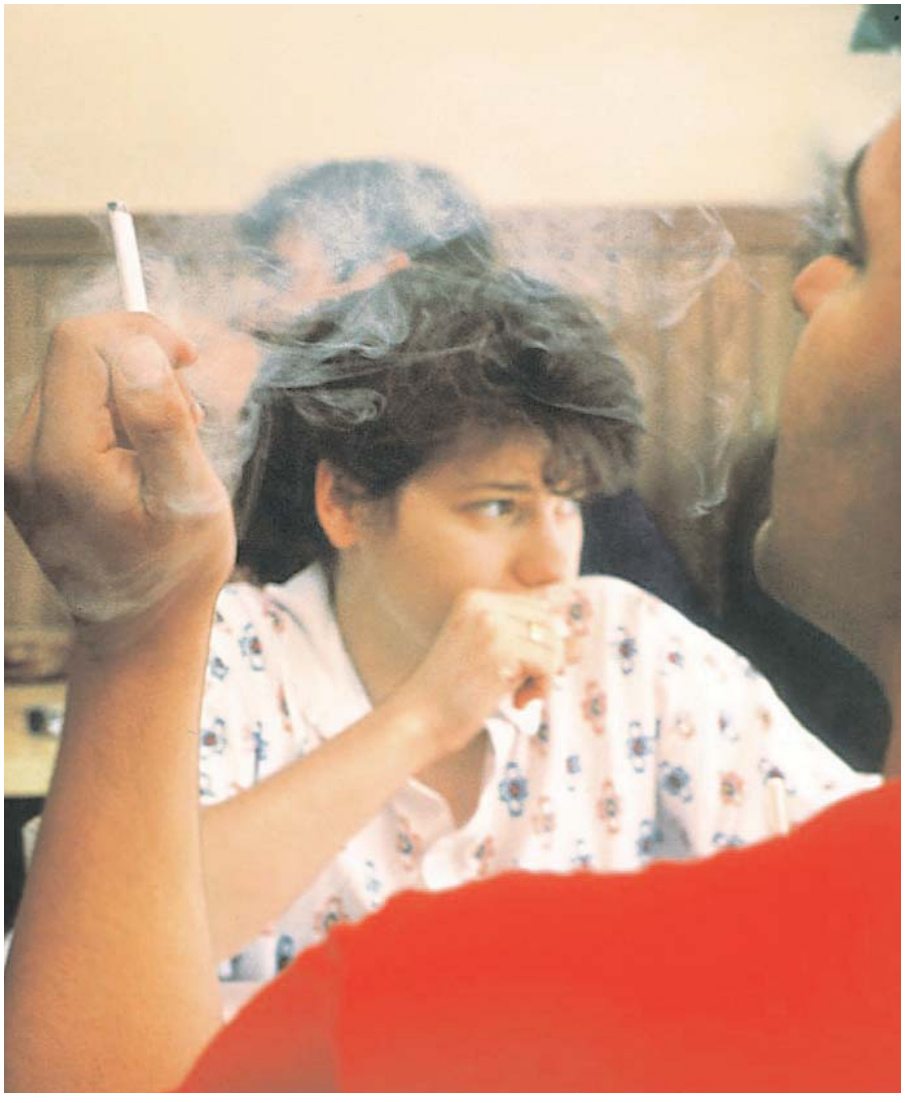
water-soluble: able to be dissolved in water

diet: the total daily food intake, or the types of foods eaten

Americans spend several billion dollars a year on **antioxidants** in an effort to improve their health. Science has been looking at antioxidants and their role in everything from preventing **cancer** and **heart disease** to boosting the **immune system** and slowing the aging process. Antioxidants provide a layer of protection for the cells and tissues of the body, just as a thick coat of wax helps protect a car's finish. Specifically, antioxidants protect against free radical damage. What are **free radicals**?

People must breathe in **oxygen** to live. Continuously on the move in the blood stream and transported to every cell, oxygen is necessary for all essential bodily functions. However, a small amount of this oxygen gets loose and produces unstable by-products called free radicals. Body processes, such as **metabolism**, as well as environmental factors, including pollution and cigarette smoke, can produce free radicals. An overload of free radicals in the body causes damage to the cells, ultimately resulting in disease and accelerated aging.

Antioxidant-rich food may help prevent various cancers, heart disease, and diseases of aging. **Vitamins** C and E, **carotenoids** (including beta-carotene), and the mineral selenium are all powerful antioxidants found in food. Vitamin C, a **water-soluble** vitamin, is also known as ascorbic acid. Most of the vitamin C in the **diet** (90%) comes from fruits and vegetables. However, since vitamin C is water soluble, cooking can destroy the vitamin C in a food.



Cigarette smoke, including second-hand smoke, is a major source of free radicals. These volatile molecules can damage tissues and cause disease. *[© 1993 Custom Medical Stock Photo, Inc. Reproduced by permission.]*

Vitamin E, also known as alpha tocopherol, is a **fat**. Because vitamin E is found in oils, people who follow a low-fat diet may not get enough. Beta-carotene is a member of the carotenoid family. Found mainly in plants, carotenoids provide the vibrant red, yellow, green, and orange colors of fruits and vegetables, with carrots being a major contributor of beta-carotene. Typically, beta-carotene is a conditionally essential **nutrient**, but when one's intake of vitamin A is low, beta-carotene becomes an essential nutrient, meaning that it must be obtained from food and cannot be manufactured by the body.

Selenium is an essential **trace** mineral (*trace* **minerals** are needed only in small amounts). The amount of selenium found in food is directly related to the amount of selenium in the soil in which the food was grown. It is necessary for healthy immune function and is tied to **killer-cell** activity and **antibody** production. The many health benefits of the various antioxidants can be provided by a variety of food sources.

More and more **functional foods** contain combinations of various supplements. As popular as antioxidants are, an excess amount of them can be toxic. One reason to obtain antioxidants from food is that high doses may

fat: type of food molecule rich in carbon and hydrogen, with high energy content-soluble vitamin that is essential for human health

nutrient: dietary substance necessary for health

trace: very small amount

mineral: an inorganic (non-carbon-containing) element, ion, or compound

killer-cell: type of white blood cell that helps protect the body from infection

antibody: immune system protein that protects against infection

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

HEALTH BENEFITS OF ANTIOXIDANTS AND THEIR FOOD SOURCES

Antioxidant	Health benefits	Food sources
Selenium	Helps maintain healthy hair and nails, enhances immunity, works with vitamin E to protect cells from damage. Reduces the risk of cancer, particularly lung, prostate, and colorectal.	Garlic, seeds, Brazil nuts, meat, eggs, poultry, seafood, whole grains. The amount in plant sources varies according to the content of the soil.
Beta-carotene	Keeps skin healthy, helps prevent night blindness and infections, promotes growth and bone development.	Red, yellow-orange, and leafy green vegetables and fruits, including carrots, apricots, cantaloupe, peppers, tomatoes, spinach, broccoli, sweet potatoes, and pumpkin.
Vitamin E	Acts as the protector of essential fats in cell membranes and red blood cells. Reduces risk of cancer, heart disease, and other age-associated diseases.	Peanut butter, nuts, seeds, vegetable oils and margarine, wheat germ, avocado, whole grains, salad dressings.
Vitamin C	Destroys free radicals inside and outside cells. Helps in the formation of connective tissue, the healing of wounds, and iron absorption, and also helps to prevent bruising and keep gums healthy. May reduce risk of cataracts, heart disease, and cancer.	Peppers, tomatoes, citrus fruits and juices, berries, broccoli, spinach, cabbage, potatoes, mango, papaya.

SOURCE: The American Dietetic Association And WebMD.

actually promote free radical production, also known as pro-oxidation, increasing the chance for health problems. Those who may benefit most from antioxidants include people dealing with a lot of **stress**, dieters limiting their **calories** to 1,200 per day or less, people on a low-fat diet, smokers, older adults, and people with a family history of heart disease or cancer. SEE ALSO FUNCTIONAL FOODS.

stress: heightened state of nervousness or unease

calorie: unit of food energy

Susan Mitchell

Bibliography

Medical Economics Company (2001). *PDR for Nutritional Supplements*. Montvale, NJ: Author.

Internet Resources

American Dietetic Association. "Vitamin E: Disease Prevention for Your Good Health." Available from <http://www.eatright.org>

Doheny, Kathleen. "The Supplement Frenzy." Available from <http://www.webmd.com>

Appetite

Why do many people desire ice cream and pie or some other rich dessert after eating a huge Thanksgiving dinner? This desire is referred to as *appetite*, which is not the same as *hunger*. Appetite is a complicated phenomenon, linking biology with **environment**. It is a biopsychological system, meaning it is the result of both our biology (hunger) and psychology (desires and feelings).

environment: surroundings

Hunger, on the other hand, is purely **biological**. It is that nagging, irritating feeling that makes one think about food and the need to eat. It gets stronger the longer one goes without food, and it weakens after eating. Although the **physiological** reasons people feel hunger have not been clearly identified, the feeling of hunger rises and falls based on the activation of **neural** circuitry related to eating. There are many chemical agents in the human body that affect the sensation of hunger. Unfortunately for some people, eating behavior is not governed by hunger and satiety (feeling of fullness), but by a variety of other factors. For example, some people eat in response to their feelings of **anxiety**, **depression**, or **stress**. Eating temporarily helps lessen these feelings, and thus tends to become a coping response whenever they have these bad feelings.

biological: related to living organisms

physiological: related to the biochemical processes of the body

neural: related to the nervous system

anxiety: nervousness

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

stress: heightened state of nervousness or unease

Weight gain may occur if people eat for reasons other than hunger. One strategy to help people manage their weight is for them to learn to differentiate between appetite and hunger, to learn to "listen to their bodies," and to eat only when they are hungry—and to stop when they are full. Hunger-control medications can help reduce the biological need to eat, but people still need to manage their psychological feelings about eating. SEE ALSO HUNGER; SATIETY; WEIGHT MANAGEMENT.

John P. Foreyt

Bibliography

Bray, George A. (1998). *Contemporary Diagnosis and Management of Obesity*. Newtown, PA: Handbooks in Health Care.

Fairburn, Christopher G., and Brownell, Kelly D. eds. (2002). *Eating Disorders and Obesity: A Comprehensive Handbook*, 2nd edition. New York: Guilford Press.

Arteriosclerosis

The term *arteriosclerosis* is used to describe several **cardiovascular** diseases, including those involving the blood vessels. In this instance, the **arteries** become hardened and blood vessels lose their "elastic" effect. Arteriosclerosis can begin in early childhood.

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carries blood away from the heart toward the body tissues

The primary risk factors for arteriosclerosis include hypertension (**high blood pressure**), **diabetes** mellitus, smoking, and **obesity**. All of these risk factors are preventable by exercising regularly, smoking cessation, eating at least five servings of fruits and vegetables daily, and through proper **stress** management.

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

stress: heightened state of nervousness or unease

Two types of arteriosclerosis include Monckeberg's arteriosclerosis, which usually involves restricted movement of the lower extremities, and arteriolar sclerosis, which can lead to decreased vision and peripheral vascular disease. Signs and symptoms of arteriosclerosis include high blood pressure, multiple kidney infections, and poor circulation in the toes and fingers. SEE ALSO ATHEROSCLEROSIS; CARDIOVASCULAR DISEASES; HEART DISEASE.

Teresa A. Lyles

Bibliography

Insel, P. M., and Roth, W. T. (2003). "Cardiovascular Disease and Cancer." In *Core Concepts in Health*, brief 9th edition. New York: McGraw-Hill

Internet Resources

Well-Net/Health Education Associates. "Arteriosclerosis." Available from <http://www.well-net.com/cardiov>

Health with Nutrition. "Arteriosclerosis/Atherosclerosis." Available from <http://www.healingwithnutrition.com>

Artificial Sweeteners

Artificial sweeteners may assist in weight management, prevention of dental **caries**, and control of blood **glucose** for diabetics. It has also been suggested that low-calorie sweeteners may stimulate the appetite, but the bulk of evidence does not support this hypothesis. Conclusive research demonstrates that artificial sweeteners have no effect on **carbohydrate metabolism**, short- or long-term blood glucose control, or **insulin** secretion, and they are thus an excellent sugar alternative for diabetics. There have been a number of health concerns related with these products, though the Food and Drug Administration (FDA) approval process for artificial sweeteners involves a comprehensive analysis of scientific data to satisfy safety requirements. All "generally recognized as safe" (GRAS) sweeteners have undergone extensive safety testing and have been carefully reviewed by the FDA.

caries: cavities in the teeth

glucose: a simple sugar; the most commonly used fuel in cells

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

metabolism: the sum total of reactions in a cell or an organism

insulin: hormone released by the pancreas to regulate level of sugar in the blood

Five FDA-Approved (GRAS) Artificial Sweeteners

Acesulfame potassium (Acesulfame-K) was discovered in 1967 and approved for use in the United States in 1988. Its trade name is Sunette. Two hundred times sweeter than **sucrose**, this sweetener is stable when heated, making it suitable for cooking. However, when used in large amounts it has a bitter aftertaste. It is not broken down by the body, and it does not provide any calories. Over ninety scientific studies have been conducted by the FDA, and the World Health Organization's Joint Expert Committee on **Food Additives** (JECFA) has also endorsed Acesulfame K's safety.

sucrose: table sugar

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

Aspartame was discovered in 1969 and approved for use in the United States in 1981. Its trade name is NutraSweet. Also two hundred times sweeter than sugar, aspartame is not suitable in applications that require high temperatures, as it loses its sweetness when heated. It contains four calories per gram, but, because of its intense sweetness, the amount of **energy** derived from it is negligible. It is synthesized from aspartic acid and phenylalanine, two essential **amino acids**. Persons with the rare hereditary **metabolic** disorder **phenylketonuria** (PKU), an inborn error of metabolism, must control their intake of phenylalanine from all sources, including aspartame, and therefore all U.S. products containing aspartame are labeled "This product contains phenylalanine." Because it is impossible to know if an unborn child has PKU, it is recommended that pregnant women not use aspartame. The FDA states that aspartame is the most thoroughly tested food additive ever submitted to the agency.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

amino acid: building block of proteins, necessary dietary nutrient

metabolic: related to processing of nutrients and building of necessary molecules within the cell

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

Neotame was discovered in 1990 and was approved for use in the United States in 2002. Eight thousand times sweeter than sugar, this analog of aspartame can be used in both cooking and baking applications. Although neotame is a derivative of aspartame, it is not metabolized to phenylalanine, and

A few popular alternatives to table sugar include sucralose, aspartame, and saccharin. Despite controversy over potential health risks related to their consumption, each of these products has undergone a decade or more of scientific testing and is generally recognized as safe. *[Octane Photographic. Reproduced by permission.]*

no special PKU labeling is required. The FDA reviewed more than 113 human and animal studies before ruling on neotame.

Saccharin was discovered in 1879 and approved for use in the United States in 1879. Its trade name is Sweet'n Low. Three hundred to five hundred times sweeter than table sugar, saccharin provides no energy, as it is not metabolized by human beings. It has a bitter and somewhat metallic aftertaste. The largest population study to date, involving nine thousand individuals, showed that saccharin does not increase the risk of **cancer**, and on December 15, 2000, the U.S. Congress passed legislation to remove the warning label that had been required on foods and beverages containing saccharin since 1977 (warning labels were required because of findings that saccharin caused bladder tumors in mice when they were given high doses of the sweetener). Saccharin is approved in more than one hundred countries around the world and has been reviewed and determined safe by the Joint Expert Committee on Food Additives of the World Health Organization and the Scientific Committee for Food of the European Union.

cancer: uncontrolled cell growth

Sucralose was discovered in 1976 and approved for use in the United States in 1988. Its trade name is Splenda. Six hundred times sweeter than sugar, sucralose is not absorbed from the digestive tract, so it adds no calories to consumed food. It is made from rearranged sugar **molecules** that substitute three **atoms** of chlorine for three hydroxyl groups on the sugar molecule. Sucralose has been tested in more than one hundred studies.

molecule: combination of atoms that form stable particles

atoms: fundamental particles of matter

Sugar Alcohols (GRAS)

Sugar alcohols are not technically artificial sweeteners. Examples include sorbitol, xylitol, lactitol, mannitol, isomalt, and maltitol, which are used to sweeten "sugar-free" foods such as candy, cookies, and chewing gum. The alcohols have fewer calories than sugar, do not promote tooth decay, and do not cause a sudden increase in blood glucose because the bloodstream does not easily absorb them. They may cause, however, effects similar to a laxative if consumed in excess. Products containing large amounts of sugar alcohols must be labeled with the warning: "Excess consumption may have a laxative effect."

Artificial Sweeteners Pending FDA Approval

Alitame is two thousand times sweeter than sugar. An FDA petition was filed in 1986. Like neotame, alitame is a derivative of aspartame. It is approved for use in a variety of food and beverage products in Australia, New Zealand, Mexico, Colombia, Indonesia, and the People's Republic of China.

Cyclamate was discovered in 1937, banned in 1969, and a petition for approval was refiled in 1982. After being banned by the FDA in 1969, due to findings that high doses cause bladder tumors in mice, cyclamate has been approved for use in more than fifty countries. The sweetener is a derivative of cyclohexylsulfamic acid and is thirty times sweeter than sucrose. In May 2003, the European Union reduced the recommended average daily intake of this sweetener in soft drinks, juice, and milk-based drinks, based on evidence that the conversion rate of cyclamate in the body is higher than previously thought.

Stevioside (stevia) is obtained from the leaves of a South American shrub. Though it can impart a sweet taste to foods, it cannot be sold as a sweetener because the FDA considers it an unapproved food additive. Stevioside is a high-intensity low-calorie sweetener three hundred times sweeter than sucrose. It is approved in Japan, South Korea, Brazil, Paraguay, and Argentina. However, the World Health Organization (WHO) has determined that the data is insufficient to label it as a sweetener.

Artificial sweeteners taste sweet like sugar without the added calories. They do not promote tooth decay, and they are an acceptable alternative for people with **diabetes** or those wishing to decrease their use of sucrose. Artificial sweeteners, and their metabolic by-products and components, are not considered harmful to human beings at the levels normally used. When used in the context of a healthful **diet**, artificial sweeteners are generally safe for consumption. SEE ALSO GENERALLY RECOGNIZED AS SAFE; INBORN ERRORS OF METABOLISM; PHENYLKETONURIA.

diabetes: inability to regulate level of sugar in the blood

diet: the total daily food intake, or the types of foods eaten

Kyle Shadix

Bibliography

American Dietetic Association (1998). "Position of the American Dietetic Association: Use of Nutritive and Nonnutritive Sweeteners." *Journal of the American Dietetic Association* 98:580–587.

Drewnoski, A. (1995). "Intense Sweeteners and Control of Appetite." *Nutrition Review* 53:1–7.

Joint FAO/WHO Expert Committee on Food Additives (1993–2003). "Evaluation of Certain Food Additives and Contaminants." Geneva, Switzerland: World Health Organization.

Nabors, Lyn (2001). *Alternative Sweeteners*, 3rd edition. New York: Marcel Dekker.

Stegink, Lewis, and Filer, L. (1984). *Aspartame: Physiology and Biochemistry*. New York: Marcel Dekker.

Asian Americans, Diets of

Asian Americans represent a large and rapidly growing segment of the U.S. population. According to the U.S. Census Bureau, there were 11.9 million Asian Americans residing in the United States (4.2 percent of the total population) in the year 2000. Chinese Americans were the leading Asian group

Asian-American diets are based on rice and rice products, with less emphasis on the regular consumption of meat and dairy products, which differs from traditional American fare. *[AP/Wide World Photos. Reproduced by permission.]*

(not including Taiwanese Americans), followed by Filipinos (2.4 million) and Asian Indians (1.9 million). A U.S. Census estimate predicts a tripling of this population by 2050.

Asian Americans are exceedingly diverse, coming from nearly fifty countries and ethnic groups, each with distinct cultures, traditions, and histories, and they speak over 100 languages and dialects. Asian Americans have immigrated to the United States from different parts of Asia, including India, Pakistan, Bangladesh, Sri Lanka, the Philippines, China, Hong Kong, Cambodia, Vietnam, Laos, Thailand, Korea, and Japan. They are categorized by the Census Bureau under the broad classification of "Asian and Pacific Islanders in the United States." In 2000, Asian-born residents accounted for 26 percent (7.2 million) of the nation's total foreign-born population, with approximately half (about 45%) of them living in three metropolitan areas: Los Angeles, New York, and San Francisco.

Food Habits

Two key elements draw the diverse cultures of the Asian region together: (1) the composition of meals, with an emphasis on vegetables and rice, with relatively little meat; and (2) cooking techniques. Eating is a vital part of the social matrix, and Asian-American cuisine includes a wide variety of meals, snacks, and desserts for social occasions. Asian food preparation techniques include stir-frying, barbecuing, deep-frying, boiling, and steaming. All in-

MERITS AND WEAKNESSES OF TRADITIONAL ASIAN DIETS

	Staple foods	Merits of diet	Weaknesses of diet	Common diseases
Cambodian	Rice Fish Tea	Low in fat Low in sugar	People often unable to obtain necessary food	Tuberculosis Polio
Chinese	Rice Vegetables Green Tea	Reduces risk for heart disease and certain cancers	Iodine deficiency Iron deficiency	Anemia
Filipino	Rice Vegetables Seafood Fruit	Reduces risk for heart disease and cancers	Protein deficiency Iron deficiency	Anemia Diarrhea Respiratory infections
Hmong	Rice Vegetables Meat Fish	Low in fat Low in sugar	Lack of fruit Calcium deficiency	
Asian Indian	Cereals Rice Vegetables	Low in fat Low in sugar	Protein deficiency Iron deficiency Vitamin A deficiency	Respiratory infections Intestinal infections Anemia Protein-energy malnutrition Diabetes
Laotian	Rice Vegetables Fish	Low in fat Low in sugar	Vitamin A deficiency Iron deficiency	Goiter Anemia
Vietnamese	Rice Fish Fruit	Low in fat Low in sugar	Iron deficiency	Anemia

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

diversity: the variety of cultural traditions within a larger culture

socioeconomic status: level of income and social class

lactose intolerance: inability to digest lactose, or milk sugar

tofu: soybean curd, similar in consistency to cottage cheese

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

gredients are carefully prepared (chopped, sliced, etc.) prior to starting the cooking process. The **nutrient** composition of the traditional Asian **diet** is very similar to the Mediterranean diet in that both are largely plant-based diets and meat is consumed only a few times a month (and often in very small amounts).

There exists great **diversity** in language, **socioeconomic status**, religion, age, education, social class, location, length of time in the United States, and country of origin among Asian Americans. Hence, caution needs to be taken not to generalize or imply that food habits are similar for all individuals of this group. For example, Chinese meals consist mainly of four food groups: grains, vegetables, fruit, and meat. Because of **lactose intolerance**, most Chinese do not consume large amounts of dairy products, substituting soymilk and **tofu** as sources of **protein** and **calcium**. Some Asian food, such as Thai food, is generally spicy, hot, and high in sodium. Hot peppers are used daily. The Japanese are very concerned about the visual appeal of food and the "separateness" of the foods and tastes. Garlic and hot pepper, commonly used among Asian Americans, are not common ingredients in the Japanese cuisine. Korean Americans eat kimchi with each meal. Kimchi is cabbage marinated in salt water, layered with peppers and spices in crockery, and left to ferment for a few days. South Asians (people from India, Pakistan, Bangladesh, and Sri Lanka) use spices (e.g., ginger, garlic, fenugreek, cumin, etc.) and condiments in their cuisine.

Most Asian Americans like to use fresh food in their cooking. Unlike the fast food society of the United States, they select live seafood, fresh meats, and seasonal fruits and vegetables from the local market to ensure freshness. Food preparation is meticulous, and consumption is ceremonious and deliberate. Most Asians living in America adhere to a traditional Asian

diet interspersed with American foods, particularly breads and cereals. Dairy products are not consumed in large quantities, except for ice cream. Calcium is consumed through tofu and small fish (bones eaten). Fish, pork, and poultry are the main sources of protein. Significant amounts of nuts and dried beans are also eaten. Vegetables and fruits make up a large part of food intake. Rice is the mainstay of the diet and is commonly eaten at every meal.

The traditional Asian diet has received a lot of attention because many **chronic** diseases, such as **heart disease**, **diabetes**, and certain cancers, are not as common in Asia as in the United States and other Western nations. Researchers believe that the Asian plant-based diet provides protection against these chronic diseases. The diet is also believed to contribute to the long life spans commonly seen in Asia. To offer a healthful alternative to the 1992 U.S. Food Guide Pyramid, which lumped some animal and plant foods together in a single group, researchers developed an Asian Diet Pyramid, which emphasizes a wide base of rice, rice products, noodles, breads and grains, preferably whole grain and minimally **processed foods**, topped by another large band of fruits, vegetables, **legumes**, nuts, and seeds. Daily physical exercise, a small amount of vegetable oil, and a moderate consumption of plant-based beverages—including tea (especially black and green), sake, beer, and wine—are also recommended daily. Small daily servings of low-fat dairy products or fish are optional; sweets, eggs, and poultry are recommended no more than weekly; and red meat is recommended no more than monthly.

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

legumes: beans, peas, and related plants

The Asian Diet Pyramid reflects the traditional, plant-based rural diets of Asia. Although there is an image of Asian Americans as a "model minority" who have overcome their "ethnic handicap" and are socioeconomically well off (Chen and Hawks), certain illnesses predominate in this group. For example, there is a particularly high rate of liver **cancer** among Asian Americans, while lung cancer is their leading cause of death. Vietnamese-American women's cervical cancer rate is five times that of Caucasian women. Asian Americans have among the highest rates of **tuberculosis** and **hepatitis** B in the United States. Asian Indian immigrants in the United States have an unusually high rate of coronary **artery** disease, and **parasitic** infections are particularly widespread among Southeast Asian refugees.

cancer: uncontrolled cell growth

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

hepatitis: liver inflammation

artery: blood vessel that carries blood away from the heart toward the body tissues

parasitic: feeding off another organism

Studies indicate that the food habits of Asians become increasingly Westernized after they move to the United States or other Western countries (see Karim, Bloch, Falciglia, and Murthy). There is a general shift from vegetarianism to nonvegetarianism, and ethnic foods are consumed along with traditional ingredients found in American supermarkets. Consequently, diets of immigrants living in the United States have changed from being low in fat and rich in **fiber** to being high in **saturated fat** and animal protein and low in fiber. There is also an increased tendency to consume fast foods and **convenience foods**. These dietary changes, along with **sedentary** and stressful lifestyles, may increase their risk for chronic disease. SEE ALSO ASIANS, DIET OF.

fiber: indigestible plant material that aids digestion by providing bulk

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

convenience food: food that requires very little preparation for eating

sedentary: not active

Ranjita Misra

Bibliography

American Dietetic Association (2000). *Ethnic and Regional Food Practices: Indian and Pakistani Food Practices, Customs, and Holidays*, 2nd edition. Chicago: Author.

Chen, M. S., Jr., and Hawks, B. L. (1995). "A Debunking of the Myth of Healthy Asian Americans and Pacific Islanders." *American Journal of Health Promotion* 9:261–268.

Karim, N.; Bloch, D. S.; Falciglia, G.; and Murthy, L. (1986). "Modifications of Food Consumption Patterns Reported by People from India Living in Cincinnati, Ohio." *Ecology of Food and Nutrition* 19:11–18.

Internet Resources

Applesforhealth.com. "Chinese Diet Can Keep Heart Healthy." Available from <http://www.applesforhealth.com/chinesediet1.html>

Betancourt, Deidre (1995). "Cultural Diversity: Eating in America—Asian." Available from <http://www.ohioline.osu.edu>

Cornell University Science News (1995). "Asian Diet Pyramid Offers Alternative to U.S. Food Guide." Available from <http://www.news.cornell.edu/science/Dec95/st.asian.pyramid.html>

Lin, Kathy. "Chinese Food Cultural Profile." Harborview Medical Center/University of Washington. Available from <http://www.ethnomed.org>

National Library of Medicine. "Asian American Health." Available from <http://www.asianamericanhealth.nlm.nih.gov>

Asians, Diet of

With forty-seven countries, innumerable tribes, and thousands of distinct languages, Asia is home to more ethnic groups than any other part of the world. In addition, the geography and climate of Asia are as diverse as its nations and peoples. From the lush rice paddies of the Philippines to the crowded Tokyo metropolis to the rainforests of Indonesia, there is a staggering variety of fruit, food, and spices in this extraordinary part of the world. Asia can be divided into three regions: East Asia (including China, Taiwan, Japan, and Korea); Southeast Asia (including Malaysia, Singapore, and the Philippines); and South Asia (including India and Sri Lanka).

The Thread that Binds Asia: Rice

Though each Asian country and region has its distinct flavors and cooking styles, almost all share one food in common—rice. But rice is not eaten in the same manner in each country. As a staple food central to survival, especially during times of **famine**, rice has acquired an almost sacred status in Asian society, and it is served in many ways. It is cooked as a significant part of each meal of the day, incorporated as a main ingredient in confections such as candy and cakes, fermented to make wine (Japanese sake) or beer, or sometimes given as an offering to the gods to ensure a good harvest. Rice is a potent culinary and spiritual staple in Asia.

famine: extended period of food shortage

Asian Fruit

The fruits of Asia are unlike those of any other part of the world. The tropical climate of South and Southeast Asia, and the mild climate of East Asia, create a hospitable environment for many different fruits to grow. Fruit is a significant part of the Asian **diet** and is usually eaten as a dessert with lunch or dinner. In East Asia, oranges, quince, dates, pears, strawberries, cherries, watermelon, peaches, and grapefruit are eaten widely. In South and Southeast Asia, there are unique fruits such as sweet mangoes (originally

diet: the total daily food intake, or the types of foods eaten

from India), which are eaten individually or made into ice cream or other confections, and green mangoes, which are used widely in Vietnam, the Philippines, and India, where they are made into chutneys or curries (which are used as a broth, stew, or dry seasoning).

Coconuts are popular in Southeast Asian cuisine. Coconut milk is used for curries in Thailand, Malaysia, Indonesia, South India, Myanmar, and the Philippines. It is also a delicious beverage, and is often drunk straight from the coconut with a straw. Coconut meat is added to desserts and salads. Other tropical fruits found in Asia include guava, papaya, pawpaw, starfruit (carambola), mangosteen, sour sop, jackfruit, longan, rambutan, durian, pineapple, and lychee.

Other Common Ingredients Used across Asia

Nuts are popular in Asia, eaten plain as snacks or mashed into porridge and sauces. In Malaysia and Indonesia, satays (peanut-based sauces) flavor chicken and beef dishes. The Chinese bake almond cookies and make rice cream with almonds or hazelnuts. Steamed cakes with almonds or macadamias are also common, and rice puddings with fruit, raisins, almonds, walnuts, or hazelnuts are popular desserts in India. Both East and Southeast Asia boast stir-fry dishes with peanuts, while India flavors its rice with lemon and peanuts.

A healthy serving of rice is the centerpiece of this modern Japanese bento box. Though they differ in many ways, most Asian cultures share a dependence on rice. *[Courtesy of Corinne Trang. Reproduced by permission.]*

East Asian Food

China.

Different regions of China have distinct tastes in food. Shanghainese cooking is known for its spicy chili flavoring and trademark red-colored meats. The Cantonese and Chaozhao regions are known for cooked meats and vegetables; and in the Beijing, Mandarin, and Shandong regions steamed bread and noodles are used as **staples** instead of rice. The most prized food staples in China are rice and wheat, though yams, taros, and potatoes are eaten when rice and wheat are not available. Chinese vegetables are mostly imported from Central Asia, including cucumbers, coriander, peas, sesame, onions, grapes and pomegranates, tomatoes, maize, sweet potatoes, peanuts, mushrooms, and daikon (radish). Preserved foods are popular, including pickled foods, fermented vegetables, and smoked and salted meats. Other well-known seasonings that are used include salted black beans (douchi), sweet and salty sauce, garlic, oyster sauce, soy sauce, black fungus, chilies, hoisin sauce, ginger, sesame seeds, and sesame oil.

staples: essential foods in the diet

The Chinese cook most of their food by mincing the ingredients and sautéing them in a deep pan called a wok. Little **fat** is used to season the meals, but plenty of fresh flavorings are added, such as ginger, chilies, soy sauces, scallions, oyster sauce, and fagara (Szechuan pepper). In the cities, most people cook over a gas stovetop, while in the country they use a brick stove to cook several dishes at once, including the rice. Tea is the most common beverage, though sodas are also popular.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Japan.

Sushi (slices of raw fish on rice), teriyaki meats, and tempura (batter-fried vegetables or shrimp) are not the only foods in the Japanese diet. Salted vegetables are part of everyday diets, as are soybean products such as **tofu**, soy sauce, miso (a soybean paste), and dashi (a stock whose base is dried fish and kelp). Meat and seafood are popular in Japanese cooking, and broths

tofu: soybean curd, similar in consistency to cottage cheese

are also common. Ingredients for stock include dried sea tangle, dried bonito (a type of tuna), and brown mushrooms. Spices like pepper, wasabi (horseradish), cloves, ginger, sesame, and garlic give special flavor to the food.

Japan centers its dishes on rice, with all other dishes thought of as side dishes. When rice stocks are low, millet or sweet potatoes are used. Different types of noodles are found in Japanese cuisine: soba (a buckwheat noodle) is popular in the west, and udon (a flour noodle) is popular in the east. Japanese rice wine (mirin or sake) is served both cold and warm. Green tea is especially popular.

Korea.

Korea's cuisine is a blend of Chinese and Japanese, though with its own distinctive flavor. The Korean national dish is *bulgogi*, or "fire beef"—beef strips marinated in soy sauce, sesame oil, garlic, and chili. The mainstay of Korean food is kimchi (or gimchi), a side dish of pickled grated vegetables infused with ginger, garlic, and chili. Seafood is a major staple in Korea, in addition to pork, hens, deer, and wild boar. Popular vegetables include turnips, lotus roots, taro, leeks, lettuce, bamboo shoots, ferns, and mushrooms. Popular spices and nuts include pine nuts, hazelnuts, and ginseng, and chili peppers are used liberally.

Noodles are usually made of wheat, buckwheat, soya, rice, or beans. Rice-cake soup, dumpling soup, five-grain rice, rice gruel, and sweet rice beverages are all popular. Green tea, scorched rice tea, **herbal** teas, and coffee are popular drinks. Other well-liked drinks are made from barley, corn rice, sesame seeds, ginseng, ginger, cinnamon, and citron.

herbal: related to or made from herbs

Southeast Asia

Southeast Asia is located in the monsoon belt, where heavy rains fall for several months a year. Most Southeast Asian countries use plenty of spice and coconut in their dishes, except for Vietnam.

Vietnam.

Vietnamese cuisine does not include large amounts of meat and fish; instead, rice is supplemented with vegetables and eggs. Similar to Chinese cooking, Vietnamese cooking uses little fat or oil for frying. Instead of using soy sauce for seasoning, *nuocmam* (fish sauce) is used as the main flavoring in almost every dish. *Pho* is a type of soup in which noodles, beef, chicken, or pork are added, and the soup is then garnished with basil, bean sprouts, and other seasonings. Fruits are an integral part of each meal—bananas, mangoes, papayas, oranges, coconuts, and pineapple are all popular. Vietnamese coffee is made with condensed milk to make the drink extra sweet and delicious. Hot green tea is very popular as well.

The Philippines.

Philippine culture is a fusion of Malay origin and Spanish, Japanese, Chinese, Islamic, and American influence. In the Philippines, four meals a day are served: breakfast, lunch, *merienda* (snack), and dinner. *Pancit*, or noodles, is considered a *merienda* dish and is served with a spongecake called *puto* and a glutinous ricecake called *cuchinta.* Lunch is the heaviest meal and consists of rice, a vegetable, a meat, and sometimes fish as well. Vegetables include *kangkung* (a local spinach), broccoli, Chinese broccoli, bitter melon, mung bean, beansprouts, eggplant, and okra. However, vegetables are not considered as important to the diet as in East Asia. Meat is a major part of the diet, with pork being one of the more popular meats.

Beef and chicken are eaten often, and water buffalo are eaten in the provinces. The primary foods in the Philippines are rice, corn, coconuts, sugarcane, bananas, coffee, mangoes, and pineapples.

Malaysia and Singapore. These two countries have Indian, Muslim, and Chinese heritages that are reflected in their spicy **cuisines**. Authentic Malay food is difficult to find, though a wide selection of Chinese, Indian, Indonesian, and occasionally Western food is almost always available. *Nonya* is a Malaysian dish that has Chinese ingredients with local spices. Satays (meat kebabs in spicy peanut sauce) are a Malaysian creation, and fiery curries, Chinese noodles, fried tofu in peanut sauce, tamarind fish curry, curry prawns, and curried meat in coconut marinade are typical dishes. *Laksa* is a creamy curry with either seafood or chicken simmered in coconut milk. Popular desserts include *endol* (sugar syrup, coconut milk, and green noodles) and *is kacang* (beans and jellies topped with shaved ice, syrups, and condensed milk).

cuisine: types of food and traditions of preparation

South Asia

India's influence can be seen in Pakistan, Sri Lanka, Afghanistan, and even Bali (Indonesia). Sri Lankan cuisine is a snapshot of Indian food. Its fiery curry dishes with rice, and hoppers (fried pancake) served with yogurt and honey, are reminiscent of India. Meat and seafood are popular staples, as is tea.

India is the only country in this region that uses milk and dairy products in its diet, mostly in the form of yogurt and cheese. Indian seasonings include turmeric, tamarind, saffron, cumin, coriander, cardamom, mustard, ginger, celery seed, aniseed, fenugreek, curry leaf, and coconut milk. Cashews, pistachios, and almonds are also often found in meat dishes, as well as in the variety of breads that are baked, fried, or roasted to accompany the meals. Indian meals are served with chutney, a spicy relish, or *raita*, a chilled yogurt to soothe the spiciness of the dish.

In the north of India, meat dishes are more common and are usually made with goat, sheep, or chicken. The meals emphasize breads, grain, and spices. Southern meals focus on rice, vegetables, and chilies. Vegetables include onions, yams, potatoes, tomatoes, pumpkin, banana flowers, cucumbers, radishes, and lotus roots. The sacred status of the cow in the agrarian society has disallowed beef to be eaten by those who practice Hinduism. The **protein** in these diets comes primarily from **legumes** or dairy products.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

legumes: beans, peas, and related plants

Food Security in Asia

Food is not always readily available across Asia because of a complex web of social and political factors. Weather also plays a heavy role in food security, which is the idea that everyone has access to food at a reasonable cost. If a typhoon causes devastating flooding or severe droughts destroy crops, people suffer because there will be no food to harvest. Droughts can also destroy food supplies and deplete drinking water supplies.

Micronutrient Deficiency

Micronutrients are essential **vitamins** and **minerals** that the body does not naturally produce. A certain amount of these vitamins and minerals are

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

required for human development, but in areas of famine or insufficient food, populations are at high risk of micronutrient deficiencies. In areas of famine, or where insufficient varieties of foods are available, certain populations (such as pregnant women, infants, and growing children) are often at high risk for **nutritional deficiencies**.

nutritional deficiency: lack of adequate nutrients in the diet

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

cataract: clouding of the lens of the eye

Vitamin A.

Vitamin A is necessary to develop a strong **immune system** and proper eyesight. Vitamin A deficiency (VAD) not only causes blindness and visual impairment (e.g., **cataract**), but also growth retardation and susceptibility to infections. When VAD is not detected early, it may make a child more prone to illness and even death. In Asia alone, it is estimated that 125 million children under five years of age are currently at risk, and 1.3 million are reported to be vitamin A deficient.

Iodine Deficiency Disorder (IDD).

Iodine is essential for pregnant women, infants, and young children because it regulates the production of **hormones** necessary for children's development. Providing the recommended daily amount of iodine to mothers and children helps prevent brain damage, stunted growth, and goiters (ball-shaped tumors on the neck) in children. Some children with IDD are unable to move normally, speak, or hear. Asia has an estimated 200 million people at risk of IDDs.

hormone: molecules produced by one set of cells that influence the function of another set of cells

Iron Deficiency and Anemia.

Iron deficiency is the most common micronutrient deficiency in the world. The consequences of iron deficiency include impaired cognitive development. Iron deficiency is the most common cause of anemia (low levels of red blood cells or **hemoglobin**) in Asia, with over 600 million people affected. Young children, adolescent girls, and women are the most severely affected. Southeast Asia has the largest proportion of anemia—about 600 million are at risk for iron deficiency in this region.

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

Lactose Intolerance.

Historically, milk and dairy products have not been used in East and Southeast Asia. As a result, the hereditary ability to digest lactose is most common in Asia and parts of Africa. Milk and dairy products are a major source of **calcium**, and people who avoid them because of lactose intolerance may compromise their nutritional status and bone strength. Low-lactose milk products have been developed to reduce the symptoms of lactose intolerance (diarrhea, abdominal bloating and gas, and stomach cramps).

calcium: mineral essential for bones and teeth

The Nutritional Transition and Its Health Effects

With people living longer, and with low birth weight at an all-time low, Asian health should be improving. But with increased Westernization of the Asian diet, elevated tobacco use (generally among Asian men), and lifestyle changes (such as decreased physical activity), there has been a marked rise in **cardiovascular** disease (CVD), **diabetes** mellitus, hypertension (**high blood pressure**), and certain cancers. **Obesity** is also a growing health problem in Asia, and is strongly associated with hypertension (along with **body mass index** and age). Despite the low obesity levels in the Asia Pacific region, rates of obesity-related diseases such as diabetes and CVD are on the rise. High blood pressure is also a growing problem in Asia. In India, Indonesia, and Thailand alone, nearly 10 to 15 percent of adults have high

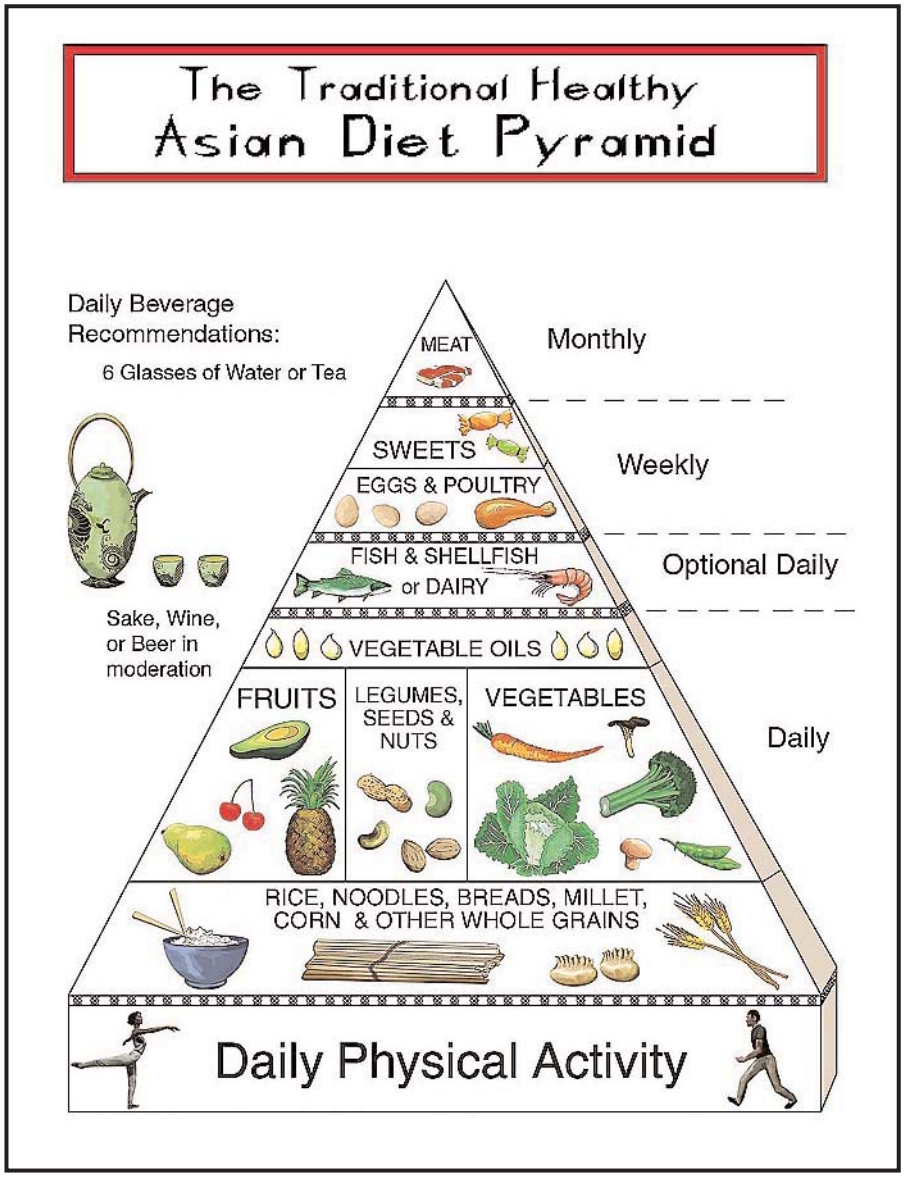
cardiovascular: related to the heart and circulatory system

diabetes: inability to regulate level of sugar in the blood

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat



The plant-based Asian diet, with its heavy reliance on rice, is reflected in the Asian food pyramid. The Asian diet does not include much meat or dairy and is low in total fat. *[2000 Oldways Preservation & Exchange Trust. Reproduced by permission.]*

blood pressure. Hypertension is dangerous because it increases a person's risk of developing CVD or having a **stroke**.

Changes in the dietary intake patterns of Asian countries have been called the nutritional transition, meaning a shift away from the traditional Asian diets to a more varied diet higher in sugars, fats, and **processed foods**. This new eating trend includes fewer **carbohydrates** and **fiber** and is higher in fat and meat. Together with a shift towards physical inactivity, obesity among the Asian population has risen. The nutritional and health effects of these new foods contribute to higher mortality rates due to CVD in many Asian countries.

Conclusion

Asian food and the diets of Asians are often believed to be the model of healthful eating. Rice and fruit figure prominently in each country's typical meal. However, as diets have diversified, **chronic** diseases, such as **heart disease**,

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material which aids digestion by providing bulk

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

nutrition: the maintenance of health through proper eating, or the study of same

have begun to affect Asians in a new and different way. Further, as weather patterns change over time and natural disasters occur, Asia, a largely agricultural society, is not always guaranteed a good crop. Asian food and **nutrition** is deeply rooted in the availability of food in each country. International organizations such as the United Nations Food and Agricultural Organization and Oxfam International continue to work on programs that ensure that continents like Asia will not suffer food shortages in the future. SEE ALSO ASIAN AMERICANS, DIETS OF; DIETARY TRENDS, INTERNATIONAL.

M. Cristina F. Garces

Bibliography

Achaya, K. T. (1994). *Indian Food: A Historical Companion.* Delhi, India: Oxford University Press.

Fiple, Kenneth F., and Ornelas, Kriemhil Coneè, eds. (2000). *The Cambridge World History of Food*, Volumes 1 and 2. Cambridge, UK: Cambridge University Press.

Gill, T. P. (2001). "Cardiovascular Risk in the Asia-Pacific Region from a Nutrition and Metabolic Point of View: Abdominal Obesity." *Asia Pacific Journal of Clinical Nutrition* 10(2):85–89.

Groff, James L.; Gropper, Sarren S.; and Hunt, Sara M., eds. (1995). *Advanced Nutrition and Human Metabolism*, 2nd edition. St. Paul, MN: West Publishing.

Hubert, Annie (1997). "Choices of Food and Cuisine in the Concept of Social Space among the Yao of Thailand." In *The Anthropology of Food and Nutrition*, Vol. 2: *Food Preferences and Taste Continuity and Change*, ed. Helen MacBeth. Oxford, UK: Berghahn.

Khor, Geok Lin (1997). "Nutrition and Cardiovascular Disease: An Asia-Pacific Perspective." *Asia Pacific Journal of Clinical Nutrition* 6(2):122–142.

Kotler, Neil G., ed. (1992). *Frontiers of Nutrition and Food Security in Asia*, *Africa*, *and Latin America.* Washington, DC: Smithsonian Institution Press.

McKeigue, P. M.; Shah, B.; and Marmot, M. G. (1991). "Relation of Central Obesity and Insulin Resistance with High Diabetes Prevalence and Cardiovascular Risk in South Asians." *Lancet* 337:382–386.

Mason, John; Mannar, Venkatesh; and Mock, Nancy (1999). "Controlling Micronutrient Deficiencies in Asia." *Asian Development Review* 17(2).

Popkin, Barry M.; Horton, Sue; and Kim, Soowon (2001). "The Nutritional Transition and Diet-Related Chronic Diseases in Asia: Implications for Prevention." Discussion Paper No. 105. International Food Policy Research Institute.

Underwood, B. A. (1999). "Perspectives from Micronutrient/Malnutrition Elimination Eradication Programmes." *Morbidity and Mortality Weekly Report* 48(SU01):37–42.

Internet Resources

Betancourt, Deidre. "Cultural Diversity: Eating in America: Vietnamese." Ohio State University Extension Fact Sheet. Available from <http://www.ohioline.osu.edu>

BBC News (12 July 2000). "144 Million Asian Children Stunted." Available from <http://news.bbc.co.uk>

British Nutrition Foundation (1999). "Adverse Reactions to Food" Available from <http://www.nutrition.org.uk>

Food and Agriculture Organization of the United Nations. "Staple Foods: What Do People Eat?" Available from <http://www.fao.org>

International Council for Control of Iodine Deficiency Disorders (2000). "About Iodine Deficiency Disorder: IDD Problem Statement." Available from <http://www.tulane.edu/~icec/>

United Nations Development Fund. "The Philippines at a Glance." Available from <http://www.undp.org>

World Health Organization (2001). "The South-East Asia Nutrition Research-cum-Action Network." Available from <http://www.who.int>

World Health Organization. "Vitamin A." Available from <http://www.who.int>

World Health Organization, South East Asia Regional Office (2001). "South-East Asia Progress Towards Health For All (1977-2000)." Available from <http://www.whosea.org/progress/index/htm>

Atherosclerosis

Macrovascular disease, or **atherosclerosis**, is the cause of more than half of all mortality in developed countries and the leading cause of death in the United States. It is a progressive disease of the large- and medium-sized **arteries**. The name is derived from the Greek *athero* meaning "gruel" or "paste" and *sclerosis* meaning "hardening." Thus, atherosclerosis is the hardening of the arteries due to the accumulation of this paste (commonly called plaque).

atherosclerosis: build-up of deposits within the blood vessels

artery: blood vessel that carries blood away from the heart toward the body tissues

Any vessel in the body may be affected; however, the aorta, coronary, carotid, and iliac arteries are most frequently affected. When the coronary arteries are involved, it results in coronary artery disease (CAD). Hardening of the arteries is due to the build up of plaque and mineral deposits. As a result, the supply of blood to the heart is reduced, which can lead to chest pain or a myocardial infarction (**heart attack**). Hardening of the arteries causes an increase in resistance to blood flow and, therefore, an increase in **blood pressure**.

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

Everyone gets atherosclerosis. It is said that if every person lived to be 100 years old, each would eventually die of atherosclerosis. The process begins early in life. Therefore, physicians should obtain risk-factor profiles and a family history for children. Surgical procedures such as **angioplasty** and cardiac bypass may restore **cardiovascular** function. However, prevention is the key. Smoking, high blood **cholesterol**, **high blood pressure**, a high-fat **diet**, and lack of physical activity are the most serious risk factors for atherosclerosis and other cardiovascular diseases. Controlling one of these risk factors can help control the others. For example, regular exercise can help control cholesterol, blood pressure, weight, and **stress** levels. Smoking is the most preventable risk factor. For some, a low-dose aspirin taken daily is recommended for adults over age forty to thin the blood.

angioplasty: reopening of clogged blood vessels

cardiovascular: related to the heart and circulatory system

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diet: the total daily food intake, or the types of foods eaten

stress: heightened state of nervousness or unease

For optimal health, health professionals recommend a change to a healthful diet and lifestyle for those at risk, including daily physical activity; smoking cessation; a low-fat, low-cholesterol diet; reducing sodium intake; and managing stress. SEE ALSO ARTERIOSCLEROSIS; CARDIOVASCULAR DISEASES.

Delores C. S. James

Internet Resource

American Heart Association. "Common Cardiovascular Diseases." Available from <http://www.americanheart.org/stroke>

Baby Bottle Tooth Decay

B

Baby bottle tooth decay occurs in young children when their teeth or gums are exposed to infant formula, milk, juice, or other sweet drinks for long

periods of time. This often happens when infants or toddlers fall asleep while sucking on a bottle. Breastfed infants are usually not at risk, unless they feed for extended periods. The **carbohydrates** in the drink (lactose in milk, or fructose in fruit drinks) mix with the normal **bacteria** in the mouth. This bacteria is found in the **plaque** on teeth and gums. When plaque mixes with carbohydrates, acids are formed that dissolve tooth enamel, causing tooth decay and dental **caries**. To prevent baby bottle tooth decay, a child should not be put in bed with a bottle; and the bottle should be taken away as soon as mealtime is over. Further, only formula or water should be put in a bottle; juices and sweet drinks should be offered in a cup. SEE ALSO INFANT NUTRITION; ORAL HEALTH.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

bacteria: single-celled organisms without nuclei, some of which are infectious

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

caries: cavities in the teeth

Heidi J. Silver

Bibliography

American Dietetic Association (1996). "Oral Health and Nutrition: Position of the American Dietetic Association." *Journal of the American Dietetic Association* 96:184–189.

Johnsen, D. and Nowjack-Raymer, R. (1989). "Baby Bottle Tooth Decay (BBTD): Issues, Assessment, and an Opportunity for the Nutritionist." *Journal of the American Dietetic Association* 89:1112–1116.

Internet Resource

American Academy of Pediatrics. Baby Bottle Tooth Decay. Available from <http://medem.com>

Battle Creek Sanitarium, Early Health Spa

The Western Health Reform Institute, which opened in 1866, was originally a residence belonging to Benjamin Graves, a judge of the Michigan Superior Court. Set on eight acres of land, this farm house gave no hint of what it was to become, but already there were ideas and propositions for the building that would lead to a worldwide reputation.

Upon its opening, in 1866, the Western Health Reform Institute was heralded far and wide through the Seventh-day Adventist journal *Review and Herald.* Dr. H. S. Lay, the first physician in charge, and James and Ellen White, early founders of the Seventh-day Adventist Church, were instrumental in founding this health institution. Taking in visitors and teaching simple principles, such as advocating the use of "Graham" bread and counseling eight hours of sleep at night, the institution struggled to live up to its grand name until 1876, when John Harvey Kellogg became medical director. In 1877, Kellogg changed the name to Battle Creek Sanitarium.

Ellen Gould White had come to Battle Creek, Michigan, in 1855 with her family. White was an advocate of healthful living, and she and her husband encouraged young John Harvey Kellogg to study medicine and eventually return to Battle Creek as medical director and surgeon.

The sanitarium, in its heyday during the 1880s, was the most famous health institution in the country, a reputation it held until World War II. The sanitarium was also instrumental in spawning the health food industry and lent strong support to the concept of vegetarianism.

Cereals put Battle Creek on the map. In November 1855, there were 3,000 inhabitants in all of Battle Creek, yet there were soon over forty cereal man-

In the late nineteenth and early twentieth centuries, the Battle Creek Sanitarium was an incubator for nutritional health movements, including vegetarianism and temperance. Early sanitarium members developed such dietary innovations as breakfast cereal and graham crackers. *[AP/Wide World Photos. Reproduced by permission.]*

ufacturers in the city, and **entrepreneurs** and famous personalities would soon find their way to Battle Creek. Both Kellogg's brother Will and C. W. Post were to find great success and spawn businesses worth millions of dollars—all from the humble principles found in eating cereal breakfasts and promoting health foods for their **protein**, their **calories**, their **minerals** and **vitamins**, and, most of all, their bran. Famous personalities that visited the Battle Creek Sanitarium included J. C. Penney in 1929 and Professor Ivan Pavlov of Leningrad, Russia, who, at the age of eighty, visited in the summer of 1929.

entrepreneur: founder of a new business

The Great Depression interrupted the growth and expansion of this successful enterprise. On February 18, 1902, a fire burned two main buildings to the ground, and Kellogg immediately began an ambitious rebuilding project. He said at the time that "buildings may burn, but principles survive." The expansion cost $4 million and was done in 1928. But by 1930, with a capacity for 1,400, there were only 300 patients in residence. In 1930, at the age of seventy-eight, Kellogg retired to Florida to start another sanitarium, which ran at full capacity (100 beds) for the remaining thirteen years of his life.

The Battle Creek Sanitarium represented a haven to those who made pilgrimages to its abundant facilities. It afforded indoor exercise facilities, a steam-heated environment, and all the amenities of a first-class hotel, including Edison electric lights and polite attendants. In 1927, its golden anniversary year, the Battle Creek Sanitarium treated more than 7,000 patients. It eventually became the Percy Jones Army Hospital, which treated casualties of World War II and the Korean War. SEE ALSO KELLOGG, JOHN HARVEY; WHITE, ELLEN G.

Louise E. Schneider

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calorie: unit of food energy

mineral: an inorganic (non-carbon-containing) element, ion or compound

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

Bibliography

Sabate, Joan (2001). *Vegetarian Nutrition.* Boca Raton, FL: CRC.

Schwartz, Richard W. (1970). *John Harvey Kellogg.* Nashville, TN: Southern Publishing Association.

Whorton, James C. (1987). "Traditions of Folk Medicine." *Journal of the Medical Association* 257:1632–1640.

Beikost

The German word *beikost* translates as "foods other than milk or formula." It refers to the first strained foods that are given to a young infant as a supplement to breast milk or formula. Beikost is introduced between four and six months of age, when an infant develops the appropriate oral motor skills and can indicate disinterest by leaning back and turning away. The first foods introduced vary by country, but are generally soft mashed foods that are easily digested. If solid foods are added before four months, there is a risk of overfeeding or negative physical reactions such as diarrhea. SEE ALSO INFANT NUTRITION.

Sheah Rarback

Beriberi

water-soluble: able to be dissolved in water

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

legumes: beans, peas, and related plants

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

clinical: related to hospitals, clinics, and patient care

nervous system: the brain, spinal cord, and nerves that extend throughout the body

Thiamin, or vitamin B_1, is a **water-soluble** vitamin that plays a role in **energy** production (through the synthesis of adenosine triphosphate [ATP]) and nerve conduction. (ATP is the major source of energy that the human body utilizes to do work.) Thiamin is found in abundance in foods such as lean pork, **legumes**, and yeast. In contrast, polished (white) rice, white flour, refined sugars, fats, and oils are foods lacking this vitamin. People at risk for thiamin deficiency include those who consume large quantities of alcohol and those who live in impoverished conditions, for such people are deficient in substantial amounts of **vitamins** and **minerals**.

Beriberi is a **clinical** manifestation of thiamin deficiency. Symptoms include **nervous system** abnormalities (e.g., leg cramps, muscle weakness), limb swelling, elevated pulse, and heart failure. Wernicke-Korsakoff syndrome is a related condition (with symptoms such as a jerky gait, disorientation, and impaired short-term memory) that occurs among alcoholics. SEE ALSO NUTRITIONAL DEFICIENCY; VITAMINS, WATER-SOLUBLE.

Kheng Lim

Bibliography

Morgan, Sarah L., and Weinsier, Roland L. (1998). *Fundamentals of Clinical Nutrition*, 2nd edition. St. Louis, MO: Mosby.

Kane, Agnes B., and Kumar, Vinay (1999). "Environmental and Nutritional Pathology." In *Robbins Pathologic Basis of Disease*, 6th edition. Philadelphia: W. B. Saunders.

Beta-Carotene

carotenoid: plant-derived molecules used as pigments

Beta-carotene is the most active of the deeply colored pigments called **carotenoids**. After consumption, beta-carotene converts to retinol, a read-

ily usable form of vitamin A. Beta-carotene's beneficial effects include protecting the skin from sunlight damage, fighting early **cancer** cells, boosting immunity, and preventing **cataract** formation. It also stops the creation of **free radicals** (oxidants), which are DNA-damaging molecular fragments in the body.

Food sources of beta-carotene include carrots, spinach, kale, and broccoli, as well as animal sources such as liver, whole eggs, and whole milk. Since beta-carotene is fat-soluble, most fat-free milk has been **fortified** with vitamin A to replace what is lost when the fat is removed.

Vitamin A is stored in the body, and an excess amount can lead to **acute** symptoms, such as vomiting and muscle weakness, as well as **chronic** problems such as liver abnormalities, birth defects, and **osteoporosis**. In addition, beta-carotene supplements have been found in some studies to actually increase the risk of cancer in smokers. (Excess beta-carotene is not stored in the body, however.) Because of these dangers, the Institute of Medicine recommends that beta-carotene supplements are not to be used by the general public. The institute does advocate the use of such supplements for populations with inadequate vitamin A intake. SEE ALSO ANTIOXIDANTS; CAROTENOIDS; VITAMINS, FAT-SOLUBLE.

Chandak Ghosh

cancer: uncontrolled cell growth

cataract: clouding of the lens of the eye

free radical: highly reactive molecular fragment, which can damage cells

fortified: altered by addition of vitamins or minerals

acute: rapid-onset and short-lived

chronic: over a long period

osteoporosis: weakening of the bone structure

Bibliography

Margen, Sheldon, and the Editors of UC Berkeley Wellness Letter (2002). *Wellness Foods A to Z: An Indispensable Guide for Health-Conscious Food Lovers*. New York: Rebus.

Internet Resources

National Institutes of Health (NIH) Clinical Center. "Vitamin A and Carotenoids." Available from <http://www.cc.nih.gov>

Wellness Guide to Dietary Supplements. "Beta-Carotene." Available from <http://www.berkeleywellness.com>

Bezoars

Bezoars are balls of undigested materials, **insoluble fiber**, and undissolved medicines that resist the action of digestive **enzymes** in the stomach. Bezoars are the result of a lack of stomach hydrochloric acid secretion, without which medicine like sulfa **drugs**, **iron**, and antacid tablets may not dissolve. They may also be caused by poor stomach emptying.

Bezoars in humans cause the feeling of fullness, pain, **nausea**, and vomiting, and they reduce or prevent stomach emptying. Treatment may include avoidance of fibrous foods such as apples, berries, Brussels sprouts, beans, and sauerkraut, as well as changes in any medication being taken. Bezoars may also form in animals' stomachs. In ancient Persian medicine, bezoars were used as an antidote to poison. SEE ALSO CRAVINGS; PICA.

Simin B. Vaghefi

insoluble: not able to be dissolved in

fiber: indigestible plant material that aids digestion by providing bulk

enzyme: protein responsible for carrying out reactions in a cell

drugs: substances whose administration causes a significant change in the body's function

iron: nutrient needed for red blood cell formation

nausea: unpleasant sensation in the gut that precedes vomiting

Binge Eating

Binge eating disorder (BED), also known as compulsive overeating, has been designated as a psychiatric disorder requiring further study by the

binge: uncontrolled indulgence

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

American Psychiatric Association. Like bulimics, individuals suffering from binge eating disorder indulge in regular episodes of gorging, but unlike bulimics, they do not purge afterward. Binges are accompanied by a similar sense of guilt, embarrassment, and loss of self-control seen among bulimics. Because of the tremendous number of **calories** consumed, many people with BED are **overweight** or **obese**, and as a result they are more prone to complications such as **high blood pressure**, **diabetes**, high **cholesterol**, and **heart disease**.

calorie: unit of food energy

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

A clinical diagnosis of BED requires bingeing at least two times a week for a period of six months or longer. SEE ALSO ADDICTION, FOOD; BULIMIA NERVOSA; EATING DISORDERS; EATING DISTURBANCES; YO-YO DIETING.

Karen Ansel

Bibliography

American Dietetic Association (1998). *Nutrition Intervention in the Treatment of Anorexia Nervosa, Bulimia Nervosa, and Eating Disorder Not Otherwise Specified (EDNOS).* Chicago.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC.

Escott-Stump, Sylvia, and Mahan, L. Kathleen (1996). *Krause's Food, Nutrition, and Diet Therapy*, 9th edition. Philadelphia: W. B. Saunders.

Bioavailability

A nutrient's **bioavailability** is the proportion of the nutrient that, when ingested, actually gets absorbed by the body. The remaining amount cannot be metabolized and is removed as waste. The ability to absorb nutrients varies by gender, disease state, and physiologic condition (e.g., pregnancy, aging). The bioavailability of a nutrient can also increase or decrease if other substances are present. For example, **calcium** and magnesium lose much of their effectiveness if taken with fatty foods. The **intestines** themselves may also regulate the amount of a mineral that enters the bloodstream. For these reasons, taking high-potency vitamin supplements does not guarantee that all of the included nutrients will enter one's system. SEE ALSO NUTRIENTS.

bioavailability: availability to living organisms, based on chemical form

calcium: mineral essential for bones and teeth

intestines: the two long tubes that carry out the bulk of the processes of digestion

Chandak Ghosh

Bibliography

"Nutrients Are Team Players." *University of California Wellness Letter* 20(7):5.

Internet Resource

British Nutrition Foundation. "Minerals." Available from <http://www.nutrition.org.uk>

Biotechnology

The term *biotechnology* refers to the use of scientific techniques, including **genetic** engineering, to improve or modify plants, animals, and **microorganisms**. In its most basic forms, biotechnology has been in use for millennia. For example, Middle Easterners who domesticated and bred deer, antelope, and sheep as early as 18,000 B.C.E.; Egyptians who made wine in

genetic: inherited or related to the genes

microorganisms: bacteria and protists; single-celled organisms

4000 B.C.E.; and Louis Pasteur, who developed **pasteurization** in 1861, all used biotechnology. In recent years, however, food biotechnology has become synonymous with the terms *genetically engineered foods* and *genetically modified organism* (GMO).

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

Traditional biotechnology uses techniques such as **crossbreeding**, **fermentation**, and **enzymatic** treatments to produce desired changes in plants, animals, and foods. Crossbreeding plants or animals involves the selective passage of desirable **genes** from one generation to another. *Microbial* fermentation is used in making wine and other alcoholic beverages, yogurt, and many cheeses and breads. Using **enzymes** as **food additives** is another traditional form of biotechnology. For example, papain, an enzyme obtained from papaya fruit, is used to tenderize meat and clarify beverages.

crossbreeding: breeding between two different varieties of an organism

fermentation: reaction performed by yeast or bacteria to make alcohol

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

gene: DNA sequence that codes for proteins, and thus controls inheritance

enzyme: protein responsible for carrying out reactions in a cell

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

Genetic Engineering

The **DNA** contained in genes determines inherited characteristics. Modifying DNA to remove, add, or alter genetic information is called genetic modification or genetic engineering. In the early 1980s, scientists developed recombinant DNA techniques that allowed them to extract DNA from one species and insert it into another. Refinements in these techniques have allowed identification of specific genes within DNA—and the transfer of that particular gene sequence of DNA into another species. For example, the genes responsible for producing **insulin** in humans have been isolated and inserted into **bacteria**. The insulin that is then produced by these bacteria, which is identical to human insulin, is then isolated and given to people who have **diabetes**. Similarly, the genes that produce chymosin, an enzyme that is involved in cheese manufacturing, have also been inserted into bacteria. Now, instead of having to extract chymosin from the stomachs of cows, it is made by bacteria. This type of application of genetic engineering has not been very controversial. However, applications involving the use of plants have been more controversial.

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

insulin: hormone released by the pancreas to regulate level of sugar in the blood

bacteria: single-celled organisms without nuclei, some of which are infectious

diabetes: inability to regulate level of sugar in the blood

Among the first commercial applications of genetically engineered foods was a tomato in which the gene that produces the enzyme responsible for softening was turned off. The tomato could then be allowed to ripen on the vine without getting too soft to be packed and shipped. As of 2002, over forty food crops had been modified using recombinant DNA technology, including pesticide-resistant soybeans, virus-resistant squash, frost-resistant strawberries, corn and potatoes containing a natural pesticide, and rice containing beta-carotene. Consumer negativity toward biotechnology is increasing, not only in the United States, but also in the United Kingdom, Japan, Germany, and France, despite increased consumer knowledge of biotechnology. The principle objections to biotechnology and foods produced using genetic modification are: concern about possible harm to human health (such as allergic responses to a "foreign gene"), possible negative impact to the environment, a general unease about the "unnatural" status of biotechnology, and religious concerns about modification.

Biotechnology in Animals

The most controversial applications of biotechnology involve the use of animals and the transfer of genes from animals to plants. The first animal-based application of biotechnology was the approval of the use of bacterially

Scientists inserted daffodil genes and other genetic material into ordinary rice to make this *golden rice.* The result is a strain of rice that provides vitamin A, a nutrient missing from the diets of many people who depend on rice as a food staple. *[AP/Wide World Photos. Reproduced by permission.]*

produced bovine somatotropin (bST) in dairy cows. Bovine somatotropin, a naturally occurring **hormone**, increases milk production. This application has not been commercially successful, however, primarily because of its expense. The **cloning** of animals is another potential application of biotechnology. Most experts believe that animal applications of biotechnology will occur slowly because of the social and ethical concerns of consumers.

hormone: molecules produced by one set of cells that influence the function of another set of cells

cloning: creation of an exact genetic copy of an organism

Concerns about Food Production

Some concerns about the use of biotechnology for food production include possible allergic reactions to the transferred **protein**. For example, if a gene from Brazil nuts that produces an **allergen** were transferred to soybeans, an individual who is allergic to Brazil nuts might now also be allergic to soybeans. As a result, companies in the United States that develop genetically engineered foods must demonstrate to the U.S. Food and Drug Administration (FDA) that they did not transfer proteins that could result in food **allergies**. When, in fact, a company attempted to transfer a gene from Brazil nuts to soybeans, the company's tests revealed that they had transferred a gene for an allergen, and work on the project was halted. In 2000 a brand

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

allergen: a substance that provokes an allergic reaction

allergy: immune system reaction against substances that are otherwise harmless

Biotechnology and Global Health

The World Health Organization estimates that more than 8 million lives could be saved by 2010 by combating infectious diseases and malnutrition through developments in biotechnology. A study conducted by the Joint Centre for Bioethics at the University of Toronto identified biotechnologies with the greatest potential to improve global health, including the following:

- Hand-held devices to test for infectious diseases including HIV and malaria. Researchers in Latin America have already made breakthroughs with such devices in combating dengue fever.
- Genetically engineered vaccines that are cheaper, safer, and more effective in fighting HIV/AIDS, malaria, tuberculosis, cholera, hepatitis, and other ailments. Edible vaccines could be incorporated into potatoes and other foods.
- Drug delivery alternatives to needle injections, such as inhalable or powdered drugs.
- Genetically modified bacteria and plants to clean up contaminated air, water, and soil.
- Vaccines and microbicides to help prevent sexually transmitted diseases in women.
- Computerized tools to mine genetic data for indications of how to prevent and cure diseases.
- Genetically modified foods with greater nutritional value.

—Paula Kepos

of taco shells was discovered to contain a variety of genetically engineered corn that had been approved by the FDA for use in animal feed, but not for human consumption. Although several antibiotechnology groups used this situation as an example of potential allergenicity stemming from the use of biotechnology, in this case the protein produced by the genetically modified gene was not an allergen. This incident also demonstrated the difficulties in keeping track of a genetically modified food that looks identical to the unmodified food. Other concerns about the use of recombinant DNA technology include potential losses of **biodiversity** and negative impacts on other aspects of the environment.

biodiversity: richness of species within an area

Safety and Labeling

In the United States, the FDA has ruled that foods produced though biotechnology require the same approval process as all other food, and that there is no inherent health risk in the use of biotechnology to develop plant food products. Therefore, no label is required simply to identify foods as products of biotechnology. Manufacturers bear the burden of proof for the safety of the food. To assist them with this, the FDA developed a decision-tree approach that allows food processors to anticipate safety concerns and know when to consult the FDA for guidance. The decision tree focuses on **toxicants** that are characteristic of each species involved; the potential for transferring food allergens from one food source to another; the concentration and **bioavailability** of **nutrients** in the food; and the safety and nutritional value of newly introduced proteins.

toxicant: harmful substance

bioavailability: availability to living organisms, based on chemical form

nutrient: dietary substance necessary for health

Labeling of genetically modified foods has sparked additional debate. Labels are required on food produced through biotechnology to inform consumers of any potential health or safety risk. For example, a label is required if a potential allergen is introduced into a food product. A label is also required if a food is transformed so that its nutrient content no longer

resembles the original food. For example, so-called golden rice has been genetically engineered to have a higher concentration of beta-carotene than regular rice, and thus it must be included on the label. In response to consumer demands, regulators in England have instituted mandatory labeling laws for all packaged foods and menus containing genetically modified ingredients. Similar but less restrictive laws have been instituted in Japan. In Canada, the policy on labeling has remained similar to that of the United States.

Some consumer advocates maintain that not requiring a label on all genetically modified foods violates consumers' right to make informed food choices, and many producers of certain foods, such as foods containing soy protein, now include the term "non-GMO" on the label to indicate that the product does not contain genetically modified ingredients.

The application of recombinant DNA technology to foods, commonly called biotechnology, may be viewed as an extension of traditional crossbreeding and fermentation techniques. The technology enables scientists to transfer genetic material from one species to another, and may produce food crops and animals that are different than those obtained using traditional techniques. The FDA has established procedures for approval of food products manufactured using recombinant DNA technology that require food producers to demonstrate the safety of their products. The American Dietetic Association, the American Medical Association, and the World Health Organization have each adopted statements that techniques of biotechnology may have the potential to improve the food supply. These organizations and others acknowledge that long-term health and environmental impacts of the technology are not known, and they encourage continual monitoring of potential impacts. SEE ALSO ADDITIVES AND PRESERVATIVES; FOOD SAFETY; GENETICALLY MODIFIED FOODS.

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Altman, Arie, ed. (1998). *Agricultural Biotechnology.* New York: Marcel Dekker.

Johnson-Green, Perry (2002). *Introduction to Food Biotechnology.* Boca Raton, FL: CRC Press.

Serageldin, Ismail (1999). "Biotechnology and Food Security in the 21st Century." *Science* 285:387–389.

adipose tissue: tissue containing fat deposits

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

diabetes: inability to regulate level of sugar in the blood

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Body Fat Distribution

Adipose tissue accumulation is referred to as body fat distribution. For individuals with *android* (apple-shaped) distribution, fat is centered around the abdominal area. This leads to an increased risk for coronary artery disease, **stroke**, **diabetes**, and high **cholesterol** and **triglyceride** levels. It is also an indicator for **obesity**. *Gynoid* (pear-shaped) distribution is associated with body fat that accumulates around the hip and thigh region.

Specific body fat distribution is often determined by measuring the waist-to-hip ratio, which is the circumference of the waist divided by the circumference of the hips. Android fat distribution is defined as a ratio

greater than 1.0 for men and 0.8 for women. SEE ALSO ANTHROPOMETRIC MEASUREMENTS; BODY IMAGE; OBESITY; WAIST-TO-HIP RATIO; WEIGHT MANAGEMENT.

Diane L. Golzynski

Body Image

The term *body image* refers to the view that a person has of his or her own body size and proportion. Body-image distortion occurs when a person's view of their body is significantly different from reality.

Many factors impact the perception of one's body image, including the mass media, peer groups, ethnic groups, and family values. There is no such thing as an "ideal" or "perfect" body, and different cultures have different standards and norms for appropriate body size and shape. Even within a particular culture, societal standards shift periodically. For example, in the United States, the value of being thin has been the predominant stereotype for women since the model Twiggy arrived on the scene in the 1960s. The average fashion model (at the beginning of the twenty-first century) is almost six feet tall and weighs 130 pounds, whereas the average American woman is five feet, four inches tall and weighs 140 pounds. This disparity in height and weight may lead to problems with self-esteem when a woman finds herself not meeting the cultural ideal of body size and shape. The interesting factor is that women tend to feel **overweight**, not "under height" when comparing themselves to fashion models.

overweight: weight above the accepted norm based on height, sex, and age

Another example of body-image distortion can be seen among the contestants in the Miss America Beauty Pageant, the Miss Universe Pageant, and the Miss World Pageant. No winner of these pageants has ever been "overweight," and the winners have gotten progressively thinner over the years. Magazines and other media convey the image that being thin equates to being happy and successful, while cases of weight discrimination have been identified and argued in the courts. Fortunately, more emphasis is now being placed on health at any size, and on women becoming more muscular and fit, rather than simply thin. With increases in **obesity** statistics, however, some people may feel even more pressure to lose weight due to body-image distortion.

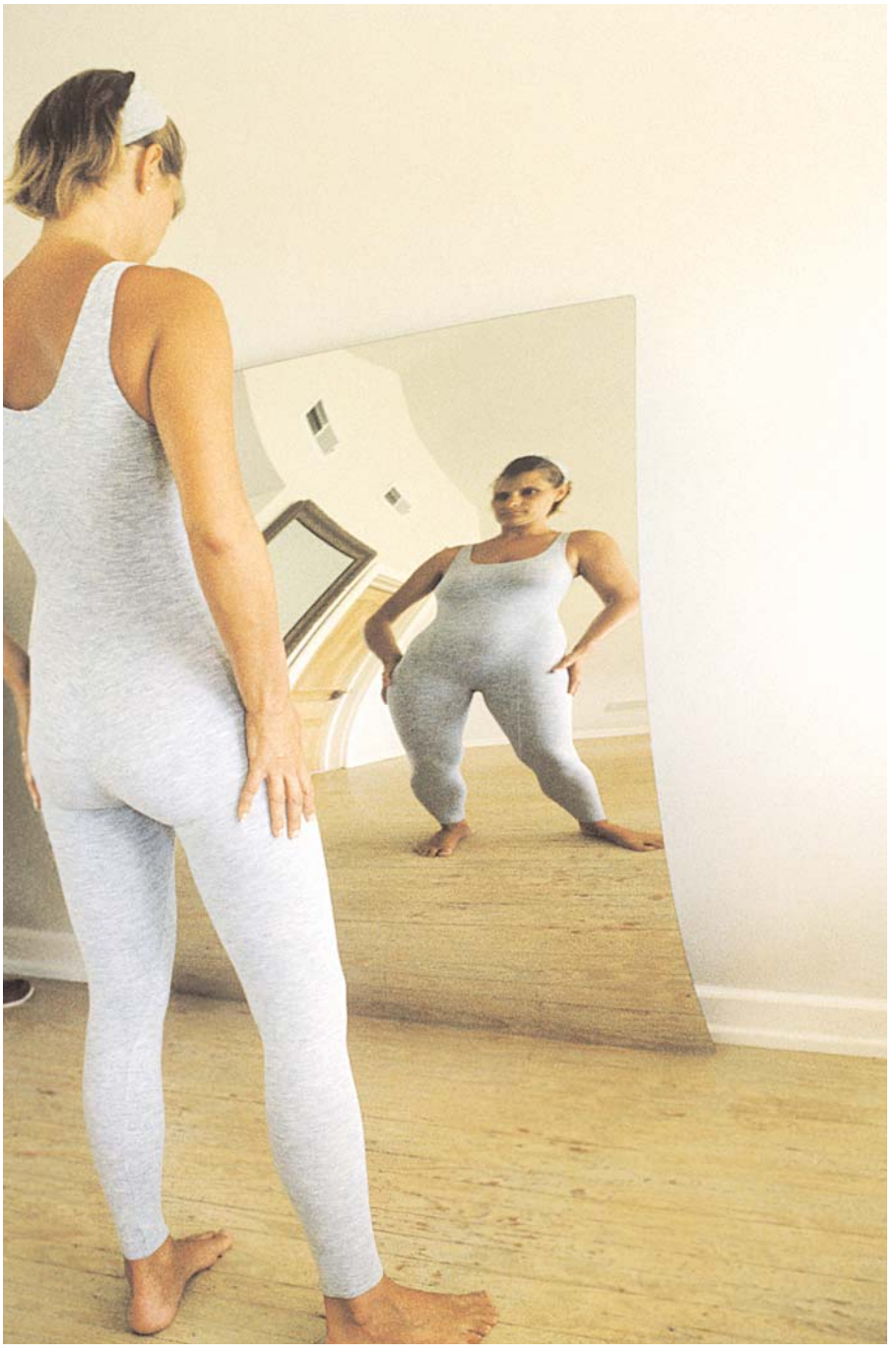
obesity: the condition of being overweight, according to established norms based on sex, age, and height

There are normal and predictable periods in life when body-image distortion occurs. One of these is **puberty**, when rapid changes in body size, body shape, and secondary sex characteristics take place. During this time, females tend to gain fat in the breasts, hips, buttocks, and thighs, developing a more pear-shaped body. Adolescent females may view their bodies as being heavier than they actually are, especially when compared to fashion models or celebrities. Adolescent males tend to gain height and muscle mass during puberty, and they may view their bodies as smaller than they actually are when compared to bodybuilders or professional athletes.

puberty: time of onset of sexual maturity

Body-image distortion also occurs when eating disorders develop. Most experts agree that the development of eating disorders is multifactorial and includes sociocultural, **psychological**, hereditary, and brain chemistry effects. Society plays a role in their development since eating disorders occur

psychological: related to thoughts, feelings, and personal experiences



Dissatisfaction with one's body can appear in adolescence and could lead to eating disorders. About 1 percent of teenage girls in the U.S. develop anorexia nervosa and up to 10 percent of those may die as a result. *[Photograph by Ariel Skelley. Corbis. Reproduced by permission.]*

incidence: number of new cases reported each year

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

dysmorphia: the belief that one's body is different (fatter, thinner, etc.) than it really is

only in developed nations where food is prevalent and the **incidence** of these diseases increases with wealth. People diagnosed with eating disorders often see their body accurately only at the end of treatment—or not at all. No matter what their eventual weight is, the females with **anorexia** or **bulimia** may see themselves as overweight or fat, and males with muscle **dysmorphia** see themselves as underweight and scrawny. In anorexia, even when severe weight loss has occurred, patients may view their emaciated bodies as overweight. The diagnostic criteria for anorexia includes a "disturbance in the way in which one's body weight or shape is experienced; undue influence of body weight or shape on self-evaluation, or denial of the seri-

ousness of current low body weight" (American Psychiatric Association). The diagnostic criteria for bulimia nervosa includes self-evaluation that is "unduly influenced by body shape and weight" (American Psychiatric Association). Body size or shape dissatisfaction appears to be one of the best predictors of dieting behavior. Another characteristic associated with body-image dissatisfaction, dieting, and **binge** eating is low self-esteem.

binge: uncontrolled indulgence

The earlier the treatment or intervention in eating disorders occurs, the better the prognosis is. With early diagnosis and treatment, body-image distortion may be minimal and can return to normal. The goals of body-image treatment are to correct distortions in body image and create a more positive body image. The longer the **eating disorder** has occurred, the more persistent the body-image distortion tends to be. Some female patients may never view their bodies as anything but overweight, and they may even view normal-weight women as fat. In males, the opposite is true: normal-weight men are viewed as scrawny, and only bodybuilders with significantly higher lean body mass than usual are considered ideal. Cognitive-behavioral therapy is commonly used as a major form of treatment for eating disorders and is often provided with a nondiet approach to improve self-esteem as bingeing or purging behaviors are reduced. SEE ALSO DIETING; EATING DISORDERS; EATING DISTURBANCES; WEIGHT MANAGEMENT.

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

Catherine Christie

Bibliography

American Psychiatric Association (2000). *Diagnostic and Statistical Manual*, 4th edition. Washington, DC: Author.

Eldredge, K.; Wilson, G. T.; and Whaley, A. (1990). "Failure, Self-Evaluation and Feeling Fat in Women." *International Journal of Eating Disorders* 9:37–50.

Rosen, J. C.; Gross, J.; and Vara, L. (1987). "Psychological Adjustment of Adolescents Attempting to Lose or Gain Weight." *Journal of Consulting and Clinical Psychology* 55:742–747.

Rubenstein, S., and Cabellero, B. (2000). "Is Miss America an Undernourished Role Model?" *Journal of the American Medical Association* 283:1569.

Body Mass Index

Body weight is used as an indicator of an individual's health. It is usually compared to tables that list "ideal" or "desirable" weight ranges for specific heights. Some of these tables use values gathered from research studies, while some include the heights and weights of individuals who have bought life insurance (e.g., the Metropolitan Height and Weight Tables). An individual's weight can be described as a percentage of the ideal or desirable weight listed, and can also be categorized as healthy, underweight, **overweight**, or **obese**. An additional method of comparing an individual to a population group is with the **body mass index**.

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

Body mass index (BMI) is an estimate of body composition that correlates an individual's weight and height to lean body mass. The BMI is thus an index of weight adjusted for stature. Body mass index is figured by dividing weight in kilograms by height in meters squared and multiplying by 100. It can also be figured by dividing weight in pounds by height in inches squared and multiplying by 705. High values can indicate excessive fat stores, while low values can indicate reduced fat stores. In this way, the BMI

BMI, or body mass index, is a number that correlates a person's height and weight. It is a useful tool for diagnosing obesity or malnutrition; however, such diagnosis should take into account a person's age, gender, fitness, and ethnicity. *[Ed Bock/Corbis. Reproduced by permission.]*

obesity: the condition of being overweight, according to established norms based on sex, age, and height

malnutrition: chronic lack of sufficient nutrients to maintain health

hydration: degree of water in the body

is a diagnostic tool for both **obesity** and protein-energy **malnutrition**. The BMI has also been associated with mortality, with lower values generally correlating with longer life.

However, when evaluating the BMI, several characteristics of an individual need to be known. An individual's age, gender, ethnicity, and level of fitness must be considered when using BMI to determine health risk. Also, the significance of the BMI is affected by disease state and **hydration** status. As with most assessment tools, the BMI is most effective when used in conjunction with other measurements.

Tables are available to identify the significance of the BMI. Calculations based on values for ideal body weight suggest the BMI for normal men and women should be in the range of 19 to 27 kg/m^2. This range corresponds to the 25th to 75th percentile values recorded from adults followed in the 1971–1974 National Health and Nutrition Examination Survey (NHANES). Tables also list levels of protein-energy malnutrition and obesity. These values were determined by research in which height, weight, and age were associated with functional measurements and health outcomes.

A BMI between 13 and 15 corresponds to 48 to 55 percent of desirable body weight for a given height and describes the lowest body weight that can sustain life. Body weight at this level consists of less than 5 percent fat. The maximum survival body weight is about 500 kg, which corresponds to a BMI of about 150.

Research with children indicates annual increases in BMI are usually due to increases in lean mass rather than fat tissue. Not until late adolescence does fat mass begin to affect the BMI—and adult values begin to be achieved.

There is a strong correlation between BMI and total fat mass, though individual variation in body type or height can cause misclassification. Un-

BODY MASS INDEX

Body mass index equation

$$\text{BMI} = \frac{\text{weight (kg)}}{\text{height (m) (squared)}} \times 100 \quad \text{OR} \quad \frac{\text{pounds}}{\text{inches (squared)}} \times 705$$

Significance of BMI values for adults

Condition Indicated	Men	Women
Protein-calorie malnutrition	< 17	< 17
Underweight	< 20	< 19
Acceptable weight	20.7 – 27.8	19.1 – 27.3
Intervention indicated	> 26.4	> 25.8
Obese	> 27.8	> 27.3
Severely obese	> 31.1	> 32.2
Morbidly obese	> 45.4	> 44

Normal BMI Values for Infants and Children	
Infants (at birth)	13
1 year	18
6 years	15

fortunately, the same BMI value can correlate with a range of body-fat percentage. For example, athletes usually have large skeletal muscles (which weigh more than fat) and therefore a high BMI, but they are not obese. Shorter individuals can also be identified as obese, since their BMIs are usually high. An older individual may have a higher body-fat percentage than a younger individual, but have the same BMI. Adult females can have a BMI of 20, which correlates to a body-fat percentage of 13 to 32 percent, while adult males can have a BMI of 27 and a body-fat percentage of 10 to 31 percent.

Findings from the third NHANES (1988–1994) describe misidentification of the elderly when self-reported height, rather than measured height, is used in the BMI equation. Height decreases over an individual's lifetime due to vertebral compression, loss of muscle tone, and postural slump. An individual may, therefore, report a height that is no longer accurate, and the resulting value will be lower than the value that actually describes the individual, possibly leading to the wrong intervention.

Research has shown that both high BMIs and low BMIs can indicate increased **morbidity** and mortality. A low BMI, usually an indication of protein-energy malnutrition or the effects of **wasting** or a disease process, is a significant predictor of mortality among young and old hospitalized patients. A high BMI has been shown to be predictive of mortality only among young hospitalized patients, usually an effect of **cardiovascular** disease and obesity. Risk of mortality is only slightly elevated at the highest BMI for elderly hospitalized patients.

morbidity: illness or accident

wasting: loss of body tissue often as a result of cancer or other disease

cardiovascular: related to the heart and circulatory system

Because ethnicity has been shown to require adjustments to the levels of concern for the BMI, care must be taken when comparing different population groups. For example, Asian populations may require a lower BMI to describe health risk, while Pacific populations, specifically Hawaiian, may require a higher threshold to indicate that an individual is at risk. This variation can be explained by body type.

BMI and waist circumference have been used to evaluate health risks associated with overweight and obesity. Because both are easy measures to

do, standardization of both are encouraged for widespread use as a reference. Additionally, the two measurements have been used in an algorithm with a cardiovascular risk index to determine which individuals would benefit most from weight loss.

BMI is an easy measurement to make—only requiring a tape measure, scale, and, perhaps, a calculator. However, for individuals who have trouble standing up straight for an accurate height measurement—either from disease process, weakness, or kyphosis (abnormal backward curvature of the spine)—BMI may not be an easy or accurate assessment tool to use. Comparisons between BMI and mid-upper arm circumference (MUAC) measurements show that they identify the same level of malnutrition in individuals. MUAC is also easily measured (it requires only a tape measure), and it is a good indicator of change in body weight and muscle mass. Standardization of these two assessment tools for reference would benefit the science of nutrition assessment. SEE ALSO AGING AND NUTRITION; BODY FAT DISTRIBUTION; DIET; MALNUTRITION; NUTRITION ASSESSMENT; OBESITY; OVERWEIGHT; UNDERWEIGHT; WAIST-TO-HIP RATIO.

Carole S. Mackey

Bibliography

Collins, Steve (1996). "Using Middle Upper Arm Circumference to Assess Severe Adult Malnutrition During Famine." *Journal of the American Medical Association* 276(5):391–395.

Kiernan, M. (2000). "Identifying Patients for Weight-Loss Treatment: An Empirical Evaluation of the NHLBI Obesity Education Initiative Expert Panel Treatment Recommendations." *Archives of Internal Medicine* 160:2169–2176.

Kuczmarski, Marie Fanelli (2001). "Effects of Age on Validity of Self-Reported Height, Weight, and Body Mass Index: Findings from the Third National Health and Nutrition Survey, 1988–1994." *Journal of the American Dietetic Association* 101(1):28–34.

Landi, F. (2000). "Body Mass Index and Mortality Among Hospitalized Patients." *Archives of Internal Medicine* 160:2641–2644.

Maskarinec, G. (2000). "Dietary Patterns Are Associated with Body Mass Index in Multiethnic Women." *Journal of Nutrition* 130:3068–3072.

Maynard, L. M. (2001). "Childhood Body Composition in Relation to Body Mass Index." *Pediatrics* 107:344–350.

Pike, Ruth, and Brown, Myrtle L. (1984). *Nutrition, An Integrated Approach*. New York: John Wiley.

Seidel, J. C. (2001). "Report from a CDC Prevention Workshop on Use of Adult Anthropometry for Public Health and Primary Health Care." *American Journal of Clinical Nutrition* 73:123–126.

Shills, Maurice E.; Olson, James A.; and Shike, Moshe. (1994). *Modern Nutrition in Health and Disease*, 8th edition. Philadelphia: Lea & Febiger.

White, Jane V. (1999). "The Utility of Body Mass Index in Predicting Health Risk." *Consultant Dietitian* 24(2).

Breastfeeding

Before 1900, most mothers breastfed their infants. Breastfeeding rates declined sharply worldwide after 1920, when evaporated cow's milk and infant formula became widely available. These were promoted as being more convenient for mothers and more nutritious than human milk. Breastfeeding rates began rising again in the late 1950s and early 1960s.

BENEFITS OF BREASTFEEDING

Benefits for Infant	Benefits for Mother
• Perfect food for infant	• Promotes faster shrinking of the uterus
• Guarantees safe, fresh milk	• Promotes less postpartum bleeding
• Enhances immune system	• Promotes faster return to pre-pregnancy weight
• Protects against infectious and noninfectious diseases	• Eliminates the need for preparing and mixing formula
• Protects against food allergies and intolerances	• Saves money not spent on formula
• Decreases risk of diarrhea and respiratory infections	• Decreases risk of breast and ovarian cancer
• Promotes correct development of jaw, teeth, and speech patterns	• Increases bonding with infant
• Decreases risk of childhood obesity	• Enhances self-esteem in the maternal role
• Increases cognitive function	• Delays the menstrual cycle
• Increases bonding with mother	

Breastfeeding, or lactation, is, in fact, the ideal method of feeding and nurturing infants. Most health organizations recommend infants be exclusively breastfed during the first four to six months of life, but ideally through the first year. Premature infants also benefit from their mothers' milk. In developing countries, breastfeeding up to age two, with appropriate supplementary solid foods, maintains good nutritional status and prevents diarrhea.

Benefits of Breastfeeding

Human milk contains the right balance of **nutrients** for human growth and development. It is low in total **protein** and high in **carbohydrates**, making it more digestible and less stressful on the immature kidneys. In addition, each mammal produces milk that is nutritionally and immunologically tailored for its young. In rare cases, such as **galactosemia** and **phenylketonuria**, some infants cannot **metabolize** human milk or other milk products. A significant benefit of human milk is that it contains many **immunologic** agents that protect the infant against **bacteria**, **viruses**, and **parasites**. Breastfeeding also provides many benefits for the mother.

nutrient: dietary substance necessary for health

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

galactosemia: inherited disorder preventing digestion of milk sugar, galactose

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

metabolize: processing of a nutrient

immunologic: related to the immune system, which protects the body from infection

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

parasite: organism that feeds off of other organisms

Breastfeeding Trends

Despite the many benefits of breastfeeding, only 64 percent of mothers in the United States initiate breastfeeding, with 29 percent still breastfeeding six months after birth. The U.S. goals for 2000 were to increase to 75 percent the proportion of women who initiate breastfeeding, and to increase to 50 percent the proportion of women who breastfeed for five to six months. In the United States, ethnic minorities are less likely to breastfeed than their white counterparts.

Based on a 2001 report by the World Health Organization (WHO), 35 percent of infants worldwide are exclusively breastfed (no other food or drink, not even water) for the first four months of life. Rates are very low in a number of African countries, especially Nigeria, Central African Republic, and Niger. Some countries, such as Benin, Mali, Zambia, and Zimbabwe have had small increases, due mainly to breastfeeding campaigns, baby-friendly hospitals, and the commitment of trained breastfeeding counselors. In Southeast Asia, the exclusive breastfeeding rate, though low, has increased. Breastfeeding rates are also low in many European countries, especially France, Italy, Netherlands, Spain, Switzerland, and the United Kingdom. Sweden, however, has a rate of 98 percent, the highest level in the world.

An increase in breastfeeding could save the lives of millions of children a year worldwide. However, the aggressive marketing campaigns by infant formula companies and the promotion of infant formula by health professionals combine to discourage breastfeeding. Other factors that determine whether a woman will breastfeed include:

- The father's preference for a specific feeding method
- Whether the mother was breastfed as an infant
- Social support
- Whether relatives and/or friends breastfeed
- Whether the mother gets help with household chores
- The mother's need to work
- Hospital policies

Physiology of Breastfeeding

hormone: molecules produced by one set of cells that influence the function of another set of cells

During pregnancy, the body increases its production of a **hormone** called prolactin, which stimulates the breast to make milk. Suckling by the infant stimulates the release of prolactin. The size of the breasts is not a factor in milk production. Oxytocin, another hormone, allows the breast tissue to "let down" or release milk from the milk ducts to the nipples.

Colostrum, the first milk produced, has all the nutrients a newborn infant needs. It also contains many substances to protect against infections. The body produces colostrum for several days until the "mature milk" comes in. Mature milk adjusts to the baby's needs for the rest of the time the infant is breastfed.

Nutritional Needs of the Mother

calorie: unit of food energy

Recommended Dietary Allowances: nutrient intake recommended to promote health

nutritional requirements: the set of substances needed in the diet to maintain health

folate: one of the B vitamins, also called folic acid

iron: nutrient needed for red blood cell formation

niacin: one of the B vitamins, required for energy production in the cell

zinc: mineral necessary for many enzyme processes

diet: the total daily food intake, or the types of foods eaten

drugs: substances whose administration causes a significant change in the body's function

Milk production requires about 800 **calories** a day. The **Recommended Dietary Allowances** for calories during breastfeeding is 500 more calories a day than is required by a nonpregnant woman. **Nutritional requirements** do not change significantly from pregnancy, with the exception of decreases in **folate** and **iron**, and increases in vitamin A, vitamin C, **niacin**, and **zinc**. The **diet** can be the same as during pregnancy, plus an additional glass of milk. Women who are on medication should check with their physicians, since most **drugs** are absorbed in breast milk.

Weaning

wean: cease breast-feeding

malnourished: lack of adequate nutrients in the diet

The decision to **wean** should be based on the desires and needs of the mother and child. Weaning should be gradual. Women returning to work can pump and store their milk for later use. Solid foods should be given based on the age and developmental stage of the child. In some countries, many toddlers become **malnourished** because they are given too many high carbohydrate foods, such as cassava, potatoes, and other root vegetables, too early. These foods are filling, but they are low in protein and other nutrients essential for growth and development.

Breast Implants and Breast Reduction

Many women with breast implants breastfeed successfully, though it is not known whether the health of the infant is affected by breast implants.

Human milk contains nutrients and antibodies that keep babies healthy. Although it is considered the ideal feeding method for infants, 36 percent of mothers in the United States do not breastfeed at all. *[Photograph by Jim Trois. Photo Researchers, Inc. Reproduced by permission.]*

Women who have had a breast reduction may not be able to breastfeed, since the surgical procedure removes glandular tissue and realigns the nipple.

Who Should Not Breastfeed?

Women with HIV/AIDS, **hepatitis**, **cancer**, and other conditions where the **immune system** may be compromised should not breastfeed. A case-by-case assessment should be made with women exposed to certain environmental **toxins** and those who use illicit drugs.

hepatitis: liver inflammation

cancer: uncontrolled cell growth

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

toxins: poisons

Policies and Recommendations

A woman's ability to breastfeed for the optimal recommended time depends on the support she receives from her family, health care providers, and the workplace. Health care institutions should adopt policies and initiatives that include:

- A written breastfeeding policy
- A breastfeeding education program
- Rooming-in of mother and child
- Breastfeeding on demand
- Limited use of pacifiers, water, and formula

With the increased number of women in the workforce, employers can do a lot to support and encourage breastfeeding, such as providing adequate breaks; flexible hours; **job sharing**; part-time work; refrigerators for storage of breast milk; and on-site child care.

job sharing: splitting a single job among two or more people

A public health campaign can greatly increase the initiation and duration of breastfeeding. These campaigns should target all social groups, including men, future parents, grandparents, health care providers, and employers. In addition, culturally appropriate programs and materials should

be available. Breastfeeding saves lives and money, and it benefits all of society. SEE ALSO BEIKOST; INFANT NUTRITION; MASTITIS; PREGNANCY.

Delores C. S. James

Bibliography

James, Delores C.; Jackson, Robert T.; and Probart, Claudia K. (1994). "Factors Affecting Breastfeeding Prevalence and Duration among International Students." *Journal of the American Dietetic Association* 94(2):194–196.

Worthington-Roberts, Bonnie S., and Rodwell-Williams, Sue (1993). *Nutrition in Pregnancy and Lactation*, 6th edition. Madison, WI: Brown & Benchmark.

U.S. Department of Health and Human Services, Office on Women's Health (2000). *HHS Blueprint for Action on Breastfeeding.* Washington, DC: U.S. Government Printing Office.

Internet Resources

American Academy of Pediatrics. "A Woman's Guide to Breastfeeding." Available from <http://www.aap.org/>

Ryan, A. S. (1997). "The Resurgence of Breastfeeding in the United States." *Pediatrics* (online). Available from <http://www.pediatrics.org>

UNICEF. "Breastfeeding and Complementary Feeding." Available from <http://www.childinfo.org/>

World Health Organization. "Global Databank on Breastfeeding." Available from <http://www.who.int/nut>

Brillat-Savarin, Jean Anthelme

French politician and writer
1755–1826

Jean Anthelme Brillat-Savarin was a French lawyer and politician. He served as mayor of Belley, the city where he was born, but his opposition to the Jacobins during the French Revolution made it necessary for him to flee to Switzerland in 1792. He then made his way to New York, where he taught language and played violin in the John Street Theater Orchestra to support himself.

"The destiny of nations depends on the manner in which they are fed." Jean Anthelme Brillat-Savarin, whose culinary writings and passion for food distinguished him in Napoleonic France. *[Photograph by Gianni Dagli Orti. Corbis. Reproduced by permission.]*

After two years in New York, Brillat-Savarin spent time in Connecticut familiarizing himself with American culture and food. He took advantage of the opportunity to ask Thomas Jefferson how to prepare a wild turkey. Approximately four years after his exile, Brillat-Savarin was able to return to France after being reinstated as an honorable person. Soon after, he began serving as a judge of the Supreme Court of Appeal in Paris, a post he held for the rest of his life.

Brillat-Savarin embraced Parisian society and intellectual life, but he is best known for his culinary expertise and his twenty aphorisms on food, one of which was, "Tell me what you eat, and I will tell you what you are." Even as a child he loved to be near the kitchen. While in Paris, he wrote *Physiology of Taste, or Meditations on Transcendental Gastronomy*, which he published anonymously. Chapters discussed, among other things, the aphrodisiac properties of certain foods, the nature of digestion, and the dangers of acids in the stomach. The book was a success, and the people of Paris were anxious to learn the identity of this very witty and elegant author. His colleagues were not as impressed as the public and looked down on him, not considering him to be an expert in a relevant field of study. He had pre-

viously written various treatises on dueling, economics, and history, but these were not very well known.

Brillat-Savarin contributed to the knowledge of digestion and **nutrition** through his essays on food and taste. He also shared his ideas on food preparation and its role in life and philosophy, and he provided discourses on **obesity** and its cure (and on thinness and its cure). In recognition of his achievements, various dishes, garnishes, and a cheese bear his name.

nutrition: the maintenance of health through proper eating, or the study of same

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Brillat-Savarin's work reflects interactions with philosophers and physicians of his time. While he remained a bachelor all his life, he had many prominent guests sitting at his table for meals, and he often sat at the best tables of Paris. Among his guests were Napoleon's doctor, Jean-Nicolas Corvisart, the surgeon Guillaume Dupuytren, the pathologist Jean Cruveilhier, and other great minds. Cruveilhier was such an authority on the stomach that **gastric ulcers** are referred to as Cruveilhier's disease. Through such interactions, Brillat-Savarin undoubtedly gained knowledge about the chemistry of food and how it relates to the physiology of digestion. So passionate was Brillat-Savarin about food that many people identified him more often as a chef rather than a lawyer.

gastric: related to the stomach

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

Slande Celeste

Bibliography

Brillat-Savarin, Jean-Anthelme (1999). *The Physiology of Taste, or, Meditations on Transcendental Gastronomy*, tr. M. F. K. Fisher. Washington, DC: Counterpoint Press.

Modlin, I. M., and Lawton, G. P. (1996). "Observations on the Gastric Illuminati." *Perspectives in Biology and Medicine* 39(4):527–543.

Schnetzer, Amanda (1999). "The Gastronomic Servings of Brillat-Savarin." *Washington Times* July 11.

Internet Resources

Kansas State University Library. "Rare Books, The Cookery Exhibit: *Physiologie du Gout.*" Available from <http://www.lib.ksu.edu/>

Vanderbilt Medical Center. "Culinary History." Available from <http://www.mc.vanderbilt.edu/biolib>

Bulimia Nervosa

Bulimia nervosa is an **eating disorder** characterized by frequent episodes of **binge** eating, which are followed by purging to prevent weight gain. During these incidents, unusually large portions of food are consumed in secret, followed by compensatory behaviors such as self-induced vomiting or diuretic and laxative abuse. Although the types of food chosen may vary, sweets and high-calorie foods are commonly favored. Bulimic episodes are typically accompanied by a sense of a loss of self-control and feelings of shame.

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

binge: uncontrolled indulgence

A clinical diagnosis of bulimia nervosa requires that the behavior occur at least two times a week for a minimum of three months. SEE ALSO ADDICTION, FOOD; ANOREXIA NERVOSA; BINGE EATING; BODY IMAGE; EATING DISORDERS; EATING DISTURBANCES.

Karen Ansel

Bibliography

American Dietetic Association (1998). *Nutrition Intervention in the Treatment of Anorexia Nervosa, Bulimia Nervosa, and Eating Disorder Not Otherwise Specified (EDNOS).* Chicago: Author.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC: Author.

Escott-Stump, Sylvia, and Mahan, L. Kathleen (1996). *Krause's Food, Nutrition, & Diet Therapy*, 9th edition. Philadelphia: W. B. Saunders.

Caffeine

Caffeine is a naturally occurring stimulant found in the leaves, seeds, or fruit of over sixty plants around the world. Caffeine exists in the coffee bean in Arabia, the tea leaf in China, the kola nut in West Africa, and the cocoa bean in Mexico. Because of its use throughout all societies, caffeine is the most widely used psychoactive substance in the world. The most common caffeine sources in North America and Europe are coffee and tea. Since about 1980, extensive research has been conducted on how caffeine affects health. Most experts agree that moderate use of caffeine (300 milligrams, or about three cups of coffee, per day) is not likely to cause health problems.

How Caffeine Affects the Body

Caffeine is best known for its stimulant, or "wake-up," effect. Once a person consumes caffeine, it is readily absorbed by the body and carried around in the bloodstream, where its level peaks about one hour after consumption. Caffeine mildly stimulates the nervous and **cardiovascular** systems. It affects the brain and results in elevated mood, decreased **fatigue**, and increased attentiveness, so a person can think more clearly and work harder. It also increases the heart rate, blood flow, respiratory rate, and **metabolic** rate for several hours. When taken before bedtime, caffeine can interfere with getting to sleep or staying asleep.

cardiovascular: related to the heart and circulatory system

fatigue: tiredness

metabolic: related to processing of nutrients and building of necessary molecules within the cell

Exactly how caffeine will affect an individual, and for how long, depends on many factors, including the amount of caffeine ingested, whether one is male or female, one's height and weight, one's age, and whether one is pregnant or smokes. Caffeine is converted by the liver into substances that are excreted in the urine.

Some people are more sensitive to the effects of caffeine than others. With frequent use, **tolerance** to many of the effects of caffeine will develop. At doses of 600 milligrams (about six cups of coffee) or more daily, caffeine can cause nervousness, sweating, tenseness, upset stomach, **anxiety**, and insomnia. It can also prevent clear thinking and increase the side effects of certain medications. This level of caffeine intake represents a significant health risk.

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

anxiety: nervousness

Caffeine can be mildly addictive. Even when moderate amounts of caffeine are withdrawn for 18 to 24 hours, one may feel symptoms such as headache, fatigue, irritability, **depression**, and poor concentration. The symptoms peak within 24 to 48 hours and progressively decrease over the course of a week. To minimize withdrawal symptoms, experts recommend reducing caffeine intake gradually.

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

CAFFEINE IN FOODS AND BEVERAGES.

Food/Beverage	Caffeine (milligrams)
Coffee	
Espresso coffee, brewed, 8 fluid ounces	502
Coffee, brewed, 8 fluid ounces	85
Coffee, instant, 8 fluid ounces	62
Coffee, brewed, decaffeinated, 8 fluid ounces	3
Coffee, instant, decaffeinated, 8 fluid ounces	2
Tea	
Tea, brewed, 8 fluid ounces	47
Tea, herbal, brewed, 8 fluid ounces	0
Tea, instant, 8 fluid ounces	29
Tea, brewed, decaffeinated, 8 fluid ounces	3
Chocolate Beverages	
Hot chocolate, 8 fluid ounces	5
Chocolate milk, 8 fluid ounces	5
Soft Drinks	
Cola, 12 ounce can	37
Cola, with higher caffeine, 12 ounce can	100
Cola or pepper-type, diet, 12 ounce can	49
Cola or pepper-type, regular or diet, without caffeine, 12 ounce can	0
Lemon-lime soda, regular or diet, 12 ounce can	0
Lemon-lime soda, with caffeine, 12 ounce can	55
Ginger ale, regular or diet, 12 ounce can	0
Root beer, regular or diet, 12 ounce can	0
Chocolate	
Milk chocolate bar, 1.55 ounces	9
M & M milk chocolate candies, 1.69 ounces	5
Dark chocolate, semisweet, 1 ounce	20

SOURCE: U.S. Department of Agriculture National Nutrient Database for Standard Reference, Release 16 July 2003.

Caffeine in Food and Drugs

Due to its stimulant properties, caffeine is used around the world in any of its many forms, such as coffee, tea, soft drinks, and chocolate. The accompanying table displays the amount of caffeine in foods. An eight-ounce cup of drip-brewed coffee has about 85 milligrams of caffeine, whereas the same amount of brewed tea contains about 47 milligrams. Twelve-ounce cans of soft drinks (soda) provide about 35 to 45 milligrams of caffeine.

The caffeine content of coffee and tea depends on the variety of the coffee bean or tea leaf, the particle size, the brewing method, and the length of brewing or steeping time. Brewed coffee has more caffeine than instant coffee, and espresso has more caffeine than brewed coffee. Espresso is made by forcing hot pressurized water through finely ground, dark-roast beans. Because it is brewed with less water, it contains more caffeine than regular coffee per fluid ounce.

In soft drinks, caffeine is both a natural and an added ingredient. About 5 percent of the caffeine in colas and pepper-flavored soft drinks is obtained naturally from cola nuts; the remaining 95 percent is added. Caffeine-free drinks contain virtually no caffeine and make up a small part of the soft-drink market.

Numerous prescription and nonprescription drugs also contain caffeine. Caffeine increases the ability of aspirin and other painkillers to do their job, and it is often used in headache and pain-relief remedies as well as in cold products and alertness or stay-awake tablets. When caffeine is an ingredient, it must be listed on the product label.

Though it has mildly addictive properties, caffeine taken in moderation is not considered to be a health risk, and may improve athletic performance. *[AP/Wide World Photos. Reproduced by permission.]*

Caffeine and Health

Current research on how caffeine affects a variety of health issues is summarized below. Keep in mind that most experts agree that moderate use of caffeine is not likely to cause any health problems.

- Studies have looked at the effects of caffeine on heart health. Moderate caffeine consumption does not appear to adversely affect cardiovascular health.
- Caffeine appears to increase the excretion of **calcium**, a mineral needed for healthy bones. Calcium is particularly important to prevent **osteoporosis**, a bone disease characterized by loss of bone strength and seen especially in older women (although men get it too). Moderate caffeine intake does not seem to cause a problem with calcium, as long as one is consuming the recommended amount (adult men and women should be taking between 1,000 and 1,200 milligrams of calcium, depending on age and gender).
- In the past there have been concerns that the caffeine in coffee may cause **cancer**. Research has shown that caffeine in coffee does not cause breast or intestinal cancer. However, not enough research has been done to determine if caffeine in coffee is involved in urinary bladder or pancreatic cancer. Taken in moderation, it is unlikely that caffeine will cause cancer.
- Evidence suggests that, at levels over 500 milligrams per day, caffeine may delay conception. Moderate caffeine consumption does not appear to be of concern to women trying to get pregnant. Moderate consumption is also important for a healthy pregnancy. Excessive caffeine intake has been associated with **miscarriages** and low birth weight babies.
- Because children have developing nervous systems, it is important to moderate their caffeine consumption. For children, major sources of caffeine include soft drinks and chocolate.

calcium: mineral essential for bones and teeth

osteoporosis: weakening of the bone structure

cancer: uncontrolled cell growth

miscarriage: loss of a pregnancy

- Caffeine may be useful as part of a weight control program because it increases the rate at which the body burns **calories** for three or more hours after being consumed.
- Caffeine's ability to improve physical performance is well known among well-trained athletes. Through a mechanism that is not completely understood, caffeine seems to increase endurance and speed in some situations. Excessive use of caffeine is restricted in international competitions.

Karen Eich Drummond

calorie: unit of food energy

Bibliography

Heaney, R. P. (2002). "Effects of Caffeine on Bone and the Calcium Economy." *Food and Chemical Toxicology* 40:1263–1270.

Juhn, M. S. (2002). "Ergogenic Aids in Aerobic Activity." *Current Sports Medicine Reports* 1:233–238.

Kaiser, Lucia Lynn, and Allen, Lindsay. (2002). "Position of the American Dietetic Association: Nutrition and Lifestyle for a Healthy Pregnancy Outcome." *Journal of the American Dietetic Association* 102:1479–1490.

Nawrot, P.; Jordan, S.; Eastwood, J.; Rotstein, J.; Hugenholtz, A.; and Feeley, M. (2003). "Effects of Caffeine on Human Health." *Food Additives and Contaminants* 20:1–30.

Sizer, Frances, and Whitney, Eleanor. (2003). *Nutrition: Concepts and Controversies.* Belmont, CA: Wadsworth/Thomson Learning.

Smith, A. (2002). "Effects of Caffeine on Human Behavior." *Food and Chemical Toxicology* 40:1243–1255.

Weinberg, Bennett Alan, and Bealer, Bonnie K. (2002). *The World of Caffeine: The Science and Culture of the World's Most Popular Drug.* London: Taylor & Francis.

Internet Resource

Spriet, Lawrence L., and Graham, Terry. "Caffeine and Exercise Performance." American College of Sports Medicine. Available from <http://mplus.nlm.nih.gov/medlineplus>

Calcium

Calcium is one of the most important elements in the **diet** because it is a structural component of bones, teeth, and soft tissues and is essential in many of the body's **metabolic** processes. It accounts for 1 to 2 percent of adult body weight, 99 percent of which is stored in bones and teeth. On the cellular level, calcium is used to regulate the permeability and electrical properties of **biological** membranes (such as cell walls), which in turn control muscle and nerve functions, glandular secretions, and blood vessel dilation and contraction. Calcium is also essential for proper **blood clotting**.

Because of its biological importance, calcium levels are carefully controlled in various compartments of the body. The three major regulators of blood calcium are parathyroid **hormone** (PTH), **vitamin D**, and calcitonin. PTH is normally released by the four parathyroid glands in the neck in response to low calcium levels in the bloodstream (hypocalcemia). PTH acts in three main ways: (1) It causes the **gastrointestinal** tract to increase calcium **absorption** from food, (2) it causes the bones to release some of their

calcium: mineral essential for bones and teeth

diet: the total daily food intake, or the types of foods eaten

metabolic: related to processing of nutrients and building of necessary molecules within the cell

biological: related to living organisms

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

hormone: molecules produced by one set of cells that influence the function of another set of cells

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

gastrointestinal: related to the stomach and intestines

absorption: uptake by the digestive tract

calcium stores, and (3) it causes the kidneys to excrete more phosphorous, which indirectly raises calcium levels.

Vitamin D works together with PTH on the bone and kidney and is necessary for intestinal absorption of calcium. Vitamin D can either be obtained from the diet or produced in the skin when it is exposed to sunlight. Insufficient vitamin D from these sources can result in **rickets** in children and **osteomalacia** in adults, conditions that result in bone deformities. Calcitonin, a hormone released by the thyroid, parathyroid, and thymus glands, lowers blood levels by promoting the deposition of calcium into bone.

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

osteomalacia: softening of the bones

Most dietary calcium is absorbed in the small intestine and transported in the bloodstream bound to albumin, a simple **protein**. Because of this method of transport, levels of albumin can also influence blood calcium measurements. Calcium is deposited in bone with phosphorous in a crystalline form of calcium phosphate.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Deficiency and Toxicity

Because bone stores of calcium can be used to maintain adequate blood calcium levels, short-term dietary deficiency of calcium generally does not result in significantly low blood calcium levels. But, over the long term, dietary deficiency eventually depletes bone stores, rendering the bones weak and prone to fracture. A low blood calcium level is more often the result of a disturbance in the body's calcium regulating mechanisms, such as insufficient PTH or vitamin D, rather than dietary deficiency. When calcium levels fall too low, nerve and muscle impairments can result. Skeletal muscles can spasm and the heart can beat abnormally—it can even cease functioning.

Toxicity from calcium is not common because the gastrointestinal tract normally limits the amount of calcium absorbed. Therefore, short-term intake of large amounts of calcium does not generally produce any ill effects aside from **constipation** and an increased risk of **kidney stones**. However, more severe toxicity can occur when excess calcium is ingested over long periods, or when calcium is combined with increased amounts of vitamin D, which increases calcium absorption. Calcium toxicity is also sometimes found after excessive **intravenous** administration of calcium. Toxicity is manifested by abnormal deposition of calcium in tissues and by elevated blood calcium levels (hypercalcemia). However, hypercalcemia is often due to other causes, such as abnormally high amounts of PTH. Usually, under these circumstances, bone density is lost and the resulting hypercalcemia can cause kidney stones and abdominal pain. Some cancers can also cause hypercalcemia, either by secreting abnormal proteins that act like PTH or by invading and killing bone cells causing them to release calcium. Very high levels of calcium can result in appetite loss, **nausea**, vomiting, abdominal pain, confusion, seizures, and even coma.

constipation: difficulty passing feces

kidney stones: deposits of solid material in kidney

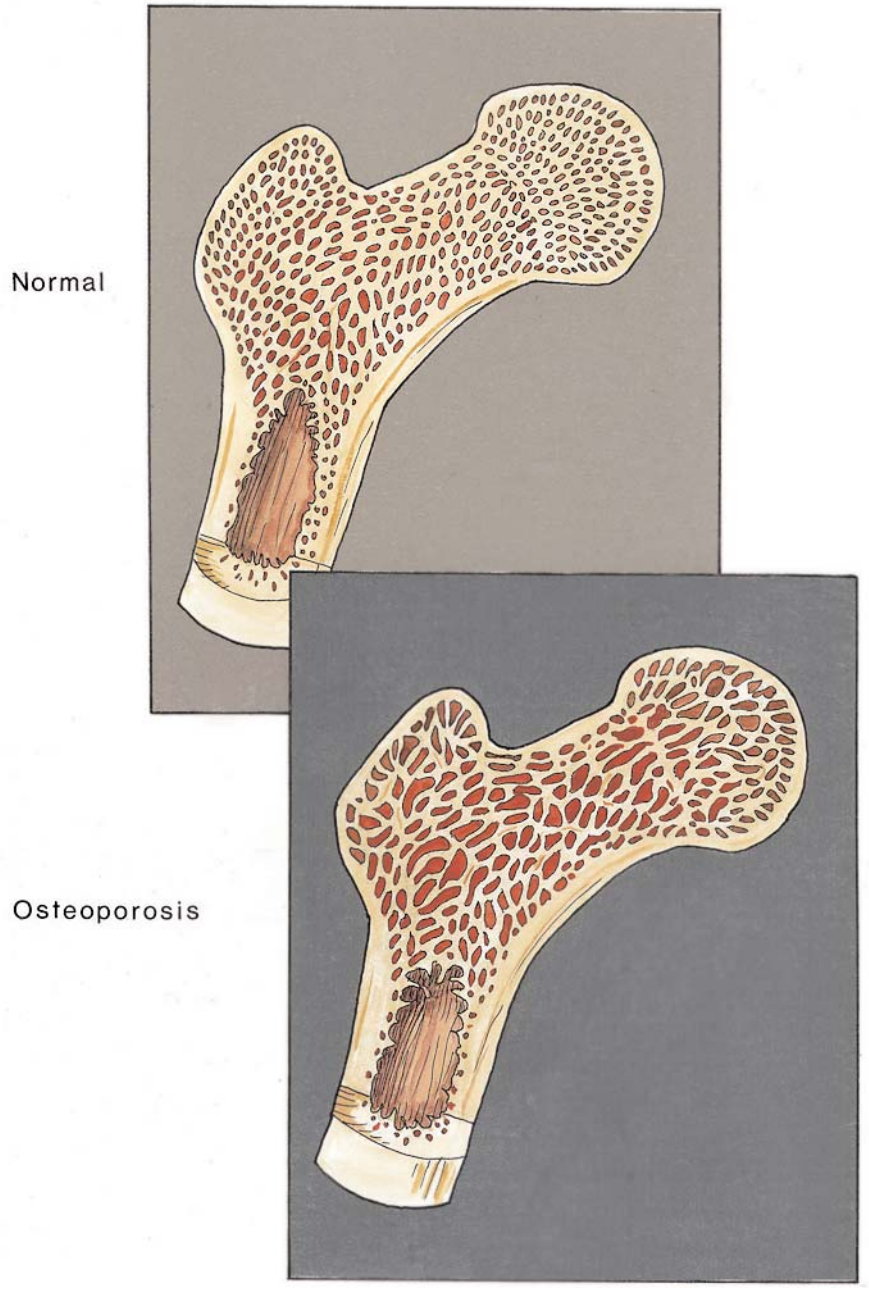
intravenous: into the veins

nausea: unpleasant sensation in the gut that precedes vomiting

Requirements and Supplementation

Dietary calcium requirements depend in part upon whether the body is growing or making new bone or milk. Requirements are therefore greatest during childhood, adolescence, pregnancy, and breastfeeding. Recommended daily intake (of **elemental** calcium) varies accordingly: 400 mg for

elemental: made from predigested nutrients



Calcium supplements can help prevent osteoporosis, which is a condition that occurs when bone breaks down more quickly than it is replaced. In this illustration, the bone above is normal, but the bone below is more porous and therefore more susceptible to fracture. *[Custom Medical Stock Photo, Inc. Reproduced by permission.]*

infants 0–6 months, 600 mg for infants 6–12 months, 800 mg for children 1–10 years, 1,200 mg for ages 11–24 years, and 800 mg for individuals over 24 years of age. Pregnant women require additional calcium (RDA 1,200 mg). Many experts believe that elderly persons should take as much as 1,500 mg to help prevent **osteoporosis**, a common condition in which bones become weak and fracture easily due to a loss of bone density. Dairy products, meats, and some seafood (sardines, oysters) are excellent sources of calcium. Spinach, beet greens, beans, and peanuts are among the best plant-derived sources.

osteoporosis: weakening of the bone structure

Calcium absorption is affected by many factors, including age, the amount needed, and what foods are eaten at the same time. In general,

CALCIUM SUPPLEMENTS

Supplement	Elemental calcium by weight	Comment
Calcium carbonate	40%	• Most commonly used • Less well absorbed in persons with decreased stomach acid (e.g., elderly or those on anti-acid medicines) • Natural preparations from oyster shell or bone meal may contain contaminants such as lead • Least expensive
Calcium citrate	21%	• Better absorbed, especially by those with decreased stomach acid • May protect against kidney stones • More expensive.
Calcium phosphate	38% or 31%	• Tricalcium or dicalcium phosphate • Used more in Europe • Absorption similar to calcium carbonate
Calcium gluconate	9%	• Used intravenously for severe hypocalcemia • Well absorbed orally, but low content of elemental calcium • Very expensive
Calcium glubionate	6.5%	• Available as syrup for children • Low content elemental calcium.
Calcium lactate	13%	• Well absorbed, but low content elemental calcium.

SOURCE: Gregory, Philip J. (2000) "Calcium Salts." *Prescriber's Letter.* Document #160313.

growth spurts: periods of rapid growth

calcium from food sources is better absorbed than calcium taken as supplements. Children absorb a higher percentage of their ingested calcium than adults because their needs during **growth spurts** may be two or three times greater per body weight than adults. Vitamin D is necessary for intestinal absorption, making Vitamin D–fortified milk a very well-absorbed form of calcium. Older persons may not consume or make as much vitamin D as is optimal, so their calcium absorption may be decreased. Vitamin C and lactose (the sugar found in milk) enhance calcium absorption, whereas meals high in **fat** or protein may decrease absorption. Excess phosphorous consumption (as in carbonated sodas) can decrease calcium absorption in the **intestines**. High dietary **fiber** and phytate (a form of phytic acid found in dietary fiber and the husks of whole grains) may also decrease dietary calcium absorption in some areas of the world. Intestinal **pH** also affects calcium absorption—absorption is optimal with normal stomach **acidity** generated at meal times. Thus, persons with reduced stomach acidity (e.g., elderly persons, or persons on acid-reducing medicines) do not absorb calcium as well as others do.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

intestines: the two long tubes that carry out the bulk of the processes of digestion

fiber: indigestible plant material which aids digestion by providing bulk

pH: level of acidity, with low numbers indicating high acidity

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

Calcium supplements are widely used in the treatment and prevention of osteoporosis. Supplements are also recommended, or are being investigated, for a number of conditions, including **hypertension**, colon **cancer**, **cardiovascular** disease, premenstrual syndrome, **obesity**, **stroke**, and preeclampsia (a complication of pregnancy). There are several forms of calcium salts used as supplements. They vary in their content of elemental calcium, the amount effectively absorbed by the body, and cost. Whatever the specific form, the supplement should be taken with meals to maximize absorption.

hypertension: high blood pressure

cancer: uncontrolled cell growth

cardiovascular: related to the heart and circulatory system

obesity: the condition of being overweight, according to established norms based on sex, age, and height

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

Calcium is one of the most important macronutrients for the body's growth and function. Sufficient amounts are important in preventing many diseases. Calcium levels are tightly controlled by a complex interaction of

hormones and **vitamins**. Dietary requirements vary throughout life and are greatest during periods of growth and pregnancy. However, recent reports suggest that many people do not get sufficient amounts of calcium in their diet. Various calcium supplements are available when dietary intake is inadequate. SEE ALSO MINERALS; OSTEOMALACIA; OSTEOPOROSIS; RICKETS.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

Donna Staton
Marcus Harding

Bibliography

Berkow, Robert, ed. (1997). *The Merck Manual of Medical Information, Home Edition.* Whitehouse Station, NJ: Merck & Co.

National Research Council (1989). *Recommended Dietary Allowances*, 10th edition. Washington, DC: National Academy Press.

Olendorf, Donna; Jeryan, Christine; and Boyden, Karen, eds. (1999). *The Gale Encyclopedia of Medicine.* Farmington Hills, MI: Gale Research.

Internet Resources

Food and Nutrition Board (1999). *Dietary Reference Intakes for Calcium, Phosphorous, Magnesium, Vitamin D, and Fluoride.* Washington, DC: National Academy Press. Available from <http://www.nap.edu>

Gregory, Philip J. (2000) "Calcium Salts." *Prescriber's Letter* Document #160313. Available from <http://www.prescribersletter.com>

Calorie

Technically, a **calorie** is the amount of heat needed to raise the temperature of 1 kilogram (kg) of water 1 degree Celsius. One calorie is 1/1000 of a kilocalorie (a kcalorie or Calorie). The kcalorie is the unit by which food, and the amount of **energy** a person takes in is measured. To maintain one's weight, energy intake should equal energy expenditure. If energy intake is negative (if a person consumes fewer kilocalories than he or she needs or expends) then weight loss will occur. If energy intake is positive (if a person consumes more kilocalories than he or she needs and expends), weight gain will occur.

calorie: unit of food energy

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Judith C. Rodriguez

Cancer

Cancer is a disease characterized by the uncontrolled growth and spread of abnormal cells. Around the world, over 10 million cancer cases occur annually. Half of all men and one-third of all women in the United States will develop some form of cancer during their lifetime. It is one of the most feared diseases, primarily because half of those diagnosed with cancer in the United States will die from it. Cancer is a leading cause of death around the world, causing over 6 million deaths a year. The exact causes of most types of cancer are still not known, and there is not yet a cure for cancer. However, it is now known that the risk of developing many types of cancer can be reduced by adopting certain lifestyle changes, such as quitting smoking and eating a better **diet**.

cancer: uncontrolled cell growth

diet: the total daily food intake, or the types of foods eaten

Prevalence

Cancer is, in general, more common in industrialized nations, but there has been a growth in cancer rates in developing countries, particularly as these nations adopt the diet and lifestyle habits of industrialized countries. Over one million people in the United States get cancer each year. Anyone can get cancer at any age; however, about 80 percent of all cancers occur in people over the age of fifty-five.

Cancer can affect any site in the body. About one hundred human cancers are recognized. The four most common cancers in the United States are: lung, colon/rectum, breast, and **prostate**. Together, these cancers account for over 50 percent of total cancer cases in the United States each year.

prostate: male gland surrounding the urethra that contributes fluid to the semen

incidence: number of new cases reported each year

There is a marked variation among countries in **incidence** of different cancers. Most of the variation in cancer risk among populations, and among individuals, is due to environmental factors, such as cigarette smoking and certain dietary patterns, that can affect one's risk of developing cancer. For example, individuals living in Australia have the highest worldwide lifetime risk of skin cancer, at over 20 percent, due to the high level of exposure to the sun of people in Australia. People in India have twenty-five times the average risk of developing oral cancer sometime during their lives due to the popularity of chewing tobacco in that country. In fact, India has the world's highest incidence of oral cancer, with 75,000 to 80,000 new cases a year. The population of Japan has the highest rates of stomach cancer in the world due to the high consumption of raw fish by the Japanese.

Types of Cancer

Cancers are classified according to the types of cells in which they develop. Most human cancers are *carcinomas*, which arise from the **epithelial cells** that form the superficial layer of the skin and some internal organs. *Leukemias* affect the blood and blood-forming organs such as **bone marrow**, the **lymphatic system**, and the spleen. *Lymphomas* affect the **immune system**. *Sarcoma* is a general term for any cancer arising from muscle cells or connective tissues.

epithelial cell: sheet of cells lining organs throughout the body

bone marrow: dividing cells within the long bones that make the blood

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

Growth and Spread of Cancer

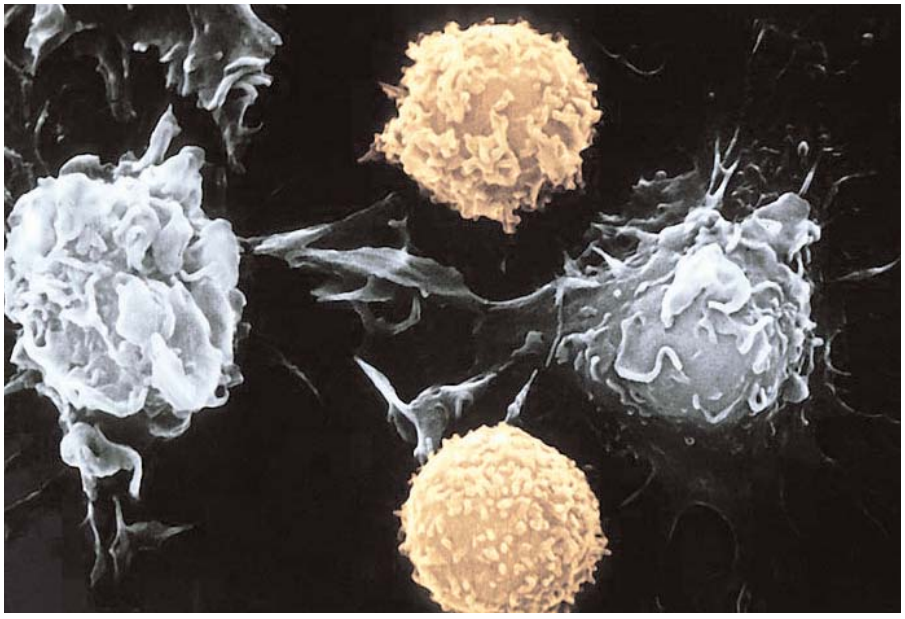
Cancer develops when cells in a particular part of the body begin to grow out of control. Normal body cells grow, divide, and die in an orderly way. Cancer cells, however, continue to grow and divide without dying. Instead, they outlive normal cells and continue to form new abnormal cancer cells. As most cancer cells continue to grow, they lump together and form an extra mass of tissue. This mass is called a **malignant** tumor.

malignant: spreading to surrounding tissues; cancerous

As a malignant tumor grows, it damages nearby tissue. Some cancers, like leukemia, do not form tumors. Instead, these cancer cells involve the blood and blood-forming organs and circulate through other tissues, where they grow.

Cancer can begin in one part of the body and spread to others. The spread of a tumor to a new site is called *metastasis*. This process occurs as cancer cells break away from a tumor and travel through the bloodstream or the **lymph system** to other areas of the body. Once in a new location, cancer cells continue to grow out of control and form a new malignant tumor.

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid



An image showing the division of cancer cells (left and right) and two healthy white blood cells (above and below). In normal cells, cell division is balanced by cell death, but cancerous cells continue to divide and accumulate, damaging nearby tissues. *[Nibsc/Photo Researchers, Inc. Reproduced by permission.]*

Causes of Cancer

The exact cause of cancer is not known. Most cancers result from permanent damage to **genes** or from mutations, which occur either due to internal factors, such as **hormones**, immune conditions, **metabolism**, and the digestion of **nutrients** within cells, or by exposure to environmental or external factors. A chemical or other environmental agent that produces cancer is called a *carcinogen*.

gene: DNA sequence that codes for proteins, and thus controls inheritance

hormone: molecules produced by one set of cells that influence the function of another set of cells

metabolism: the sum total of reactions in a cell or an organism

nutrient: dietary substance necessary for health

Overall, environmental factors, defined broadly to include tobacco use, diet, **infectious diseases**, chemicals, and radiation, are believed to cause between 75 and 80 percent of all cancer cases in the United States. Tobacco use, including cigarettes, cigars, chewing tobacco, and snuff, can cause cancers of the lung, mouth, throat, larynx, bladder, kidney, esophagus, and pancreas. Smoking alone causes one-third of all cancer deaths in the United States. Heavy consumption of alcohol has also been shown to increase the risk of developing cancer of the mouth, pharynx, larynx, esophagus, liver, and breast.

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

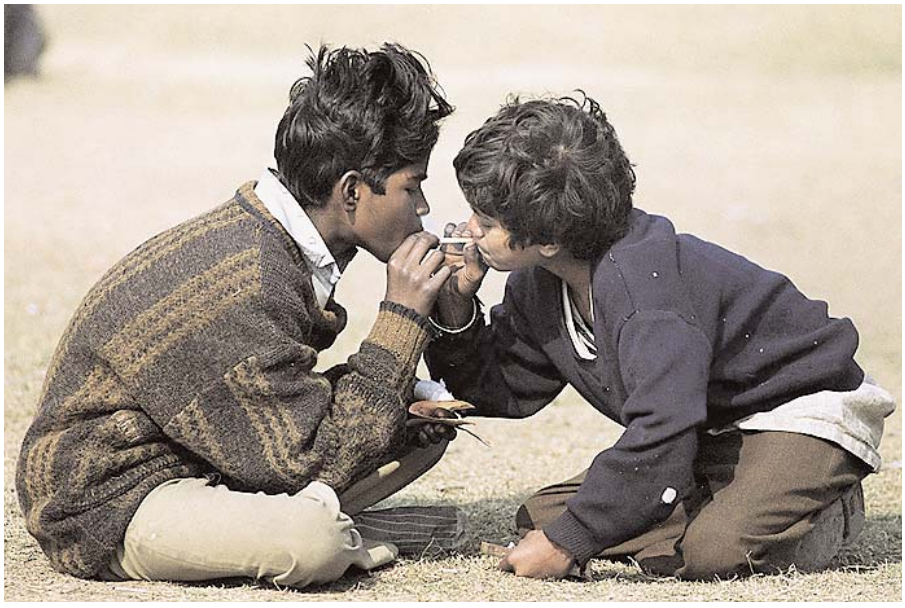
Overweight and **obesity** are associated with increased risk of cancers of the breast, colon, endometrium, esophagus, kidney, and gallbladder. The following chemicals have been found to cause cancer: coal tars and their derivatives, such as benzene; some hydrocarbons; aniline, a substance used to make dyes; and asbestos. Radiation from a variety of sources, including the ultraviolet light from the sun, is known to lead to skin cancer.

overweight: weight above the accepted norm based on height, sex, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Several infectious agents have also been implicated in cancer. Evidence suggests that **chronic** viral infections are associated with up to one-fifth of all cancers. These include hepatitis B virus (HBV), which can lead to cancer of the liver; the Epstein-Barr virus, a type of herpes virus that causes infectious mononucleosis and has been associated with Hodgkin's disease, non-Hodgkin's lymphomas, and nasopharyngeal cancer; the human immunodeficiency virus (HIV), which is associated with an increased risk of developing several cancers, especially Kaposi's sarcoma and non-Hodgkin's

chronic: over a long period



Tobacco use is a major cause of lung, lip, mouth, larynx, and throat cancer, and is a contributing cause of many other cancers. In India, where this photo was taken, the prevalence of tobacco use among students approaches 60 percent in some states. *[© AFP/Corbis. Reproduced by permission.]*

virus: noncellular infectious agent that requires a host cell to reproduce

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

lymph node: pocket within the lymph system in which white blood cells reside

genetic: inherited or related to the genes

lymphoma; and human papilloma **viruses** (HPV), which have been proven to cause cervical cancer and have also been associated with cancers of the vagina, vulva, penis, and colon. The bacterium *Helicobacter pylori* has been linked to stomach cancer.

About 5 to 10 percent of cancers are hereditary, in that a faulty gene or damaged **DNA** that has been inherited predisposes a person to be at a very high risk of developing a particular cancer. Two genes, BRCA1 and BRCA2, have been found to cause some breast cancers. Other genes have been discovered that are associated with some cancers that run in families, such as cancers of the colon, rectum, kidney, ovary, esophagus, **lymph nodes**, skin melanoma, and pancreas.

Carcinogenesis Process

All cancers involve the malfunction of genes that control cell growth and division. The process by which cancers develop is called *carcinogenesis*. This process usually starts when chemicals or radiation damage DNA, the **genetic** structure inside cells. Viruses induce carcinogenesis by introducing new DNA sequences. Most of the time, when DNA becomes damaged the body is able to repair it. In cancer cells, however, the damaged DNA is not repaired. While normal cells with damaged DNA die, cancer cells with damaged DNA continue to multiply.

There is a long time lag between exposure to a carcinogen and the occurrence of cancer. While cellular mutations cause cancer to develop, it is not exactly clear how this happens. Carcinogenesis is a multistep process, in which as many as ten distinct mutations may have to accumulate in a cell before it becomes cancerous. The fact that so many mutations are needed for a cancer to develop indicates that cell growth is normally controlled through many sets of checks and balances.

The cell cycle is regulated by a large number of cellular genes that are expressed, or exhibited, at different stages of the cycle. The genes code for,

When cells in some area of the body divide without control, these cells accumulate and form lumps. A *tumor,* or *neoplasm,* is an abnormal lump or mass of tissue that may compress, invade, and destroy normal tissue. Tumors may be benign or malignant. Cancer is a malignant neoplasm, though not all tumors are malignant. A noncancerous growth is called a benign tumor. Benign tumors do not metastasize and, with very rare exceptions, are not life threatening.

or determine, **growth factors**, growth-factor receptors, and **proteins** that control gene functions and cell survival. Damaged DNA can lead to cancer because the cell cycle is distorted by the alteration and activation of *oncogenes*, genes that stimulate cell growth, or by the inactivation of *tumor suppressor genes*, which ordinarily suppress cell growth. Activated oncogenes drive abnormal, unregulated cell proliferation and lead to tumor formation. Mutations of the tumor suppressor gene p53 are found in about 50 percent of human cancers.

growth factor: protein that stimulates growth of surrounding cells

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

In experimental animals, three stages of chemical carcinogenesis have been identified. These are: (1) initiation, where DNA is irreversibly altered; (2) promotion, which is the multiplication of altered cells; and (3) progression, which involves chromosomal changes, high growth rate, invasiveness, and potential to metastasize.

Prevention

All cancers caused by cigarette smoking and heavy use of alcohol could be prevented completely. Approximately 30 percent of all cancers worldwide are due to tobacco use. Many of the skin cancers could be prevented by protection from sunlight. Certain cancers that are related to infectious exposures, such as HBV, HPV, HIV, and *Helicobacter* could be prevented through **behavioral** changes, **vaccines**, or **antibiotics**. Research shows that about 30 to 40 percent of all cancers worldwide are due to dietary factors and lack of physical activity, including obesity, and could therefore have been prevented. By making changes in regard to diet, exercise, healthy weight maintenance, and tobacco use, the incidence of cancer around the world could be reduced by 60 to 70 percent.

behavioral: related to behavior, in contrast to medical or other types of interventions

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

antibiotic: substance that kills or prevents the growth of microorganisms

The Relationship between Diet, Physical Activity, and Cancer

While the exact mechanisms by which diet is related to cancer have not been completely understood, research has shown that food plays a role in cancer prevention. For example, populations whose diet includes at least five servings of fruits and vegetables a day have lower rates of some of the most common cancers. Fruits and vegetables contain many **antioxidants** and **phytochemicals**, such as vitamins A, C, and E, and beta-carotene, which have been shown to prevent cancer. It is not completely clear, however, whether it is individual phytochemicals, or a combination of them, or the **fiber** in fruits and vegetables that result in reduced risk of cancer.

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

phytochemical: chemical produced by plants

fiber: indigestible plant material that aids digestion by providing bulk

Studies have shown the risk of prostate cancer drops for men who eat tomato products, possibly because of the phytochemical lycopene. In addition, it has been shown that colon cancer declines among those who drink green tea, which contains antioxidants and phytochemicals, and who regularly eat soy products and foods rich in selenium, an antioxidant.

Those who eat a diet low in **fat**, especially animal fat, also have lower cancer rates, but again it is not clear whether it is the **calories**, the amount and distribution of body fat, or the likelihood that a low-fat diet is high in fiber, fruits, and vegetables that is protective against cancer. High-fiber diets are thought to reduce the risk of colon cancer because the fiber helps move food through the lower digestive tract, possibly reducing the contact of any **carcinogens** with the **bowel** lining.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

carcinogen: cancer-causing substance

bowel: intestines and rectum

Scientific evidence indicates that physical activity may reduce the risk of certain cancers. This effect may be due to the fact that physical activity is associated with the maintenance of a healthy body weight. Other mechanisms by which physical activity may help to prevent certain cancers may involve both direct and indirect effects. For colon cancer, physical activity accelerates the movement of food through the intestine, thereby reducing the length of time that the bowel lining is exposed to potential carcinogens. For breast cancer, vigorous physical activity may decrease the exposure of breast tissue to circulating **estrogen**, a hormone that has been implicated in breast cancer. Physical activity may also affect cancers of the colon, breast, and other sites by improving **energy** metabolism and reducing circulating concentrations of **insulin** and related growth factors.

estrogen: hormone that helps control female development and menstruation

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

insulin: hormone released by the pancreas to regulate level of sugar in the blood

Because of these factors, recommendations of the American Cancer Society to reduce the risk of cancer include: consumption of a mostly plant-based diet, including five or more servings of fruits and vegetables each day; consumption of whole grains in preference to processed or refined grains and sugar; limited consumption of high-fat foods, particularly from animal sources; physical activity; and limited consumption of alcohol.

Nutrition for People with Cancer

People with cancer often have increased nutritional needs. As such, it is important for them to consume a variety of foods that provide the nutrients needed to maintain health while fighting cancer. These nutrients include: protein, **carbohydrates**, fat, water, vitamins, and **minerals**. Nutrition suggestions for people with cancer often emphasize eating high-calorie, high-protein foods. Protein helps to ensure growth, repair body tissue, and maintain a healthy immune system. Therefore, people with cancer often need more protein than usual.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Great progress has been made in the fight against cancer, and cancer detection and treatments have improved significantly. However, there is a disparity in cancer death rates between developed and developing countries. Between 80 and 90 percent of cancer patients in developing countries have late-stage and often incurable cancer at the time of diagnosis.

A growing body of evidence shows that simple changes in diet and lifestyle can help prevent many cancers. Further research into the exact mechanisms by which certain diets may help prevent cancer is ongoing. SEE ALSO ANTIOXIDANTS; FUNCTIONAL FOODS; PHYTOCHEMICALS.

Gita C. Gidwani

Bibliography

American Institute for Cancer Research (1997). *Food, Nutrition, and the Prevention of Cancer: A Global Perspective*. Washington, DC: Author.

Cooper, Geoffrey M. (1992). *Elements of Human Cancer*. Boston: Jones and Bartlett.

Tortora, Gerald J., and Grabowski, Sandra Reynolds (2003). *Principles of Anatomy and Physiology*, 10th edition. New York: Wiley.

Internet Resources

American Cancer Society. "Cancer Facts and Figures, 2002." Available from <http://www.cancer.org/downloads>

National Cancer Institute (2000). "Cancer Facts: Questions and Answers About Cancer." Available from <http://www.nci.nih.gov>

Carbohydrates

Carbohydrates are one of three macronutrients that provide the body with **energy** (**protein** and fats being the other two). The chemical compounds in carbohydrates are found in both simple and complex forms, and in order for the body to use carbohydrates for energy, food must undergo digestion, **absorption**, and **glycolysis**. It is recommended that 55 to 60 percent of caloric intake come from carbohydrates.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

absorption: uptake by the digestive tract

glycolysis: cellular reaction that begins the breakdown of sugars

oxygen: O_2, atmospheric gas required by all animals

Chemical Structure

Carbohydrates are a main source of energy for the body and are made of carbon, hydrogen, and **oxygen**. Chlorophyll in plants absorbs light energy from the sun. This energy is used in the process of photosynthesis, which allows green plants to take in carbon dioxide and release oxygen and allows for the production of carbohydrates. This process converts the sun's light energy into a form of chemical energy useful to humans. Plants transform carbon dioxide (CO_2) from the air, water (H_2O) from the ground, and energy from the sun into oxygen (O_2) and carbohydrates ($C_6H_{12}O_6$) (6 CO_2 + 6 H_2O + energy = $C_6H_{12}O_6$ + 6 O_2). Most carbohydrates have a ratio of 1:2:1 of carbon, hydrogen, and oxygen, respectively.

Humans and other animals obtain carbohydrates by eating foods that contain them. In order to use the energy contained in the carbohydrates, humans must **metabolize**, or break down, the structure of the molecule in a process that is opposite that of photosynthesis. It starts with the carbohydrate and oxygen and produces carbon dioxide, water, and energy. The body utilizes the energy and water and rids itself of the carbon dioxide.

metabolize: processing of a nutrient

Simple Carbohydrates

Simple carbohydrates, or simple sugars, are composed of *monosaccharide* or *disaccharide* units. Common monosaccharides (carbohydrates composed of single sugar units) include **glucose**, fructose, and galactose. Glucose is the most common type of sugar and the primary form of sugar that is stored in the body for energy. It sometimes is referred to as blood sugar or dextrose and is of particular importance to individuals who have **diabetes** or **hypoglycemia**. Fructose, the primary sugar found in fruits, also is found in honey and high-fructose corn syrup (in soft drinks) and is a major source of sugar in the **diet** of Americans. Galactose is less likely than glucose or fructose to be found in nature. Instead, it often combines with glucose to form the disaccharide lactose, often referred to as milk sugar. Both fructose and galactose are metabolized to glucose for use by the body.

glucose: a simple sugar; the most commonly used fuel in cells

diabetes: inability to regulate level of sugar in the blood

hypoglycemia: low blood sugar level

diet: the total daily food intake, or the types of foods eaten

Oligosaccharides are carbohydrates made of two to ten monosaccharides. Those composed of two sugars are specifically referred to as disaccharides, or double sugars. They contain two monosaccharides bound by either an alpha bond or a beta bond. Alpha bonds are digestible by the human body, whereas beta bonds are more difficult for the body to break down.

There are three particularly important disaccharides: **sucrose**, maltose, and lactose. Sucrose is formed when glucose and fructose are held together by an alpha bond. It is found in sugar cane or sugar beets and is refined to make granulated table sugar. Varying the degree of purification alters the

sucrose: table sugar

SUGAR COMPARISON

Sugar	Carbohydrate	Monosaccharide or disaccharide	Additional information
Beet sugar (cane sugar)	Sucrose	Disaccharide (fructose and glucose)	Similar to white and powdered sugar, but varied degree of purification
Brown sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to white and powdered sugar, but varied degree of purification
Corn syrup	Glucose	Monosaccharide	
Fruit sugar	Fructose	Monosaccharide	Very sweet
High-fructose corn syrup	Fructose	Monosaccharide	Very sweet and inexpensive Added to soft drinks and canned or frozen fruits
Honey	Fructose and glucose	Monosaccharides	
Malt sugar	Maltose	Disaccharide (glucose and glucose)	Formed by the hydrolysis of starch, but sweeter than starch
Maple syrup	Sucrose	Disaccharide (fructose and glucose)	
Milk sugar	Lactose	Disaccharide (glucose and galactose)	Made in mammary glands of most lactating animals
Powdered sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to white and brown sugar, but varied degree of purification
White sugar	Sucrose	Disaccharide (fructose and glucose)	Similar to brown and powdered sugar, but varied degree of purification

SOURCE: Mahan and Escott-Stump, 2000; Northwestern University; Sizer and Whitney, 1997; and Wardlaw and Kessel, 2002.

final product, but white, brown, and powdered sugars all are forms of sucrose. Maltose, or malt sugar, is composed of two glucose units linked by an alpha bond. It is produced from the chemical decomposition of starch, which occurs during the germination of seeds and the production of alcohol. Lactose is a combination of glucose and galactose. Because it contains a beta bond, it is hard for some individuals to digest in large quantities. Effective digestion requires sufficient amounts of the **enzyme** lactase.

enzyme: protein responsible for carrying out reactions in a cell

Complex Carbohydrates

Complex carbohydrates, or *polysaccharides*, are composed of simple sugar units in long chains called polymers. Three polysaccharides are of particular importance in human **nutrition**: starch, **glycogen**, and dietary **fiber**.

nutrition: the maintenance of health through proper eating, or the study of same

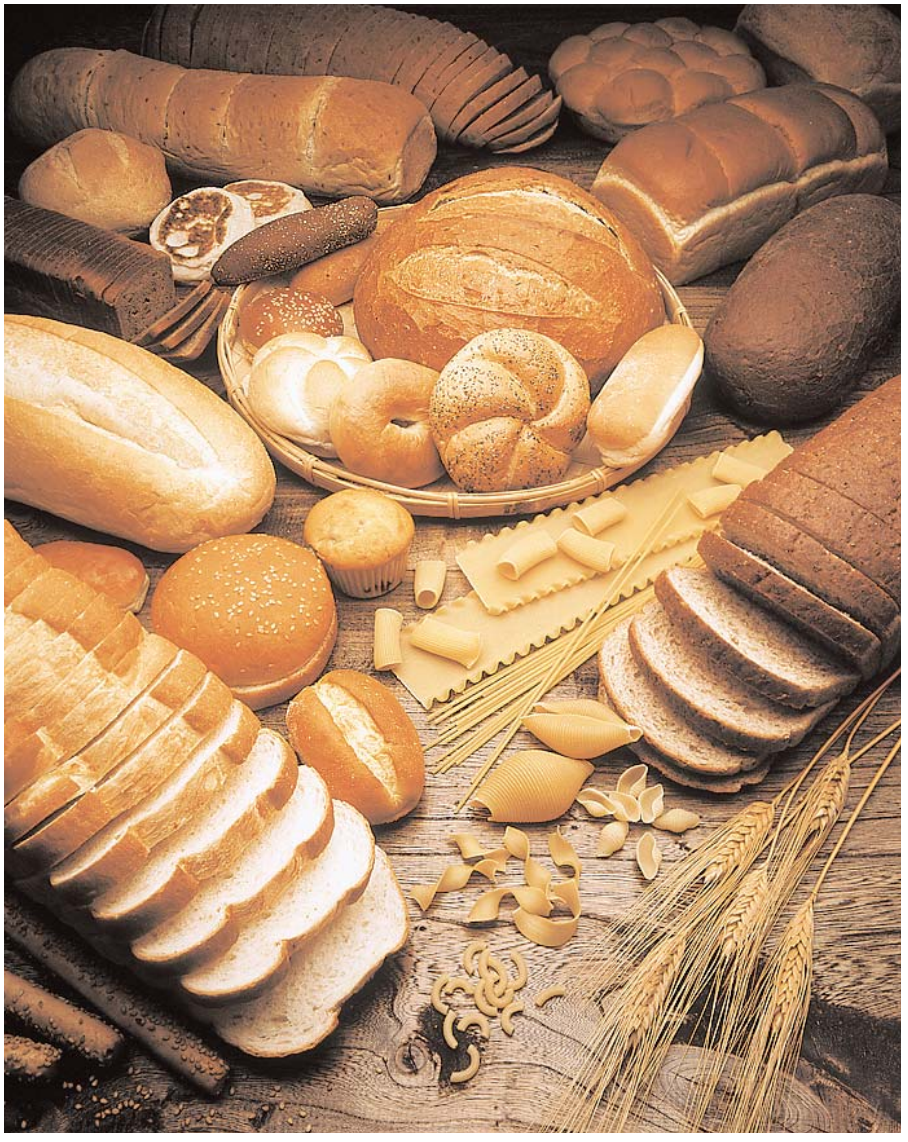
glycogen: storage form of sugar

fiber: indigestible plant material that aids digestion by providing bulk

Starch and glycogen are digestible forms of complex carbohydrates made of strands of glucose units linked by alpha bonds. Starch, often contained in seeds, is the form in which plants store energy, and there are two types: amylose and amylopectin. Starch represents the main type of digestible complex carbohydrate. Humans use an enzyme to break down the bonds linking glucose units, thereby releasing the sugar to be absorbed into the bloodstream. At that point, the body can distribute glucose to areas that need energy, or it can store the glucose in the form of glycogen.

Glycogen is the polysaccharide used to store energy in animals, including humans. Like starch, glycogen is made up of chains of glucose linked by alpha bonds; but glycogen chains are more highly branched than starch. It is this highly branched structure that allows the bonds to be more quickly broken down by enzymes in the body. The primary storage sites for glycogen in the human body are the liver and the muscles.

Another type of complex carbohydrate is dietary fiber. In general, dietary fiber is considered to be polysaccharides that have not been digested at the point of entry into the large intestine. Fiber contains sugars linked by bonds that cannot be broken down by human enzymes, and are there-



Pastas and whole-grain breads contain complex carbohydrates, which are long strands of glucose molecules. Nutritionists recommend that 55–60 percent of calories come from carbohydrates, and especially complex carbohydrates. *[Photograph by James Noble. Corbis. Reproduced by permission.]*

fore labeled as indigestible. Because of this, most fibers do not provide energy for the body. Fiber is derived from plant sources and contains polysaccharides such as **cellulose**, hemicellulose, pectin, gums, mucilages, and lignins.

cellulose: carbohydrate made by plants; indigestible by humans

The indigestible fibers cellulose, hemicellulose, and lignin make up the structural part of plants and are classified as **insoluble** fiber because they usually do not dissolve in water. Cellulose is a nonstarch carbohydrate polymer made of a straight chain of glucose **molecules** linked by beta bonds and can be found in whole-wheat flour, bran, and vegetables. Hemicellulose is a nonstarch carbohydrate polymer made of glucose, galactose, xylose, and other monosaccharides; it can be found in bran and whole grains. Lignin, a noncarbohydrate polymer containing alcohols and acids, is a woody fiber found in wheat bran and the seeds of fruits and vegetables.

insoluble: not able to be dissolved in water

molecule: combination of atoms that form stable particles

In contrast, pectins, mucilages, and gums are classified as soluble fibers because they dissolve or swell in water. They are not broken down by human enzymes, but instead can be metabolized (or fermented) by **bacteria**

bacteria: single-celled organisms without nuclei, some of which are infectious

present in the large intestine. Pectin is a fiber made of galacturonic acid and other monosaccharides. Because it absorbs water and forms a gel, it is often used in jams and jellies. Sources of pectin include citrus fruits, apples, strawberries, and carrots. Mucilages and gums are similar in structure. Mucilages are dietary fibers that contain galactose, manose, and other monosaccharides; and gums are dietary fibers that contain galactose, glucuronic acid, and other monosaccharides. Sources of gums include oats, **legumes**, guar, and barley.

legumes: beans, peas, and related plants

Digestion and Absorption

Carbohydrates must be digested and absorbed in order to transform them into energy that can be used by the body. Food preparation often aids in the digestion process. When starches are heated, they swell and become easier for the body to break down. In the mouth, the enzyme amylase, which is contained in saliva, mixes with food products and breaks some starches into smaller units. However, once the carbohydrates reach the acidic environment of the stomach, the amylase is inactivated. After the carbohydrates have passed through the stomach and into the small intestine, key digestive enzymes are secreted from the pancreas and the small intestine where most digestion and absorption occurs. Pancreatic amylase breaks starch into disaccharides and small polysaccharides, and enzymes from the cells of the small-intestinal wall break any remaining disaccharides into their monosaccharide components. Dietary fiber is not digested by the small intestine; instead, it passes to the colon unchanged.

Sugars such as galactose, glucose, and fructose that are found naturally in foods or are produced by the breakdown of polysaccharides enter into absorptive intestinal cells. After absorption, they are transported to the liver where galactose and fructose are converted to glucose and released into the bloodstream. The glucose may be sent directly to organs that need energy, it may be transformed into glycogen (in a process called glycogenesis) for storage in the liver or muscles, or it may be converted to and stored as fat.

Glycolysis

The molecular bonds in food products do not yield high amounts of energy when broken down. Therefore, the energy contained in food is released within cells and stored in the form of adenosine triphosphate (ATP), a high-energy compound created by cellular energy-production systems. Carbohydrates are metabolized and used to produce ATP molecules through a process called glycolysis.

Glycolysis breaks down glucose or glycogen into pyruvic acid through **enzymatic** reactions within the **cytoplasm** of the cells. The process results in the formation of three molecules of ATP (two, if the starting product was glucose). Without the presence of oxygen, pyruvic acid is changed to **lactic acid**, and the energy-production process ends. However, in the presence of oxygen, larger amounts of ATP can be produced. In that situation, pyruvic acid is transformed into a chemical compound called *acetyle coenzyme A*, a compound that begins a complex series of reactions in the **Krebs Cycle** and the electron transport system. The end result is a net gain of up to thirty-nine molecules of ATP from one molecule of glycogen (thirty-eight

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

cytoplasm: contents of a cell minus the nucleus

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

Krebs Cycle: cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules

molecules of ATP if glucose was used). Thus, through certain systems, glucose can be used very efficiently in the production of energy for the body.

Recommended Intake

At times, carbohydrates have been incorrectly labeled as "fattening." Evidence actually supports the consumption of more, rather than less, starchy foods. Carbohydrates have four **calories** per gram, while dietary fats contribute nine per gram, so diets high in complex carbohydrates are likely to provide fewer calories than diets high in fat. Recommendations are for 55 to 60 percent of total calories to come from carbohydrates (approximately 275 to 300 grams for a 2,000-calorie diet). The majority of carbohydrate calories should come from complex rather than simple carbohydrates. Of total caloric intake, approximately 45 to 50 percent of calories should be from complex carbohydrates, and 10 percent or less from simple carbohydrates.

calorie: unit of food energy

It is important to consume a minimum amount of carbohydrates to prevent **ketosis**, a condition resulting from the breakdown of fat for energy in the absence of carbohydrates. In this situation, products of fat breakdown, called ketone bodies, build up in the blood and alter normal **pH** balance. This can be particularly harmful to a fetus. To avoid ketosis, daily carbohydrate intake should include a minimum of 50 to 100 grams. In terms of dietary fiber, a minimum intake of 20 to 35 grams per day is recommended.

ketosis: build-up of ketone bodies in the blood, due to fat breakdown

pH: level of acidity, with low numbers indicating high acidity

Low-Carb Diets

Low-carbohydrate diets, such as the Atkins and South Beach diets, are based on the proposition that it's not fat that makes you fat. Allowing dieters to eat steak, butter, eggs, bacon, and other high-fat foods, these diets instead outlaw starches and refined carbohydrates on the theory that they are metabolized so quickly that they lead to hunger and overeating. This theory, which was first popularized in the nineteenth century, came under scathing criticism from the medical establishment during the early 1970s when Dr. Robert Atkins published the phenomenally popular low-carb diet bearing his name. According to the American Medical Association (AMA), the Atkins diet was a "bizarre regimen" that advocated "an unlimited intake of saturated fats and cholesterol-rich foods" and therefore presented a considerable risk of heart disease. Most doctors recommended instead a diet low in fat and high in carbohydrates, with plenty of grains, fruits, and vegetables and limited red meat or dairy products. This became the received wisdom during the 1980s, at the same time that the U.S. waistline began to expand precipitously. As dieters found that weight loss was difficult to maintain on a low-fat diet, low-carb diets regained popularity—with as many as 30 million people trying a low-carb diet in 2003. Several small-scale studies began to suggest that a low-carb diet may indeed be effective and may not have the deleterious effects its detractors have claimed; other research found that any benefits of a low-carb diet are short-lived, and that the negative effects will take decades to become evident. The National Institutes of Health has pledged $2.5 million for a five-year study of the Atkins diet with 360 subjects. While the results of this and other large-scale studies are awaited, many researchers stress that the key issue in maintaining a healthy weight is the number of calories consumed, not the type of calories. The National Academy of Sciences recommends that adults obtain 45 to 65 percent of their calories from carbohydrates, 20 to 35 percent from fat, and 10 to 35 percent from protein.

—Paula Kepos

Exchange System

The exchange system is composed of lists that describe carbohydrate, fat, and protein content, as well as caloric content, for designated portions of specific foods. This system takes into account the presence of more than one type of nutrient in any given food. Exchange lists are especially useful for individuals who require careful diet planning, such as those who monitor intake of calories or certain nutrients. It is particularly useful for diabetics, for whom carbohydrate intake must be carefully controlled, and was originally developed for planning diabetic diets.

Diabetes, Carbohydrate-Modified Diets, and Carbohydrate Counting

Diabetes is a condition that alters the way the body handles carbohydrates. In terms of diet modifications, diabetics can control blood sugar levels by appropriately managing the carbohydrates, proteins, and fats in their meals. The amount of carbohydrates, not necessarily the source, is the primary issue. Blood glucose levels after a meal can be related to the process of food preparation, the amount of food eaten, fat intake, sugar absorption, and the combination of foods in the meal or snack.

insulin: hormone released by the pancreas to regulate level of sugar in the blood

One method of monitoring carbohydrate levels—carbohydrate counting—assigns a certain number of carbohydrate grams or exchanges to specific foods. Calculations are used to determine **insulin** need, resulting in better control of blood glucose levels with a larger variety of foods. Overall, diabetic diets can include moderate amounts of sugar, as long as they are carefully monitored. SEE ALSO DIABETES MELLITUS; FATS; NUTRIENTS; PROTEIN; WEIGHT LOSS DIETS.

Catherine N. Rasberry

Bibliography

Bounds, Laura E.; Agnor, Dottiedee; Darnell, Gayden S.; and Shea, Kirstin Brekken (2003). *Health and Fitness: A Guide to a Healthy Lifestyle*, 2nd edition. Dubuque, IA: Kendall/Hunt.

Duyff, Roberta Larson (2002). *American Dietetic Association: Complete Food and Nutrition Guide*, 2nd edition. Hoboken, NJ: John Wiley.

Mahan, L. Kathleen, and Escott-Stump, Sylvia (2000). *Krause's Food, Nutrition, and Diet Therapy*, 10th edition. Philadelphia: W. B. Saunders.

Robbins, Gwen; Powers, Debbie; and Burgess, Sharon (2002). *A Wellness Way of Life*, 5th edition. New York: McGraw-Hill.

Sizer, Frances, and Whitney, Eleanor (1997). *Nutrition: Concepts and Controversies*, 7th edition. Belmont, CA: Wadsworth Publishing.

Wardlaw, Gordon M., and Kessel, Margaret (2002). *Perspectives in Nutrition*, 5th edition. New York: McGraw-Hill.

Wilmore, Jack H., and Costill, David L. (1999). *Physiology of Sport and Exercise*, 2nd edition. Champaign, IL: Human Kinetics.

Internet Resources

American Diabetes Association. <http://www.diabetes.org>

American Dietetic Association. <http://www.eatright.org>

Carpi, Anthony. "Carbohydrates." Visionlearning. Available from <http://www.visionlearning.com>

Kennedy, Ron. "Carbohydrates in Nutrition." Doctor's Medical Library. Available from <http://www.medical-library.net/sites>

Northwestern University, Department of Preventive Medicine. "Nutrition Fact Sheets: Carbohydrates." Available from <http://www.feinberg.northwestern.edu/nutrition>

Cardiovascular Disease

The **cardiovascular** system comprises the heart, veins, **arteries**, and capillaries, which carry blood back and forth from the heart to the lungs (pulmonary circulation) and from the heart to the rest of the body (systemic circulation). The heart works on electrical impulses and produces them constantly, unless **stress**, fear, or danger is involved, in which case the impulses will increase dramatically. The body's largest artery is the aorta and the largest vein is the vena cava. Veins are thinner than arteries, which resemble rubber bands in that they expand more easily (depending on the amount of blood passing through them). Smaller blood vessels, or capillaries, channel **oxygen** and blood to tissues. The process is a cycle in which the capillaries deliver oxygen-rich blood to the body and pick up oxygen-poor blood, which is then taken into the veins and finally to the heart to be "rejuvenated" or cleansed.

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carries blood away from the heart toward the body tissues

stress: heightened state of nervousness or unease

oxygen: O_2, atmospheric gas required by all animals

Cardiovascular disease (CVD), and the resulting complications, is the main cause of death for both males and females in the United States and other technologically advanced countries of the world. It usually is in the top five causes of death in lesser-developed countries. Diseases of the cardiovascular system include those that compromise the pumping ability of the heart, cause failure of the valves, or result in narrowing or hardening of the arteries. In addition, **toxins** and infectious agents may damage the heart and blood vessels. Injury or failure of the cardiovascular system, especially the heart, also will affect the peripheral tissues that depend on the delivery of **nutrients** and the removal of wastes through the blood vascular system. CVD is a family of diseases that includes **hypertension**, **atherosclerosis**, **coronary heart disease**, and **stroke**.

toxins: poison

nutrient: dietary substance necessary for health

hypertension: high blood pressure

atherosclerosis: build-up of deposits within the blood vessels

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

Hypertension (High Blood Pressure)

Blood pressure is a measure of the force of blood against the walls of arteries. It is recorded as two numbers: the systolic pressure over the diastolic pressure. Systolic pressure is the pressure as the heart beats, while diastolic pressure measures the pressure when the heart relaxes between beats.

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

Blood pressure is normally measured at the brachial artery with a sphygmomanometer (pressure cuff) in millimeters of mercury (mm Hg) and given as systolic over diastolic pressure. Normal blood pressure is less than 120 mm Hg systolic and less than 80 mm Hg diastolic—usually expressed as "120 over 80." However, normal for an individual varies with the height, weight, fitness level, age, and health of a person. Blood pressure is normally maintained within narrow limits, but it can drop during sleep or increase during exercise. Hypertension (HTN), or high blood pressure, occurs when the force of blood passing through blood vessels is above normal. The increase in pressure forces the blood to hit the blood vessel walls. HTN is called "the silent killer" because many people do not know they have the condition. Consistently high blood pressure increases the risk for a stroke or a **heart attack**.

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

The sphygmomanometer around this woman's arm is inflated until it collapses her brachial artery, and then gradually deflated. Blood rushing into the vessel makes Korotkoff sounds that are used to time the measurements of systolic and diastolic pressure. *[Photograph by Michael Keller. Corbis. Reproduced by permission.]*

diet: the total daily food intake, or the types of foods eaten

obesity: the condition of being overweight, according to established norms based on sex, age, and height

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

lipid: fats, waxes and steroids; important components of cell membranes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

trans-fatty acids: type of fat thought to increase the risk of heart disease

diabetes: inability to regulate level of sugar in the blood

It may be caused by poor **diet**, **obesity**, smoking, stress, and inactivity. The Dietary Approach to Stop Hypertension (DASH) project recommends a diet that is low in sodium and high in fruits, vegetables, and low-fat dairy products. Other approaches to controlling HTN include weight loss, smoking cessation, increased physical activity, and stress management.

Atherosclerosis

Atherosclerosis, or hardening of the arteries, is the cause of more than half of all mortality in developed countries and the leading cause of death in the United States. When the coronary arteries are involved, it results in coronary artery disease (CAD). The hardening of the arteries is due to the build up of fatty deposits called **plaque**, and mineral deposits. As a result, the supply of blood to the heart muscle (myocardium) is reduced and can lead to ischema (deficiency of blood) to the heart, causing chest pain or a myocardial infarction (heart attack). The hardening of the arteries causes an increase in resistance to blood flow, and therefore an increase in blood pressure. Any vessel in the body may be affected by atherosclerosis; however, the aorta and the coronary, carotid, and iliac arteries are most frequently affected. The process begins early in life. Therefore, physicians should obtain risk-factor profiles and a family history for children.

Coronary Artery Disease

Coronary artery disease (CAD) refers to any of the conditions that affect the coronary arteries and reduces blood flow and nutrients to the heart. It is the leading cause of death worldwide for both men and women. Atherosclerosis is the primary cause of CAD. Controlled risk factors associated with CAD include hypertension, cigarette smoking, elevated blood **lipids** (e.g., **cholesterol**, **triglyceride**), a high-fat diet (especially saturated fats and **trans-fatty acids**), physical inactivity, obesity, **diabetes**, and stress. Lifestyle changes can assist in prevention of CAD. Uncontrolled risk factors include a family history of CAD, gender (higher in males), and increasing age.

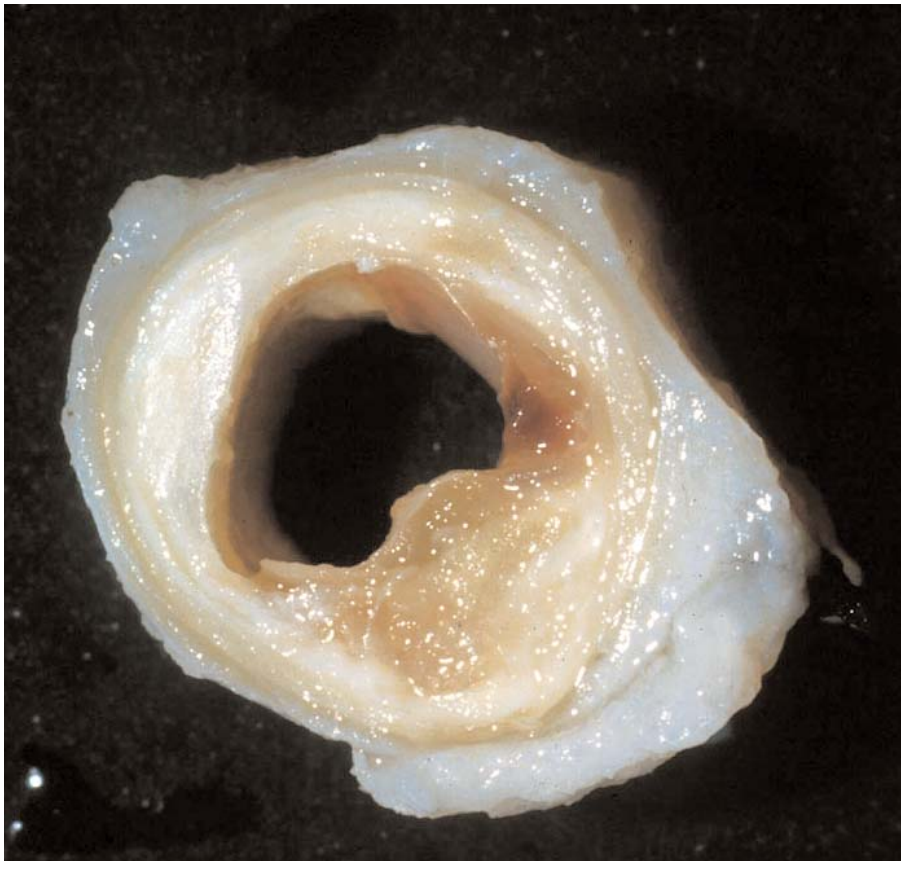
Stroke

Stroke, or a cerebrovascular accident (CVA), occurs when the brain does not receive sufficient oxygen-rich blood through blood vessels or when a blood vessel bursts. A stroke may result from blockage of the blood vessels due to a blood clot (ischemic) or from ruptures of the blood vessels (hemorrhagic bursts). Uncontrolled hypertension is a major risk factor for strokes.

Preventing CVD

The symptoms of CVD develop over many years and often do not manifest themselves until old age. Autopsies of young servicemen indicate significant accumulation of plaque and hardening of the arteries (atherosclerosis). Thus, primary prevention for CVD must begin in early childhood. Preventing premature CVD (before age 60) is crucial. Heart attacks between the ages of forty and sixty are primarily due to lifestyle factors.

Smoking, high blood cholesterol, high blood pressure, and lack of physical activity are the most serious risk factors for CVD and heart attack. Controlling one of these risk factors can help control others. For example, regular



This cross section of a coronary artery shows plaque buildup, possibly indicating coronary artery disease—the most common cause of death worldwide. Risk factors for the disease include poor diet, cigarette smoking, and stress, among others. *[B&B Photos/Custom Medical Stock Photo. Reproduced by permission.]*

exercise can help control cholesterol, blood pressure, weight, and stress levels. Smoking is the most preventable risk factor. Smokers have twice the risk for heart attack that nonsmokers have. Tobacco use alters the blood chemistry and increases **blood clotting**. Nearly one-fifth of all deaths are due to tobacco use, and a smoker lives an average of seven to eight fewer years than a nonsmoker.

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

The worldwide increase in obesity and type 2 diabetes (in both children and adults) point to a high-fat, high-calorie diet and a **sedentary** lifestyle. Poverty increases the risk for poor dietary habits and poor access to healthful foods. Many of the world's urban poor have more access to highly **processed foods**, **convenience foods**, and fast foods than to fresh fruits and vegetables. But even in the most wealthy and technologically advanced countries, the affluent are choosing to eat more fast foods and processed foods that are high in fat, cholesterol, and sodium. For optimal health, health professionals recommend:

sedentary: not active

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

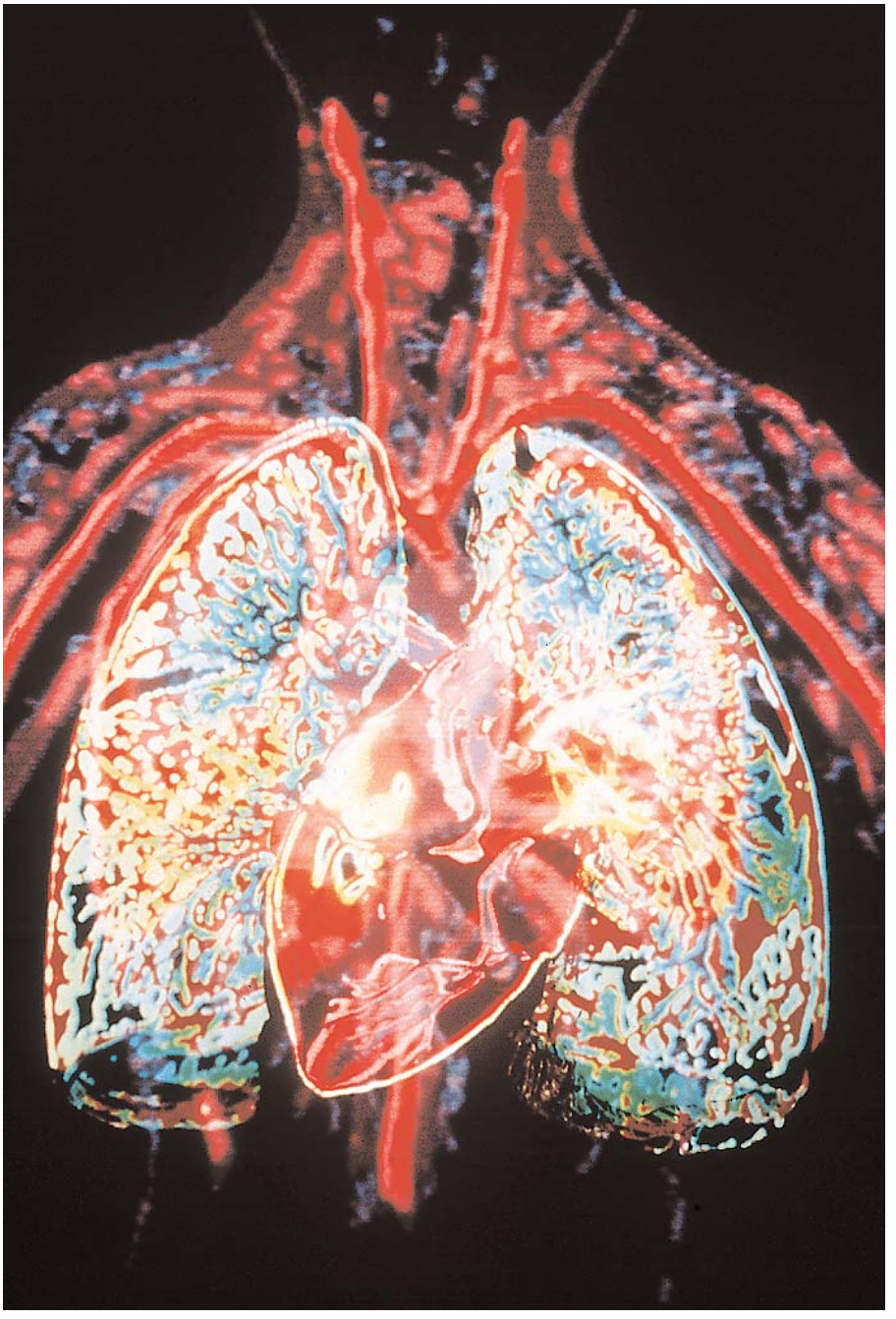
convenience food: food that requires very little preparation for eating

- Maintaining a healthy weight, with a **body mass index** (BMI) of 18.5–24.9.
- Limiting dietary fat to 30 percent or less of total calories—10 percent **saturated fat**, 10 percent **polyunsaturated** fat, and 10 percent monounsaturated fats. Consumers should be aware that ounce for ounce, all sources of fat have approximately the same amounts of calories.
- Limiting saturated fats to 10 percent of calories. Saturated fats come primarily from animal sources (e.g., high-fat dairy and meats), but also are found in coconut and palm oil.

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it



This scan of the cardiovascular system shows the heart and lungs, with major blood vessels radiating from them. Cardiovascular diseases, which affect the pumping of the heart and the circulation of blood, are the leading cause of death in developed nations. *[Photograph by Howard Sochurek. Corbis. Reproduced by permission.]*

- Limiting polyunsaturated fats to 10 percent of calories. Polyunsaturated fats come primarily from vegetable oils (e.g., corn oil, safflower oil).
- Limiting monounsaturated fats to 10 percent of calories. Monounsaturated fats may have a protective role in **heart disease**. Excellent sources of monounsaturated fats include olive oils, nuts, avocado, and canola oil.
- Increasing intake of omega-3 **fatty acids**. Two to four grams daily of omega-3 fatty acids may lower risk for CVD by reducing blood clotting, making platelets less sticky, and lowering triglycerides. Patients should inform their physician if they are using omega-3 supplements, since they may increase the risk of bleeding. Excellent sources of

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

fatty acids: molecules rich in carbon and hydrogen; a component of fats

omega-3 include fatty fish (such as salmon and sardines), fish oils, and flax seed.

- Limiting sodium intake to 2,400 milligrams per day.
- Increasing potassium intake to at least 3,500 milligrams per day.
- Eating at least five servings a day of fruits and vegetables.
- Eating a plant-based diet consisting primarily of whole grains, fruits, and vegetables is also recommended.
- Eating at least 25 grams of **fiber** daily.
- Eating 25 grams of soy **protein** daily.

fiber: indigestible plant material that aids digestion by providing bulk

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

In addition to diet modification, research is increasingly focused on the role of physical activity in preventing CVD. People who are not physically active have twice the risk of heart disease as those who are active. More than half of U.S. adults do not achieve recommended levels of physical activity. Studies indicate a correlation between the amount of television viewing, playing videos, and other sedentary activities and increased rates of childhood obesity. In general, the more sedentary the activities, the more high-fat and sugary foods are consumed. At least thirty minutes of moderate physical activity, five times a week, is recommended. Moderate physical activity slows down the narrowing of the blood vessels, due to contraction of the smooth muscles in the vessel walls. It also increases coronary blood flow, strengthens the heart muscles, and reduces stress.

Worldwide, HTN is linked to about 50 percent of CVDs and approximately 75 million "lost healthy life years" each year. Thus, controlling HTN may greatly reduce the risk of disability and death from CVD. Secondary prevention involves treating the signs and symptoms of CVD. These strategies include management of hypertension, cholesterol, and other blood lipids. Dietary and lifestyle modification are tried first. However, medication may also be prescribed, depending on other clinical factors. Compliance with a medication regimen is extremely important, as is the monitoring of blood pressure and blood lipids. Recommended total **serum** cholesterol should not exceed 200 milligrams per deciliter (mg/dl); low-density **lipoproteins** (LDLs or "bad cholesterol") should not exceed 100 mg/dl, and high-density lipoproteins (HDLs or "good cholesterol") should not be lower than 40 mg/dl.

serum: noncellular portion of the blood

lipoprotein: blood protein that carries fats

Conclusion

Surgical intervention may restore cardiovascular function. Vessels may be opened by **angioplasty** or repaired by the use of grafts or stents, heart valves can be repaired or replaced with artificial valves, and pacemakers or **drugs** may aid heart function. A heart transplant may be an individual's last resort. Many large-scale international studies have focused on preventing cardiovascular disease through smoking cessation, healthful eating, physical activity, hypertension and cholesterol control, health education, and media campaigns. These include the Stanford Three City, the Stanford Five City Projects, the Framingham Heart Study, the Bogalusa Heart Study, the Multiple Risk Factor Intervention Trial (MRFIT), Active Australia, the Whickham Study (based on the Framingham model), and the North Karelia Study (Finland). Small, gradual changes in diet and exercise and smoking cessation are

angioplasty: reopening of clogged blood vessels

drugs: substances whose administration causes a significant change in the body's function

the best way to produce long-term effects. SEE ALSO ARTERIOSCLEROSIS; ATHEROSCLEROSIS; HEART DISEASE.

Teresa Lyles

Bibliography

Bauman, A.; Bellow, B.; Owen, N.; and Vita, P. (2001). "Impact of an Australian Mass Media Campaign Targeting Physical Activity in 1998." *American Journal of Preventive Medicine* 21:41–47.

Bijnen, F. C.; Caspersen, C. J.; Feskens, E. J.; Saris, W. H.; Mosterd, W. L.; and Kromhout, D. (1998). "Physical Activity and 10-Year Mortality from Cardiovascular Diseases and All Causes." *Archives of Internal Medicine* 158(14):1499–1505.

Elward, K., and Larson, E. K. (1992). "Benefits of Exercise for Older Adults: A Review of Existing Evidence and Current Recommendations for the General Population." *Journal of Clinical Gerontology Medicine* 8(1):35–50.

Fortman, S. P., and Varady, A. N. (2000). "Effects of a Community-Wide Health Education Program on Cardiovascular Disease Morbidity and Mortality: The Stanford Five-City Project." *American Journal of Epidemiology* 152:316–323.

Fox, S. I. (1999). *Human Physiology*, 6th edition. Boston: McGraw-Hill.

Insel, P. M., and Roth, W. T. (2004). "Cardiovascular Disease and Cancer." In *Core Concepts in Health*, 9th (brief) edition. Boston: McGraw-Hill.

Internet Resources

American Heart Association/American Stroke Association. "Heart Disease and Stroke Statistics—2003 Update." Available from <http://www.americanheart.org>

American Heart Association. "Common Cardiovascular Diseases." Available from <http://americanheart.org/stroke>

Bogalusa Heart Study (n.d.). Tulane Center for Cardiovascular Health. Available from <http://www.som.tulane.edu/cardiohealth>

HeartCenterOnline. "Coronary Artery." Available from <http://www.heartcenteronline.com/myheartdr>

National Heart, Lung, and Blood Institute. "Framingham Heart Study: 50 Years of Research Success." Available from <http://www.nhlbi.nih.gov>

National Institutes of Health, National Cancer Institute. "Action Guide for Healthy Eating." Available from <http://www.5aday.nci.nih.gov/actionguide>

National Public Health Partnership of Australia. "Developing an Active Australia: A Framework for Action for Physical Activity and Health." Available from <http://www.health.gov.au/pubhlth>

World Health Organization. "Cardiovascular Death and Disability Can Be Reduced More than 50 Percent." Available from <http://www.who.int/mediacentre>

Careers in Dietetics

nutrition: the maintenance of health through proper eating, or the study of same

clinical: related to hospitals, clinics, and patient care

The science and profession of **nutrition** and dietetics is based on the application of foods and nutrition to promote health and treat disease. Most dietitians and nutritionists work in **clinical**, community, public health, or food service settings. Others work as consultants or researchers, in the food industry, in university, worksite, medical school, home health, or fitness center settings. Some persons work for world or regional health organizations. At least a bachelor's degree in dietetics, foods, and nutrition is needed to practice as a dietitian or a nutritionist. Dietetic technicians need an associate's degree.

Practice Roles

diet: the total daily food intake, or the types of foods eaten

Clinical dietitians, also known as medical nutrition therapists, usually work in a hospital setting as generalists or specialists and as part of a health care team. This person is responsible for using **diet** to treat disease and as part

of the treatment plan. Clinical dietitians assess needs, manage the nutrition care of patients, and conduct individual or group counseling sessions. In almost all settings in the United States, a dietitian must be registered (R.D.) to practice medical nutrition therapy.

As generalists, clinical dietitians may rotate through, or work in a variety of the clinical settings, such as the medical and obstetrics areas. As specialists they have additional training. Some dietitians may also be Certified **Diabetes** Educators (CDE) or Certified in Nutrition Support (CNS).

diabetes: inability to regulate level of sugar in the blood

Community Nutritionist refers to persons that work in community programs that are funded by governmental organizations or private groups. The terms Public Health Nutritionist and Nutrition Educator usually refer to persons that are employed by governmental health agencies. These persons do one-to-one counseling, conduct assessments, design, implement, and evaluate programs. Some are involved in the screening, surveillance or monitoring of community programs.

Dietitians involved in food service work in hospitals, schools, and **long-term care facilities**. They have responsibilities related to the day-to-day preparation and delivery of foods, food acquisition, employee supervision, and fiscal matters. Advanced-level practitioners manage program budgets, design marketing strategies, promote programs, or initiate collaborative ventures, such as a joint program with a local clinic or health club.

long-term care facilities: hospitals or nursing homes in which patients remain for a long time for chronic care, rather than being treated and quickly discharged

As nutrition has gained popularity, so have the opportunities for innovative and entrepreneurial practice. Many nontraditional areas of practice are emerging, especially in the area of consultation. Nutritionists work in mass media, rehabilitation, sports, law, marketing, pharmaceuticals, and **wellness** settings. **Entrepreneurs** participate in a variety of creative activities, such as development of materials, creation or editing of newsletters or websites, or in the use of new technologies to promote nutrition.

wellness: related to health promotion

entrepreneur: founders of new businesses

For example, a consulting nutritionist may work at a long-term care facility on Mondays, see individual clients at a medical clinic on Tuesdays, spend Wednesdays and Thursdays writing articles for the local newspaper, and provide "brown-bag lunch" lectures to employees of a local company on Fridays.

Academic (Didactic) and Supervised Practice Training

In the United States, preparation for the dietetic profession is a formal process. The Commission on Accreditation of Dietetics Education (CADE) has two career paths for persons who wish to be eligible to take the national Registration Examination. In the more common path, students complete a baccalaureate degree and then a supervised practice experience (**internship**). In the second path, students complete a coordinated undergraduate program (CUP), in which they work on the baccalaureate degree requirements and the supervised practice simultaneously. In either path, the student must complete academic (didactic) and supervised practice (internship) training.

internship: training program

Didactic training emphasizes theoretical knowledge and is generally achieved by completing a baccalaureate-level degree from a CADE-accredited program in a college or university. The supervised practice component is an internship. The student rotates through a series of preplanned learning experiences in community, clinical, food-service, and selected specialty practice

Registered dietitians (RDs) use their expertise in food and nutrition to prevent disease and improve health through diet. RDs work at hospitals, at research institutions, for governments, and for private companies. *[© 1994 SIU Biomed Comm. Custom Medical Stock Photo, Inc. Reproduced by permission.]*

settings. Upon successful completion of these two elements of learning, the individual becomes eligible to take the national Registration Exam. Related professions include culinary careers (e.g., chefs) and the food sciences.

Knowledge and Skills

nutrient: dietary substance necessary for health

Nutritionists and dietitians have a basic knowledge of nutrition, **nutrient** needs throughout the life cycle, medical nutrition therapy, food service, food and consumer science, health education, and food habits and behavior. They have assessment, counseling, program design, marketing, and management skills. Some have advanced training in specialty areas such as pediatric nutrition, nutrition support, or diabetes education.

Registration and Licensure in the United States

health-promotion: related to advocacy for better health, preventive medicine, and other aspects of well-being

The terms *nutritionist* and *dietitian* are sometimes used interchangeably. In most cases a nutritionist, or nutrition educator, works in a community or **health-promotion** setting, while a dietitian works in a clinical setting. In international health and nutrition programs, the term *nutritionist* is generally used, and training, activities, and levels of responsibility can vary greatly. However, some U.S. states have licensure laws that define the requirements and scope of practice for a nutritionist. Persons who wish to practice in these states must meet the eligibility requirements to obtain a license.

Dietitians in the United States are credentialed by the profession's accrediting body, the Commission on Dietetic Registration (CDR) of the American Dietetic Association (ADA), as registered dietitians (RDs). Dietetic technicians, who assist in program service and delivery, are credentialed as dietetic technicians, registered (DTR). In some settings, such as long-term care facilities, DTRs may be responsible for day-to-day operations, with guidance from a consulting dietitian. SEE ALSO AMERICAN DIETETIC ASSOCIATION; DIETETIC TECHNICIAN, REGISTERED (DTR); DIETITIAN; NUTRITIONIST.

Judith C. Rodriguez

Bibliography

Barker, A. M.; Arensberg, M. B. F.; and Schiller, M. R. (1994). *Leadership in Dietetics.* Chicago: American Dietetic Association.

Boyle, Marie A., and Morris, Diane H. (1999). *Community Nutrition in Action.* New York: Wadsworth Publishing.

Chmelynski, Carol Ciprione. (2000). *Opportunities in Food Service Careers.* Chicago: VGM Career Horizons NTC/Contemporary Publishing.

Donovan, Mary D. (1998). *Opportunities in Culinary Careers.* Chicago: VGM Career Horizons NTC/Contemporary Publishing.

Ullrich, Helen D. (1992). *The SNE Story: 25 Years of Advancing Nutrition Education.* Berkeley, CA: Nutrition Communication Associates.

Internet Resources

American Dietetic Association. "Check It Out: Careers in Dietetics." Available from <http://www.eatright.org>

U.S. Department of Labor. "Occupational Outlook Handbook, Dietitians and Nutritionists." Available from <http://www.bls.gov>

Caribbean Islanders, Diet of

Travel advertisements for the Caribbean Islands portray long stretches of sun-drenched beaches and swaying palm trees, with people dancing to jazz, calypso, reggae, or meringue music. Indeed, the beauty, warmth, and lush landscapes had Christopher Columbus in awe in 1492 when he came upon these tropical islands, stretching approximately 2,600 miles between Florida and Venezuela.

European Settlement

The Arawaks and Caribs, the first natives of the islands, were not treated kindly, however, as the Spanish, French, Dutch, and British conquered the islands at different periods, all but wiping out the native populations. Today, only a few aboriginals remain in the Caribbean.

The European settlers soon realized that sugarcane was a profitable crop that could be exported to the European market. However, there was a shortage of European farmers, and slaves were brought from Africa to work on the sugar plantations. The slave trade started in 1698. European settlers fought to keep their territories and hoped for great wealth, while actively pursuing the sugar and slave trades.

Two things changed the situation on the islands. In 1756, missionaries from Germany (Moravian Protestants), came to the islands, though the landowners were opposed to their presence, fearing that any education of the slaves could lead to a revolution. At about the same time a German scientist by the name of Margraf discovered that sugar could be produced from beets, and many European countries began to produce their own sugar.

In 1772, after many revolts and uprisings, the Europeans began to free their slaves. The sugar plantations still needed laborers, however, and indentured workers were brought from China and India to work in the fields. Sugar cane, and its by-products, molasses and rum, brought great prosperity to the settlers. However, not wanting to depend solely on sugar, they began to grow yams, maize, cloves, nutmeg, cinnamon, coconuts, and pineapples on a very

The ancestors of many Caribbean islanders were brought as slaves to work on the sugarcane plantations. In the New World, their traditional African cuisines integrated new flavors both from their new environment and from the cuisines of various European colonial powers. *[Catherine Karnow/ Corbis. Reproduced by permission.]*

large scale. Coffee also began to flourish. Many of the islands had wild pigs and cattle on them, and spiced, smoked meat became part of the **diet**. Today, jerk meat is a specialty.

diet: the total daily food intake, or the types of foods eaten

Foods of the Islands

The foods of the Caribbean are marked by a wide variety of fruits, vegetables, meats, grains, and spices, all of which contribute to the area's unique cuisine. Foods of Creole, Chinese, African, Indian, Hispanic, and European origin blend harmoniously to produce mouth-watering dishes.

Fruits and Vegetables.

There are many fruits and vegetables found in the various Caribbean Islands, and because many of them have been exported to North America and Europe, people have become familiar with them. This exotic array of fruits and vegetables in vibrant colors forms the heart of island cooking.

Chayote, also called Christophene or Cho-cho, is a firm pear-shaped squash used in soups and stews. The Chinese vegetable bokchoy (or pakchoy) has become widely used on the islands. Plantains, which resemble bananas, are roasted, sautéed, fried, and added to stews and soups. The breadfruit grows profusely, and is either boiled or baked, sliced, and eaten hot, or ground into flour. The breadfruit blossoms make a very good preserve.

Yucca, also known as cassava or manioc, is a slender **tuber** with bark-like skin and a very starchy flesh that must be cooked and served like a potato, or it can be made into cassava bread. Mangoes can be picked from the tree and eaten by peeling the skin and slicing the flesh off the large pit. They are used in salads, desserts, frozen drinks, and salsa. Papaya, which has a cantaloupe-like flavor, contains the **enzyme** papain, which aids in digestion. To be eaten, the black seeds must be removed and the flesh scooped out.

tuber: swollen plant stem below the ground

enzyme: protein responsible for carrying out reactions in a cell

The soursop is a large, oval, dark-green fruit with a thick skin that is soft to the touch when it ripens. The fruit has a creamy flesh with a sweet, tart flavor. Its rich custard-like flavor can be made into a sherbet, ice cream, or refreshing drink.

Spices and Condiments.

The food of the Caribbean can be highly spiced. The Scotch bonnet, a colorful pepper with a hot aroma, is widely used in soups, salads, sauces, and marinades. Some other important spices are annatto, curry, pimento, cinnamon, and ginger. Annatto seeds are often steeped in oil and used to flavor soups, stews, and fish dishes. Curry powder is made from a variety of freshly grounded spices. Curry dishes and hot sauces, which are used regularly in cooking, were brought to the islands by Indian settlers.

Pimento, also known as allspice, is used in pickles, marinades, soups, and stews and is an important ingredient in jerking, a method of cooking meat and poultry over an open fire. To bring out the flavor of meat and chicken, they are marinated in a mixture of scallions, garlic, thyme, onion, lemon juice, and salt. The spices and the method of slow cooking over a fire give jerk meat its distinctive flavor.

Protein Sources.

Although fish, conch (a pink shellfish), goat meat, pork, and beef are used throughout the Caribbean, **legumes** make up a fair percentage of the region's protein intake. Kidney and lima beans, chickpeas, lentils, black-eyed peas, and other legumes are used in soups, stews, and rice dishes. Accra fritters, made from soaked black-eyed peas that are mashed, seasoned with pepper, and then fried, is a dish of West African origin similar to the Middle Eastern falafel. Sancocho is a hearty Caribbean stew made with vegetables, tubers, and meats.

legumes: beans, peas, and related plants

Cooking Methods.

A "cook-up" dish is one made with whatever ingredients an individual has on hand, and is an opportunity to be creative. Such a dish will often include rice, vegetables, and possibly meat. By adding coconut milk, this could turn into an enticing coconut-scented pilaf. Burning sugar to color stews is another technique used in island cooking. This process begins by heating oil, then adding sugar, and stirring until the sugar becomes an amber color.

The roti is a griddle-baked flour wrapping that is filled with curried meat, chicken, or potatoes. Coucou, or fungi, is a cornmeal mush that is served with meat, poultry, fish, or vegetable dishes.

Beverages and Desserts.

A variety of fruit beverages are often served in the Caribbean. Beverages include green tea and "bush tea," served sweetened with sugar or honey, with or without milk. Bush tea is an infusion of tropical shrubs, grasses, and leaves that has a number of medicinal uses. People drink it as a remedy for gas, the common cold, **asthma**, **high blood pressure**, fever, and other ailments. Sweetened commercial drinks made from carrot, beet, guava, tamarind, and other fruits and vegetables are also popular.

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

A number of fermented drinks are also popular. *Garapina* is made from pineapple peelings, while *mauby* is made from the bark of the mauby tree. Grated ginger is used to produce ginger beer. *Horlicks* is a malted milk made with barley.

POPULAR DISHES OF SELECTED CARIBBEAN ISLANDS

Island	Special dishes
Antigua, Montserrat, Nevis	Fish soup, pepper pot soup (any available fish, meat, chicken, and vegetables cooked in fermented cassava juice); saltfish with avocado and eggplant
Barbados	Flying fish; jug-jug (mashed stew of pigeon peas, usually served at Christmas)
	Black pudding (a type of sausage made by combining cooked rice mixed with fresh pig's blood, seasoned with salt, pepper, and other condiments, and placed in thoroughly cleaned pieces of pig's intestine, and then tied on both ends and boiled in seasoned water)
Belize	Rice and chicken, tamales, conch fritters, refried beans and iswa (fresh corn tortillas)
Dominica	Tannia (coco, a starch tuber soup); mountain chicken (frog's legs)
Grenada	Callaloo (soup with green vegetables)
	Lambi souse (conch marinated in lime juice, hot pepper, onion); oil-down (a highly seasoned dish of coconut milk and salted fish)
Guyana	Mellagee (one-pot stew of pickled meat/fish and coconut milk with tubers and vegetables); rice treat (rice with shrimp, vegetables, and pineapple)
Jamaica	Saltfish and ackee (a fruit commonly used as a vegetable, boiled and then sautéed in oil); escoveitched fish (fried fish marinated in vinegar spices, seasoning); roasted breadfruit; asham or brown George (parched dried corn that is finely beaten in a mortar, sifted, and mixed with sugar)
St. Vincent and the Grenadines	Stewed shark
British Virgin Islands	Fish chowder, conch salad, saltfish and rice
Trinidad and Tobago	Pelau (rice with meat, fish, peas, vegetables); pakoras; kachouri; palouri (fried vegetable fritters)
Guadeloupe and Martinique	Mechoui (spit-roasted sheep); pate en pot (finely chopped sheep and lamb parts cooked into a thick, highly seasoned stew)

Fruit is eaten anytime of the day, but is not considered a dessert unless prepared in a fruit salad or some other form. Coconut and banana form the basis for many desserts. A sweet pudding that goes by many names (e.g., duckunoo, blue drawers, pain me, paimee, and konkee) is made from grated banana, plantain, or sweet potato, which is then sugared, spiced, and mixed with coconut milk or grated coconut, and then wrapped in banana leaves and boiled in spiced water. A prepared sweet pone (pudding) cake or pie is a popular dessert. Black fruitcake, made from dried fruits soaked in wine, is popular at Christmas time, and is also used for weddings and other celebrations.

Health Issues

chronic: over a long period

malnutrition: chronic lack of sufficient nutrients to maintain health

calorie: unit of food energy

In the Caribbean region, nutrition-related **chronic** diseases are common, threatening the well-being of the people of the islands. In the 1950s, the governments of the Caribbean were concerned about the **malnutrition** that permeated the region. They were able to increase the protein and **calorie** needs by making meat, fats, oils, and refined sugar more available. The health and nutrition initiatives introduced helped curbed the malnutrition, but new and related health and nutrition problems began to emerge.

The health administrators of the Caribbean region are concerned with the rise of iron-deficiency **anemia** in pregnant women and school-aged children due to inadequate iron intake and poor **absorption**. The increased **incidence** of **diabetes**, **hypertension**, **coronary heart disease**, **cancer**, and **obesity**, especially in the thirty-five-and-over age group, is thought to be directly linked to the existing lifestyle and dietary practices of the islanders.

The Caribbean Islands have seen a proliferation of **fast-food** restaurants, and the increased consumption of meals high in **fat**, sugar, and salt has contributed to the increase in chronic diseases. In addition, there has been a reduction in the amount of cereals, grains, fruits, vegetables, tubers, and legumes that are eaten. The popularity of fast foods among the young has led the government to focus on improving nutrition in the schools. Also contributing to the health problems is the dependency on costly imported **processed foods** that do the body harm. Overconsumption of imported foods high in fat and sodium has led to a deterioration of the health status of people throughout the region, with an increase in health problems such as obesity, diabetes, hypertension, **cardiovascular** disease, and cancer.

anemia: low level of red blood cells in the blood

absorption: uptake by the digestive tract

incidence: number of new cases reported each year

diabetes: inability to regulate level of sugar in the blood

hypertension: high blood pressure

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

cancer: uncontrolled cell growth

obesity: the condition of being overweight, according to established norms based on sex, age, and height

fast-food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fat: type of food molecule rich in carbon and hydrogen, with high energy content

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

cardiovascular: related to the heart and circulatory system

Innovative Programs

Due to insufficient resources and less than adequate planning, the school feeding programs on most of the islands exhibit many shortcomings. However, on the island of Dominica, where a self-help initiative involving the parents was introduced, the eating habits of school-aged children improved and the parents and communities adopted many of the program's menus and preparation methods. As a result, school attendance increased and the attention span of the children in class improved.

School nutrition programs need constant monitoring to improve the nutritional status of the children involved. Furthermore, a good nutrition promotion campaign must be designed to educate and promote a healthy lifestyle for the population at large.

The Caribbean region has the tremendous task of putting in place appropriate policies, plans, and programs to address the changing health and disease patterns of the region's people. This effort is made more difficult because of the socioeconomic, political, and cultural differences among the Caribbean countries. The various countries must not only examine the food availability and how it is consumed, but they must also assess and evaluate the quality of the food and the nutrition intake of those most at risk.

The Caribbean Food and Nutrition Institute (CFNI), established in 1967, aims to improve the food and nutrition status in member countries, which include Anguilla, Antigua, Bahamas, Barbados, Belize, the British Virgin Islands, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, Montserrat, St. Christopher-Nevis, St. Lucia, St. Vincent, Suriname, Trinidad and Tobago, and Turks and Caicos Islands.

The governments of the Caribbean have come together under an initiative called Caribbean Cooperation in Health. They hope to work closely together through five types of activities: service, education training, providing information, coordination, and research. The food goals of each country must be analyzed, with care and attention paid to the agricultural policies and economic opportunities in each specific country.

Forming Healthy Communities

Desiring a longer and richer quality of life, many governments of the Caribbean Islands have introduced programs to combat chronic diseases and promote a more physically active lifestyle. For example, in Grenada, a campaign to "grow what you eat and eat what you grow" demonstrates a move to increase consumption of local foods.

Adequate nutrition cannot be achieved without the consumption of sufficient foods containing a wide array of **nutrients**. Poor health status, whether as a result of insufficient food intake, overconsumption, or nutrition imbalance, threatens longevity and increases health care costs. The challenge is to improve the availability of nutritious foods and the eating habits of the varied population. SEE ALSO AFRICANS, DIETS OF; AFRICAN AMERICANS, DIET OF; DIETARY TRENDS, INTERNATIONAL; FAST FOODS.

nutrient: dietary substance necessary for health

Paulette Sinclair-Weir

Bibliography

"Assessing Dietary Trends in the Caribbean" (1998). *Cajanus, the Caribbean Food and Nutrition Quarterly* 31(4).

Campbell, Versada (1988). *Caribbean Foodways.* Kingston, Jamaica: Caribbean Food and Nutrition Institute.

"Food Consumption Issues and Trends" (2000). *Cajanus, the Caribbean Food and Nutrition Quarterly* 33(1).

"Food Marketing Trends" (2000). *Cajanus, the Caribbean Food and Nutrition Quarterly* 33(4).

Forrester, Clare (1999). "Selling Nutrition Behavior." *Cajanus, the Caribbean Food and Nutrition Quarterly* 32(1).

Kutler, Pamela Goyan, and Sucher, Kathryn P. (2000). *Food and Culture*, 3rd edition, New York: Thomson Learning.

McIntosh, E. Curtis (2000). "Food, Nutrition, and Health for National Development." *Cajanus, the Caribbean Food and Nutrition Quarterly* 33(4).

Prasad, P. V. Devi (1986). *Edible Fruits and Vegetables of the English-Speaking Caribbean.* Kingston, Jamaica: Caribbean Food and Nutrition Institute.

Sheridan, Richard B. (1974) *Sugar and Slavery.* Johns Hopkins University Press.

Stein-Barer, Thelma (1999). *You Eat What You Are: People, Culture, and Food Tradition*, 2nd edition. Toronto: Firefly.

Internet Resource

Pan American Health Organization. <http://www.paho.org>

Carotenoids

Carotenoids are a group of red and yellow fat-soluble compounds that pigment different types of plants, such as flowers, citrus fruits, tomatoes, and carrots, as well as animals, such as salmon, flamingos, and goldfish. The ingestion of carotenoids is essential to human health, not only because some convert into Vitamin A, but also because they have **antioxidant** effects, which may combat such diverse problems as **cancer** and **macular degeneration**. Carotenoids also help prevent **heart disease** by inhibiting low-density lipoprotein (LDL) **cholesterol** (the "bad" cholesterol) from sticking to **artery** walls and creating plaques.

carotenoid: plant-derived molecules used as pigments

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

cancer: uncontrolled cell growth

macular degeneration: death of cells of the macula, part of the eye's retina

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

artery: blood vessel that carries blood away from the heart toward the body tissues

Up to one-third of the Vitamin A consumed by humans comes from the conversion of alpha-carotene and beta-carotene, the two most active of the over 600 carotenoids that have been identified. These two compounds combat early cancers, regulate the **immune system**, and maintain the integrity of the skin, lungs, liver, and urinary tract, among other organs. Food sources include eggs, liver, milk, spinach, and mangos.

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

Lycopene is a carotenoid that offers protection to the **prostate** and the **intestines**. It has also been associated with a decreased risk of lung cancer. Found in tomatoes, it remains intact despite the processing involved in making ketchup and tomato paste. The carotenoids lutein and zeaxanthin seem to aid in the prevention of **cataracts** and macular degeneration, and can be found in spinach and collard greens. SEE ALSO ANTIOXIDANTS; BETA-CAROTENE; VITAMINS, FAT-SOLUBLE.

prostate: male gland surrounding the urethra that contributes fluid to the semen

intestines: the two long tubes that carry out the bulk of the processes of digestion

cataract: clouding of the lens of the eye

Chandak Ghosh

Bibliography

Margen, Sheldon, and Editors of U.C. Berkeley Wellness Letter (2002). *Wellness Foods A to Z: An Indispensable Guide for Health-Conscious Food Lovers.* New York: Rebus.

Internet Resources

National Institutes of Health Clinical Center. "Facts about Dietary Supplements: Vitamin A and Carotenoids." Available from <http://www.cc.nih.gov>

WebMD Health. "What Are Vitamins and Carotenoids and What Are the Adverse Effects of Deficiencies and Overdose?" Available from <http://www.my.webmd.com>

Central Americans and Mexicans, Diets of

The diets of peoples in Mexico and Central America (Guatemala, Nicaragua, Honduras, El Salvador, Belize, and Costa Rica) have several commonalities, though within the region great differences in methods of preparation and in local recipes exist. The basis of the traditional **diet** in this part of the world is corn (maize) and beans, with the addition of meat, animal products, local fruits, and vegetables. As in other parts of the world, the diet of people in this area has expanded to include more **processed foods**. In many parts of Mexico and Central America, access to a variety of foods remains limited, and **undernutrition**, particularly among children, is a major problem. Although access to an increased variety of foods can improve the adequacy of both **macronutrient** and **micronutrient** status, there is evidence that the use of processed foods is contributing to the rapidly increasing **prevalence** of **obesity** and diet-related **chronic** diseases such as **diabetes**.

diet: the total daily food intake, or the types of foods eaten

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

macronutrient: nutrient needed in large quantities

micronutrient: nutrient needed in very small quantities

prevalence: describing the number of cases in a population at any one time

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

diabetes: inability to regulate level of sugar in the blood

Traditional Dietary Habits

The central staple in the region is maize, which is generally ground and treated with lime and then pressed into flat cakes called *tortillas.* In Mexico and Guatemala, these are flat and thin, while in other Central American countries tortillas are thicker. In El Salvador, for example, small, thick cakes of maize, filled with meat, cheese, or beans, are called *pupusas.* Maize is also used in a variety of other preparations, including tacos, tamales, and a thin gruel called **atole**. The complementary staple in the region is beans (*frijoles*), most commonly black or pinto beans. Rice is also widely used, particularly

atole: a porridge made of corn meal and milk

A Tzotzil mother makes tortillas with her daughters. The Tzotzil live in Chiapas, Mexico, near Guatemala. Central Americans traditionally have simple diets that depend on corn, beans, and local fruits and vegetables. *[© Corbis. Reproduced by permission.]*

in the southernmost countries, such as El Salvador, Honduras, Nicaragua, and Costa Rica. Historically, major changes in the traditional diet occurred during colonial times, when the Spaniards and others introduced the region to wheat bread, dairy products, and sugar. Wheat is commonly consumed in the form of white rolls or sweet rolls, or, in the northern part of Mexico, as a flour-based tortilla. Noodles (*fideos*), served in soups or mixed with vegetables, have also become popular.

The consumption of meat and animal products, although popular, is often limited due to their cost. Beef, pork, chicken, fish, and eggs are all used. Traditional cheeses are prepared locally throughout the region as *queso del pais*, a mild, soft, white cheese, and milk is regularly used in *café con leche* and with cereal gruels.

Commonly Used Fruits and Vegetables

The region is a rich source of a variety of fruits and vegetables. Best known among these are the chile peppers, tomatoes, and tomatillos that are used in the salsas of Mexico. Avocado is also very popular in Mexican and Central American **cuisines**. Other commonly used vegetables include *calabaza* (pumpkin), carrots, plantains, onions, locally grown greens, and cacti. Fruits are seasonal but abundant in the rural areas and include guavas, papayas, mangoes, melons, pineapples, bananas, oranges, and limes, as well as less-known local fruits such as *nances*, *mamey*, and *tunas* (prickly pears from cacti). Traditional drinks (*frescos*, *chichas*, or *liquados*) are made with fruit, water, and sugar.

cuisine: types of food and traditions of preparation

Methods of Cooking

The traditional preparation of maize involves boiling and soaking dried maize in a lime-water solution and then grinding it to form a soft dough called *masa*. Soaking in lime softens the maize and is an important source of **calcium** in the diet. The masa is shaped and cooked on a flat metal or

calcium: mineral essential for bones and teeth

clay surface over an open fire. In some areas, lard or margarine, milk, cheese, and/or baking powder may be added to the tortilla during preparation. Beans are generally boiled with seasonings such as onion, garlic, and sometimes tomato or chile peppers. They are served either in a soupy liquid or are "refried" with lard or oil into a drier, and higher **fat**, preparation.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Meat, poultry, and fish are commonly prepared in local variations of thin soup (*caldo* or *sopa*), or thicker soups or stews (*cocido*) with vegetables. In Mexico and Guatemala, grilled meats are cut into pieces and eaten directly on corn tortillas as tacos.

These are often served with a variety of salsas based on tomato or tomatillo with onion, chile, coriander leaves (cilantro), and other local seasonings. Tamales are made with corn (or corn and rice) dough that is stuffed with chicken and vegetables. The tamales are steamed after being wrapped in banana leaves. Salvadorian *pupusas* are toasted tortillas filled with cheese, beans, or pork rind eaten with coleslaw and a special hot sauce.

Central American and Mexican Dishes

Beyond the basic **staples**, the cuisine of Mexico and Central America is rich with many regional variations. The tortilla-based Mexican preparations familiar in the United States are generally simpler in form in Mexico. *Tacos* are generally made with meat, chicken, or fish grilled or fried with seasoning and served on tortillas; *enchiladas* are filled tortillas dipped in a chile-based sauce and fried; and *tostadas* are fried tortillas topped with refried beans or meat, and sometimes with vegetables and cream. *Chiles rellenos* are made with the large and sweet chile *poblano* and filled with ground meat. Examples of specialty dishes include *mole*, a sauce made with chocolate, chile, and spices and served over chicken, beef, or enchiladas; and *ceviche*, raw marinated fish or seafood made along the coast throughout Central America and Mexico.

staples: essential foods in the diet

Nutritional Benefits

The staple diet of the region—corn and beans, supplemented with meat, dairy products, and local fruit and vegetables—is nutritionally complete and well suited to a healthful lifestyle. The proper combination of tortilla and beans provides an excellent complement of **amino acids**, thus supplying the necessary amount of complex **protein**. The process of liming the maize makes the calcium and the **niacin** in the tortilla more bioavailable, and this food is a major source of these **nutrients**. In addition, the traditional preparation of tortillas with a hand mill and grinding stones appears to add **iron** and **zinc** to the tortilla. Beans are excellent sources of **B vitamins**, magnesium, **folate**, and **fiber**. The tomato and chile-based salsas, along with several of the tropical fruits such as limes and oranges are important sources of vitamin C, and the variety of vegetables and yellow fruits such as papaya, melon, and mango provide excellent sources of **carotenoids**, which are precursors of vitamin A.

amino acid: building block of proteins, necessary dietary nutrient

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

niacin: one of the B vitamins, required for energy production in the cell

nutrient: dietary substance necessary for health

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

B vitamins: a group of vitamins important in cell energy processes

folate: one of the B vitamins, also called folic acid

fiber: indigestible plant material which aids digestion by providing bulk

carotenoid: plant-derived molecules used as pigments

Nutritional Limitations

Unfortunately, limited financial access to this variety of foods for many people in Central America and Mexico means that the diet often does not include sufficient levels of **vitamins** and **minerals**. For low-income groups,

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

lack of access to animal products contributes to deficiencies in iron, zinc, vitamin A, and other nutrients. When animal products are included, there has been a tendency to choose high-fat products such as sausage and fried pork rinds (*chicharron*). The use of lard and a preference for fried foods also contributes to high intakes of **saturated fat** and **cholesterol** among subsets of the population.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

Influence of Central American and Mexican Culture

As two cultures intermingle, foods and preparations from each tend to infiltrate the other. This is clearly the case near the U.S.-Mexican border, where Mexican immigrants and return immigrants have incorporated foods from U.S. diets into their traditional diets. The result has been a modified form of Mexican cuisine popularly known as "Tex-Mex." Beyond the border, this **Americanized** version of popular Mexican foods has spread throughout the United States through the popularity of Mexican restaurants. In the United States, tacos and tostadas tend to have less Mexican seasoning, but include lettuce and shredded processed cheese. Flour, rather than corn, tortillas are more widely used along the border. Many foods, such as soups and chiles, prepared along the border have become known for their spicy hotness, due to the Mexican-influenced use of chiles and chile powder.

Americanized: having adopted more American habits or characteristics

Changes in Dietary Practices

Throughout the world, the diets of traditional cultures have experienced what has been called the "**nutrition** transition," particularly during the last few decades of the twentieth century. In Mexico and Central America, as elsewhere, this transition has been fueled by **globalization** and urbanization. Major dietary changes include an increased use of animal products and processed foods that include large amounts of sugar, refined flour, and hydrogenated fats. At the same time, a decline in the intake of whole grains, fruit, and vegetables has been documented. While the increased variety has improved micronutrient status for many low-income groups, the inclusion of more animal fat and refined foods has contributed to a rapid increase in obesity and chronic disease throughout the region.

nutrition: the maintenance of health through proper eating, or the study of same

globalization: development of worldwide economic system

These changes are more evident among immigrants to the United States, where adoption of U.S. products has been shown to have both positive and negative impacts on nutritional status. Studies that compared diets of Mexican residents to newly arrived Mexican-American immigrants and to second-generation Mexican Americans have documented both nutritionally positive and negative changes with acculturation. On the positive side, acculturated Mexican Americans consume less lard and somewhat more fruit, vegetables, and milk than either newly arrived immigrants or Mexican residents. On the negative side, they also consume less tortilla, beans, soups, stews, gruels, and fruit-based drinks, with greater use of meat, sweetened ready-to-eat breakfast cereals, soft drinks, candy, cakes, ice cream, snack chips, and salad dressings.

Conclusion

The traditional diet of Mexico and Central America is based on corn and beans, but offers a wide **diversity** of preparations. Coupled with locally available fruits, vegetables, meat and dairy products, the diet can be highly nutritious. However, poverty frequently limits access to an adequate variety of

diversity: the variety of cultural traditions within a larger culture

quality foods, resulting in **malnutrition**. At the same time, the increasing use of processed foods is contributing to obesity, diabetes, and other chronic conditions in this region. The balance between improving access to variety and maintaining dietary quality poses a challenge for public health. SEE ALSO HISPANICS AND LATINOS, DIET OF; SOUTH AMERICANS, DIET OF.

malnutrition: chronic lack of sufficient nutrients to maintain health

Katherine L. Tucker

Bibliography

Guendelman, Sylvia, and Abrams, Barbara (1995). "Dietary Intake among Mexican-American Women: Generational Differences and a Comparison with White Non-Hispanic Women." *American Journal of Public Health* 85(1):20–25.

Romero-Gwynn, Eunice; Gwynn, Douglas; Grivetti, Louis; McDonald, Roger; Stanford, Gwendolyn; Turner, Barbara; West, Estella; and Williamson, Eunice (1993). "Dietary Acculturation among Latinos of Mexican Descent." *Nutrition Today* 28(4):6–12.

Romieu, Isabelle; Hernandez-Avila, Mauricio; Rivera, Juan A.; Ruel, Marie T.; and Parra, Socorro (1997). "Dietary Studies in Countries Experiencing a Health Transition: Mexico and Central America." *American Journal of Clinical Nutrition* 65(4, Suppl):1159S–1165S.

Sanjur, Diva (1995). *Hispanic Foodways, Nutrition, and Health*. Boston: Allyn and Bacon.

Tucker, Katherine L., and Buranapin, Supawan (2001). "Nutrition and Aging in Developing Countries." *Journal of Nutrition* 131:2417S–2423S.

Central Europeans and Russians, Diets of

A health gap separates Central and Eastern Europe from the United States, Canada, Japan, and the Western part of Europe. This East-West gap in health started during the 1960s. Almost half of this gap was due to **cardiovascular** disease (CVD) mortality differentials. There has been a marked increase of CVD in Central and Eastern Europe, which is only partially explainable by the high **prevalence** of the three traditional CVD risk factors (**hypercholesterolemia**, **hypertension**, and smoking) in these countries. There is an extreme nonhomogeneity of the former Soviet bloc, and the data from each country must be analyzed individually. The aim here is to present the latest available data, which show the health status of various regions of postcommunist Europe. All data used are taken from the World Health Organization (WHO) Health for All Database (as updated in June 2003). The last available data from most countries are from the year 2002.

cardiovascular: related to the heart and circulatory system

prevalence: describing the number of cases in a population at any one time

hypercholesterolemia: high levels of cholesterol in the blood

hypertension: high blood pressure

As premature mortality was considered the most important information, the standardized death rate (SDR) for the age interval 0–64 years was used (SDR is the age-standardized death rate calculated using the direct method; it represents what the crude death rate would have been been if the population had the same age distribution as the standard European population).

Central Europe (Poland, Hungary, Czech Republic, Slovakia)

Total, CVD and **cancer** mortality in Central Europe was relatively low at the beginning of the 1960s, but then an increase occurred. While the differences in 1970 between the nations of the European Union (EU) and the

cancer: uncontrolled cell growth

Central European communist countries were not great, from the mid-1970s on, the relative trends in CVD mortality in EU countries and Central Europe showed a marked change: mortality in Central Europe increased, whereas in EU countries it decreased steadily. Between 1985 and 1990, the male CVD mortality in Central Europe was more than two times higher than in EU countries. A substantial proportion of this divergence was attributable to ischemic **heart disease**. After the collapse of Communism, however, a decrease in CVD mortality in Central Europe was observed.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

The Former Soviet Union (Russian Federation)

The most significant changes in CVD mortality have been observed in the region of the former Soviet Union (USSR). Between the years 1980 and 1990, male premature mortality was relatively stable in all regions of the USSR, and two to three times higher than in EU nations, or average. After the collapse of the USSR, CVD mortality began to rise dramatically in all the new independent states within the territory of the former USSR. In 1994 the male CVD mortality in Russia and Latvia was more than five times higher than the EU average. Women in these countries have been affected to almost the same degree as men, and the CVD mortality trends were strongest among young adults and middle-aged individuals. Cancer mortality was stable during this period, however. In 1994 the life expectancy of Russian men was almost twenty years less than that of men in Japan and some European countries. After 1994, however, there was a sudden drop in mortality both in males and females, followed by a further increase.

Lifestyle and Nutrition

Communist period (1970–1989).

The socioeconomic situation in the democratic part of Europe and in the United States after World War II was substantially different than that in the Soviet bloc. The United States and the European democratic states were prosperous countries with effective economies and a rich variety of all kinds of foods. The communist states, however, had ineffective centralized economies and lower standards of living. The amount of various foods, especially foods of animal origin, was almost always insufficient in the USSR and the majority of its satellite countries. Data on food consumption compiled by the Food and Agricultural Organization (FAO) confirm that meat consumption was, between 1961 and 1990, substantially lower in the USSR, Poland, Romania, and Bulgaria than in Western Europe or the United States. Similarly, the consumption of milk and butter in Bulgaria, Hungary, and Romania was significantly lower in comparison with Western and Northern Europe.

The increase of CVD mortality within the Soviet bloc seems to be only partially associated with a high prevalence of traditional risk factors. Efforts to apply the experience gained from successful preventive projects in Finland or the United States without analyzing the specificity of risk factors in this region, could lead to an incorrect formulation of priorities when determining preventive measures. The contribution of physical activity remains an open issue, but due to technical backwardness (lower number of cars, lower mechanization, etc.), the physical activity of people working in industry, agriculture, and services was generally higher in Eastern Europe than in the West.

The life-expectancy of Russians dropped sharply during the 1990s. Poor nutrition contributed to higher mortality rates, as did high rates of alcoholism. *[Photograph by Alexander Nemenov. AFP/Getty Images. Reproduced by permission.]*

Some authors believe that economic conditions were the principal determinant of the gap in health status between the East and West. The close relationship between the gross national product per capita and life expectancy is well known, but the inhabitants of Central Europe were less healthy than their wealth predicted. The dramatic changes that occurred after the onset of communism created a toxic psychosocial environment. A loss of personal perspectives, **chronic stress**, tension, anger, hostility, social isolation, frustration, hopelessness, and apathy led to a lowered interest in health and to a very high **incidence** of alcoholism and suicide. People living for many decades in the informationally polluted environment rejected even useful health education.

chronic: over a long period

stress: heightened state of nervousness or unease

incidence: number of new cases reported each year

It is widely believed that chronic stress can aggravate the development of chronic diseases. However, the reasons for the high cancer and CVD mortality in Eastern Europe are (with the significant exception of male smoking) not yet known. It is possible that in communist countries the effect of traditional risk factors has been intensified unidentified factors. Hypothetically, such factors can comprise psychosocial disorders, alcoholism, environmental pollution and specific **nutritional deficiencies** (e.g., very low intake of **antioxidant vitamins**, folic acid, and bioflavonoids). Very low blood levels of antioxidants, especially of vitamin C and selenium, were found in various regions of Central and Eastern Europe between 1970 and 1990.

nutritional deficiency: lack of adequate nutrients in the diet

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

Postcommunist period (after 1989). Thanks to its geographical location, Central Europe was best prepared for the democratic changes that occurred after 1989. After the collapse of communism, the decrease in CVD mortality in politically and economically more consolidated countries occured. The positive changes in Central European countries can be explained by higher consumption of healthful food, including a substantial increase in the consumption of fruit and vegetables, a decrease in butter and fatty milk consumption, and an increase in the consumption of vegetable oils and

MALE AND FEMALE LIFE EXPECTANCY AT BIRTH IN EUROPE DURING 2000 AND 2001

Country	Males	Females
Russia	59.1	72.3
Ukraine	62.3	73.6
Hungary	68.3	76.8
Romania	67.7	75.0
Bulgaria	68.6	75.4
Poland	70.3	78.5
Slovakia	69.7	77.7
Czech Republic	72.1	78.7
Portugal	72.6	79.7
Spain	75.2	82.4
United Kingdom	75.7	80.5
Germany	75.2	81.3
Italy	76.2	82.6
Sweden	77.5	82.3
Switzerland	77.0	82.8
France	75.2	82.8

SOURCE: World Health Organization

high-quality margarines. There was also a rapid improvement in the availability and quality of modern CVD health care.

plasma: the fluid portion of the blood, distinct from the cellular portion

Finnish and Russian epidemiologists compared the **plasma** ascorbic-acid concentrations among men in North Karelia (Finland) and in the neighboring Russian district. Almost all Russian men had levels suggesting a severe vitamin C deficiency, while more than 95 percent Finns had normal vitamin C levels. Comparison of fifty-year-old men in Sweden and Lithuania found significantly lower plasma concentrations of some antioxidant vitamins (beta-carotene, lycopene, gamma-tocopherol) in Lithuanian men. They also had substantially lowered resistance of low-density lipoprotein to oxidation than Swedish men. It is probable that in Russia an imbalance arose in which factors enhancing the production of **free radicals** (alcoholism, smoking, and pollution) dominated protective antioxidant factors.

free radical: highly reactive molecular fragment, which can damage cells

High prevalence of smoking and alcoholism has also been an important factor in high CVD mortality rates in Russia. A substantial proportion of CVD deaths in Russia, particularly in the younger age groups, have been sudden deaths due to cardiomyopathies related to alcoholism. Alcoholism has evidently played a key role in the extremely high incidence of CVD mortality, as well as in the numbers of accidents, injuries, suicides, and murders. There is no way to determine a reliable estimation of the actual consumption of alcohol in Russia, since alcohol is being smuggled into the country on a large scale.

Normalization in the Russian Federation will likely be more difficult than in Central Europe. Trends in lifestyle, smoking, food selection, alcohol consumption, and other areas will be determined by both economic and political factors. The successfulness of the economic transformation, which provides hope for a sensible life, will be a key factor in improving health status in postcommunist countries. A significant decrease in cardiovascular and cancer mortality in Central Europe provides hope for the Russian Federation. Unfortunately, differences in life expectancy between these countries and Western Europe are still very great.

Emil Ginther

Internet Resource

World Health Organization."Health for All Database: Mortality Indicators by Cause, Age, and Sex." Available from <http://www.euro.who.int/hfadb>

Childhood Obesity

There have always been **overweight** children. Historically, chubby babies and toddlers were more likely to survive infections and contagious diseases, and overweight children and family members were often signs of affluence and financial security in a community. Thus, in some cultures, overweight was a valued body type.

overweight: weight above the accepted norm based on height, sex, and age

Today, being overweight puts a child at risk of developing **chronic** diseases such as **type II diabetes**, **hypertension**, and high **cholesterol** levels. **Obesity** can promote degenerative joint disease, which will result in painful knees, hips, feet, and back, and it can severely limit physical activity. These are health concerns previously seen only in adults, usually in those over age forty. Obesity can be measured using a tool called **body mass index** (BMI). The BMI of an individual can be derived from tables or calculated using a formula (weight in kilograms divided by height in meters squared). In the year 2000, the U.S. Centers for Disease Control and Prevention (CDC) released updated growth charts incorporating BMI percentiles for children, beginning with children two years of age and extending the curves to age twenty. Using these gender-specific graphs, children, adolescents, and young adults are at risk for overweight at the 85th through 89.9th percentiles and are classified as overweight at the 95th percentile or greater. Using this criteria, children and teens are not labeled "**obese**"; technically, they are only "at risk of overweight" or "overweight." In much of the scientific literature, however, the terms are used interchangeably.

chronic: over a long period

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

hypertension: high blood pressure

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

obese: above accepted standards of weight for sex, height, and age

Nutritionists and researchers have been tracking data that clearly shows an increasing trend of overweight children in the United States. Monitoring the proportion of overweight children was identified as one of the ten leading health indicators in Healthy People 2010. All ethnic, racial, gender, and age groups have shown increases. For example, in the 1963–1970 National Health Examination Survey (NHES), the **prevalence** of overweight among white six to eleven years old was 5.1 percent and 5.3 percent for African-American girls of the same age. The prevalence of overweight in this same age group doubled for white girls (10.2%) and tripled for African-American girls (16.2%) in the 1988–1991 National Health and Nutrition Examination Survey (NHANES III). Preliminary data from 1999 NHANES suggests that the percentage of overweight children has continued to increase in recent years. It is estimated that 13 percent of children ages six to eleven years and 14 percent of adolescents ages twelve to nineteen years are overweight. This represents a 2-3 percentage point increase from NHANES III.

prevalence: describing the number of cases in a population at any one time

African-American and Hispanic teens are more likely to be at risk or overweight than white or Asian adolescents. Combined data from nine large studies (including NHANES II and NHANES III) of 66,772 children between five to seventeen years old indicates that the highest percentage of overweight exists among Hispanic boys and African-American and Hispanic girls.

The National Institutes of Health have declared childhood obesity an epidemic in the United States. As with adults, the primary causes of children's obesity are too many calories and not enough exercise. Healthier meals and frequent physical activity are the proper method of prevention. *[© Larry Williams/Corbis. Reproduced by permission.]*

genetic: inherited or related to the genes

biological: related to living organisms

diabetes: inability to regulate level of sugar in the blood

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fiber: indigestible plant material that aids digestion by providing bulk

calorie: unit of food energy

sedentary: not active

sleep apnea: difficulty breathing while sleeping

dyslipidemia: disorder of fat metabolism

Studies also show an increase in overweight rates among Native American children between 1970 and 2000. Second- and third-generation Asian-American children are more likely to be overweight, and certain Asian-American and Pacific Islander groups (Pacific Islanders, Koreans, Asian Indians) are noted to have higher overweight risks than other Asian Americans.

According to Dr. Mikael Fogelholm (at the May 2003 European Conference on Obesity), "the prevalence of obesity among adolescents worldwide has increased more rapidly than in middle-age adults." Outside the United States, obesity rates range from 2 percent in some developing countries to as high as 80 percent on remote Pacific Islands. In the United States, one child in four is now classified as overweight or at risk for becoming overweight. It is generally agreed that the longer and more overweight a child is, the more likely it is that the condition will continue into adulthood. Predisposing factors are complex and include a mix of **genetic**, social, cultural, environmental, and lifestyle factors.

Statistics show that a child with two obese parents has an 80 percent risk of becoming overweight, a child with only one obese parent has a 40 percent risk, and a child with normal weight parents has a 7 percent risk of becoming overweight. Twins who were adopted by different families were found to be more similar in weight to the **biological** parents than to their adoptive parents. Although the exact cause is still unknown, prenatal factors such as maternal obesity, excess pregnancy weight gain, and **diabetes** may also predispose a child to becoming overweight.

Other risk factors include meal patterns (e.g., skipping breakfast, meals and snacks eaten outside of the home, infrequent family dinners), unhealthful dietary intake (e.g., high **fat** intake, low intake of fruit and vegetables, **fast-food** meals, low **fiber** intake, high soft-drink intake), psychosocial factors such as acculturation and parenting style, and declining rates of physical activity. Based on data from NHANES II and III, among children twelve to seventeen years of age the prevalence of overweight increases 2 percent for each additional hour of TV viewed daily.

Prevention is the best treatment. Restricting **calories** can lead to stunted growth, adversely affect bone density, and even lead to eating disorders. Intervention strategies should involve the family and focus on permanent lifestyle changes under the supervision of a primary care physician or a registered dietitian. Parents can begin by limiting dining out to special occasions and by making time to enjoy regular meals at home together as a family. Time involved in **sedentary** activities such as playing video games or using the computer should be monitored and supervised, and the whole family should be encouraged to participate in thirty to sixty minutes of vigorous activity each day. To be successful, the entire family must be willing and ready to institute the many gradual, permanent changes needed.

Pharmacological and surgical treatments are associated with long-term risks and serious complications, and they constitute, at best, a last resort for severely overweight adolescents. Prolonged weight maintenance is recommended for many overweight children and allows a gradual decline in BMI as the child grows in height. However, if medical complications related to obesity already exist (**sleep apnea**, hypertension, **dyslipidemia** and orthopedic problems) weight loss of approximately one pound per month is rec-

ommended. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; OBESITY; SCHOOL-AGED CHILDREN, DIET OF.

Nadine Pazder

Bibliography

Barlow, S., and Dietz, W. (1998). "Obesity Evaluation and Treatment: Expert Committee Recommendations." *Pediatrics* 102(3):1–11.

Ebbeling, Cara B.; Pawlak, Dorota B.; and Ludwig, David S. (2002). "Childhood Obesity: Public-Health Crisis, Common Sense Cure." *Lancet* 360:473–482.

Meerschaert, Carol (2002). "Managing Obesity in Children." *Soy Connection* 10(4):2. Also available from <http://www.talksoy.com>

Internet Resources

The Center for Weight and Health, University of California, Berkley (2001). "Pediatric Overweight: A Review of the Literature." Available from <http://www.cnr.berkeley.edu>

Centers for Disease Control and Prevention. "CDC Growth Charts." Available from <http://www.cdc.gov/growthcharts>

International Association for the Study of Obesity. Available from <http://www.iaso.org>

National Institutes of Health Weight Control Information Network (2002). "Youths' Weight and Eating Patterns Fall Short of Healthy People 2010 Objectives." *WIN NOTES* Winter 2002/2003. Available from <http://www.niddk.nih.gov/health>

College Students, Diets of

When students first enter college, their diets often deteriorate and they often gain weight. There are many factors responsible for these changes. However, there are also several actions that can be taken to avoid the weight gain and decline in **diet** quality that may occur during the college years.

diet: the total daily food intake, or the types of foods eaten

The term "freshman 15" refers to the number of pounds many students gain during their first year in college. This weight gain is related to **stress**, a **sedentary** lifestyle, and changes in food intake and diet patterns, and it is not unique to American college students—international students attending American universities become heavier, too.

stress: heightened state of nervousness or unease

sedentary: not active

Meal and Snack Patterns and Serving Sizes

Meals are often skipped by college students, and management of weight and food intake is often nonexistent or disordered. Class and work schedules change daily, as well as every semester. However, structured eating patterns help students' academic performance. A study by Mickey Trockel, Michael Barnes, and Dennis Eggett, for example, found a positive relationship between eating breakfast and first-year college students' grade-point averages.

Lifestyle changes, peer pressure, limited finances, and access to food also contribute to erratic eating patterns. College students have little variety in their diet and often turn to high-fat snacks. A common error is underestimating serving sizes, meaning they often eat more than they think they are eating.

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fiber: indigestible plant material that aids digestion by providing bulk

Food and Nutrient Intakes of College Students

Of the three nutrients that provide **calories** (**carbohydrates**, **proteins**, and fats), carbohydrate (particularly sugar) and fat intake often exceeds recommended levels. College students also tend to have a low intake of dietary **fiber**,

Irregular class schedules, part-time jobs, and variable homework loads can disrupt normal eating patterns among college students, leading to unhealthy habits that may be hard to break. Despite these difficulties, it is important for students to find time for nutritious and varied foods. *[AP/Wide World Photos. Reproduced by permission.]*

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

which is important for intestinal health. In terms of **vitamins**, a low vitamin C status has been associated with college students' low intake of fruits and vegetables (with levels of vitamin C being even lower among smokers). In terms of **minerals**, **calcium**, **iron**, and **zinc** intake are low, while sodium intake is generally higher than recommended.

Male college students are more likely to meet dietary intake recommendations for the meat, poultry, fish, dry beans, and nuts group; from the bread, cereal, rice, and pasta group; and from the vegetable food group than are females. Males seem to consume more food overall, and thus have a higher **energy** (calorie) intake. Female college students tend to eat too few breads, grains, and dairy products. In addition, it is estimated that about 10 percent of college students drink more than fifteen alcoholic beverages per week, further impairing the quality of their diet.

Eating disorders such as **anorexia** and **bulimia** are more prevalent among college females than among the general population. This is related

to body image dissatisfaction—females that are underweight, as measured by their **body mass index** (BMI), sometimes consider themselves to be **overweight**. The **incidence** of anorexia and bulimia may increase when there is excessive preoccupation with weight, academic achievement, body image, and eating, as well as during stressful periods, such as final exams.

The **prevalence** of disordered eating is especially high among female athletes. College athletes may manipulate diet and fluid intake, putting their health at risk. They may also jeopardize their health by taking dangerous or excessive amounts of supplements as a result of misinformation, or of pressure from coaches or peers. Athletes may feel pressured to restrict their food intake if they are on an athletic scholarship or competing in weight-classification sports such as wrestling. Female athletes may be underweight or have an extremely low amount of body fat. The *female athlete triad* (disordered eating, **amenorrhea**, and **osteoporosis**) is estimated to occur in 15 to 62 percent of female college athletes.

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

overweight: weight above the accepted norm based on height, sex, and age

incidence: number of new cases reported each year

prevalence: describing the number of cases in a population at any one time

amenorrhea: lack of menstruation

osteoporosis: weakening of the bone structure

Recommendations for Improvement

There are many actions that college students can take to eat in a healthful way and enjoy their college years without jeopardizing their health from excessive weight gain or weight loss. Among some recommendations are:

- Get at least eight hours of sleep a night. Lack of sleeps affects one's ability to concentrate and makes one feel tired. Sleep deprivation also seems to be connected with weight problems.
- Avoid skipping meals. When a meal is skipped, the subsequent hunger may cause one to overeat.
- Eat breakfast, which helps concentration and increases the likelihood of consuming calcium, folic acid, and vitamin C. These nutrients are often low in the diet of college students.
- Manage portion sizes. If portion sizes are underestimated, one may eat more calories than are needed. Also, the availability of a wide variety and mass quantities of "dorm" food (pizza, soda, etc.) may promote overeating and a significant increase of total energy intake.
- Drink water and eat fruit throughout the day. Water is calorie-free and fruits help manage urges to eat and contribute fiber, vitamins, and minerals.
- Exercise regularly. Physical activity helps burn off calories, helps manage stress, and promotes mental and physical stamina.
- Become familiar with the campus **environment** and the foods that are available. Most colleges and universities have a variety of eateries, each with a different format, theme, and food options.
- Try the low-calorie, low-fat, and vegetarian options available around campus. As part of a well-planned diet, these items can help manage total energy intake and introduce one to items that can become part of a regular diet.
- Keep low-fat and low-calorie snacks in the dorm room. This will help manage calorie intake when snacking, especially when eating late at night.

environment: surroundings

Most universities offer a variety of meal plans. Students who take the time to acquaint themselves with the various foods available around campus, and who strive for nutritional balance, may find their academic performance improves along with their physical health. *[AP/Wide World Photos. Reproduced by permission.]*

Many universities have required or optional meal plans, which provide access to campus food for a flat rate paid either by semester or academic year. Per meal, these plans are a good value and provide access to a regular food resource. Among the things to consider are the hours the facilities are open, their proximity to student housing and classes, the quality and variety of items, and whether favorite foods are regularly available.

wellness: related to health promotion

Universities can also take a variety of steps to promote healthful food behaviors. Campus and residence hall **wellness** programs can provide students with information and point-of-purchase information at dining halls can help students make on-the-spot decisions that support healthful choices. Education programs for university personnel can help them recognize and properly refer at-risk students.

College students will eat healthful foods if they are available. During the college years, students form a foundation and create eating habits that impact future health, so it is important to practice healthful eating during these years. SEE ALSO ADULT NUTRITION; EATING DISORDERS; EATING DISTURBANCES.

Judith C. Rodriguez

Bibliography

Anding, Jenna D.; Suminski, Richard R.; and Boss, Linda (2000). "Dietary Intake, Body Mass Index, Exercise, and Alcohol: Are College Women Following the Dietary Guidelines for Americans?" *Journal of American College Health* 49:167–171.

Johnston, Carol S.; Solomon, Elizabeth; and Conte, Corinne (1998). "Vitamin C Status of a Campus Population: College Students Get a C Minus." *Journal of American College Health* 46:209–213.

Schwitser, Alan M.; Bergholz, Kim; Dore, Terri; and Salimi, Lamieh (1998). "Eating Disorders among College Women: Prevention, Education, and Treatment Responses." *Journal of American College Health* 46(5):199–207.

Selkowitz, Ann (2000). *The College Student's Guide to Eating Well on Campus.* Bethesda, MD: Tulip Hill Press.

Tavelli, Suzanne; Beerman, Kathy; Shultz, Jill E.; and Heiss, Cindy (1998). "Sources of Error and Nutritional Adequacy of the Food Guide Pyramid." *Journal of American College Health* 47(2):77–87.

Trockel, Mickey T.; Barnes, Michael D.; and Egget, Dennis L. (2000). "Health Related Variables and Academic Performance among First-Year College Students: Implications for Sleep and Other Behaviors." *Journal of American College Health* 49(3):125–131.

Internet Resources

Grieger, Lynn. "15 Diet Tips to Beat the 'Freshman 15' (At Any Age!)." Available from <http://www.ivillage.com/diet>

Hobart, Julie A., and Smucker, Douglas R. "The Female Athlete Triad." Available from <http://www.aafp.org>

Commodity Foods

The United States Department of Agriculture (USDA) administers several programs that distribute commodity foods, which are foods that the federal government has the legal authority to purchase and distribute in order to support farm prices. The first commodity distribution program began during the Great Depression of the 1930s, when it was known as the Needy Family Program. This was the main form of food assistance for low-income people in the United States until the Food Stamp Program was expanded in the early 1970s. The Needy Family Program distributed surplus agricultural commodities such as cheese, butter, and other items directly to low-income people. Today, the Food and Nutrition Service (FNS), an agency of the U.S. Department of Agriculture, administers the nation's commodity food distribution programs. The programs continue to improve the nutrition status of low-income people, while providing a means for using surplus agricultural commodities from U.S. farm programs.

Commodity Supplemental Food Program

The Commodity Supplemental Food Program (CSFP) works to improve the health of low-income pregnant and breastfeeding women, other new mothers up to one year postpartum, infants, children up to age six, and low-income elderly persons sixty years of age and older by supplementing their diets with commodity foods. Eligible people cannot participate in USDA's Special Supplemental Program for Women, Infants, and Children (WIC) and CSFP at the same time.

The USDA purchases food and makes it available to state agencies and Indian tribal organizations, along with funds for administrative costs. The commodity foods provided to participants do not provide a complete **diet**, but are designed to supplement the nutritional needs of participants and may include canned fruit juice, canned fruits and vegetables, farina, oats, ready-to-eat cereal, nonfat dry milk, evaporated milk, egg mix, dry beans, peanut butter, canned meat, poultry or tuna, dehydrated potatoes, pasta, rice, cheese, butter, honey, and infant cereal and formula. Distribution sites make packages available on a monthly basis.

diet: the total daily food intake, or the types of foods eaten

As of 2003, the program operates in thirty-two states and the District of Columbia. An average of more than 410,000 people participated in the program each month in 2002, including more than 337,000 elderly people and more than 73,000 women, infants, and children.

Food Distribution Program on Indian Reservations (FDPIR)

The FDPIR provides monthly food packages of commodity foods to low-income American Indian households living on or near Indian reservations. Currently there are some 243 tribes receiving benefits under the FDPIR. Household eligibility for the program is based on income and resource standards set by the federal government. Many people participate in FDPIR as an alternative to the Food Stamp Program because they lack easy access to food stamp offices or authorized grocery stores. Households cannot participate in FDPIR and the Food Stamp Program in the same month.

Each month, participant households receive a food package to help them maintain a nutritionally balanced diet. Participants can select from over seventy products, including items such as frozen ground beef and chicken; canned meats, poultry, and fish; canned fruits and vegetables; canned soups and spaghetti sauce; macaroni and cheese; pasta; cereal; rice and other grains; cheese; egg mix and nonfat dry and evaporated milk; dried beans; dehydrated potatoes; canned juices and dried fruit; peanuts and peanut butter; flour, cornmeal, and crackers; corn syrup; and vegetable oil and shortening.

The Emergency Food Assistance Program (TEFAP)

The Emergency Food Assistance Program is the largest of the commodity food donation programs. TEFAP was designed to reduce the level of government-held surplus commodities by distributing them to low-income households to supplement the recipients' purchased food. Local agencies may also use the commodities to prepare and serve meals in congregate settings, such as soup kitchens.

Most states set eligibility criteria at between 130 and 150 percent of the poverty line. In many states, food stamp participants are automatically eligible for TEFAP. The types of foods USDA purchases for TEFAP distribution vary depending on the preferences of states and agricultural market conditions. Typical foods include canned and dried fruits, fruit juice, canned vegetables, dry beans, meat, poultry, fish, rice, oats, grits, cereal, peanut butter, nonfat dried milk, dried egg mix, pasta products, vegetable oil, and corn syrup.

Food Assistance for Disaster Relief

Food assistance for disaster relief is furnished to state relief agencies and organizations (e.g., Red Cross, Salvation Army) in times of emergency, such as hurricanes, earthquakes, floods, and winter storms. FNS may provide commodity foods for distribution to shelters and mass feeding sites, or distribute commodity food packages directly to persons in need.

Disaster relief organizations request food assistance through state agencies that run USDA's food and nutrition assistance programs. Emphasis is on food that requires little or no preparation, including such items as canned juice, canned meat, and canned fruits and vegetables. Baby food and infant formula are provided as needed.

Commodity Distribution to Other Programs

The USDA also donates food commodities to a variety of programs. The largest donations go to school food programs at more than 94,000 public

The Food and Nutrition Service

The goal of the Food and Nutrition Service (FNS) is to eliminate hunger amid the prosperity of the United States. The FNS administers 15 nutrition assistance programs at a cost of more than $40 billion per year. While these programs have been extremely successful in reducing widespread hunger in the United States, the U.S. Department of Agriculture estimates that approximately 3.5 percent of American households continue to experience hunger at some time during the year because they can't afford enough food.

—Paula Kepos

Workers prepare to redistribute surplus foods purchased by the U.S. Department of Agriculture. The USDA's commodity foods programs serve a dual purpose, maintaining the price of certain food products and ensuring that at-risk populations get the food they need. *[Photograph by Ken Hammond. USDA. Reproduced by permission.]*

and private nonprofit schools. During 2002, the USDA spent over $700 million on over a billion pounds of commodity foods for Schools/Child Nutrition Commodity Programs. Commodity food donations are also made to the Child and Adult Care Food Program and the nutrition programs for the elderly administered by the Department of Health and Human Services. Food commodities are also distributed to nonprofit, charitable institutions that serve meals to low-income people on a regular basis. These include homes for the elderly, hospitals, soup kitchens, food banks, Meals On Wheels programs, temporary shelters, and summer camps or orphanages not participating in any federal child nutrition program.

For these programs, states select a variety of foods from a list of one hundred different kinds of products. Typical foods include fruits and vegetables; meats; cheese; dry and canned beans; fruit juices; vegetable shortening and vegetable oils; peanut products; rice, pasta products, flour, and other grain products. Additional foods may be offered to states periodically, if they become available as agricultural surpluses. Additional products donated in previous years have included applesauce, beef roasts, dried fruit products, fresh pears, frozen apricots, nonfat dry milk, orange juice, pork products, salmon, and turkey. SEE ALSO NATIVE AMERICANS, DIET OF; NUTRITION PROGRAMS IN THE COMMUNITY; SCHOOL FOOD SERVICE; WIC PROGRAM.

Marie Boyle Struble

Bibliography

Boyle, Marie A. (2003). "Food Insecurity and the Food Assistance Programs." In *Community Nutrition in Action: An Entrepreneurial Approach*, 3rd edition. Belmont, CA: Wadsworth/Thomson Learning.

Food Research and Action Center (2002). *State of the States: A Profile of Food and Nutrition Programs Across the Nation.* Washington, DC: Author.

Internet Resources

U.S. Department of Agriculture, Food and Nutrition Service. "Nutrition Program Fact Sheets." Available from <http://www.fns.usda.gov>

U.S. Department of Agriculture, Food and Nutrition Service. "Food Distribution Programs." Available from <http://www.fns.usda.gov/fdd>

U.S. Department of Agriculture, Food and Nutrition Service. "Healthy Eating in Indian Country Fliers." Available from <http://www.fns.usda.gov/fdd>

Comprehensive School Health Program

The Comprehensive School Health Program (CSHP) is a national program in the United States that makes efforts in schools to improve the health of children. Since schools profoundly influence the health of young people, the CSHP is very important. The program is supported by a national health organization, the American School Health Association (ASHA), which is actively involved in improving the health of school-age children.

School-Age Children

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diet: the total daily food intake, or the types of foods eaten

fat: type of food molecule rich in carbon and hydrogen, with high energy content

obesity: the condition of being overweight, according to established norms based on sex, age, and height

The major causes of death in America, such as **cardiovascular** disease and **cancer**, are greatly related to lifestyle, behavior, education, and prevention efforts are best focused on physical activity and **diet**. School-age children often have poor diets, making this a critical area for CSHPs to focus on. Few students are meeting the Dietary Guidelines for Americans. Their diets generally lack fruit and vegetables and contain an excess of foods that are high in **fat**. Childhood **obesity** has reached epidemic proportions, with greater numbers of people becoming affected earlier in their lives. This is an important issue for school health programs, since it has been well documented that the health of school-age children is directly related to their educational success.

American School Health Association

The American School Health Association (ASHA) recognizes that schools can do more than any single agency to help young people. This national organization unites the many professionals who are committed to improving the well being of school-age children. With more than 2,000 members, ASHA is comprised of counselors, health educators, physical educators, school nurses, school physicians, and administrators. Over half of members practice in K-12 schools or advise and oversee health-services programs or health education. The ASHA's mission is to protect and improve the well-being of children. To achieve this mission, ASHA members support the CSHP.

The Comprehensive School Health Program

The CSHP is an "organized set of policies, procedures, and activities designed to protect and promote the health and well-being of students and staff" (Cottrell, Girvan, and McKenzie, p. 67). This program traditionally includes three components: health education, a healthful school **environment**, and health services. It was expanded in 1987 (see Allensworth and Kolbe) to include physical education, **nutrition** services, counseling services, community and family involvement, and health promotion for faculty. These eight components promote the health of students, faculty, and the

environment: surroundings

nutrition: the maintenance of health through proper eating, or the study of same

Physical education is one component of the Comprehensive School Health Program. The benefits of regular physical activity are numerous, and include enhanced bone, joint, and muscle fitness, weight control, and stress relief. *[Photo by Denay Wilding.]*

community. Since students spend a major part of their lives in school, schools are a good place to influence healthful living before harmful habits are established.

The first component, health education, suggests a planned health curriculum for students in grades K-12. The major content areas suggested for instruction are: community health, consumer health, environmental health, family life, mental and emotional health, injury prevention and safety, nutrition, personal health prevention, control of disease, and substance use and abuse. The individual states and local districts decide the actual content to be taught. Teachers are encouraged to teach healthful behaviors and provide students with skills to live healthier lives.

The second component, a healthful school environment, promotes a healthful physical and emotional environment. It is important that schools are safe and secure for all those who attend and work there. This component includes issues regarding safety, school security, a school's emotional and social atmosphere, the physical environment, and sexual harassment. Each year, many children are hurt on playgrounds, are exposed to environmental hazards, and witness violence among peers. The CSHP works towards making schools as safe as possible.

The third component, school health services, encourages promoting and protecting the health of every child. This may include on-site health clinics, school nurses, school physicians, and providing immunizations and screenings for vision, hearing, healthy weight, and head lice. With clinics and medical professionals located in schools, students have the opportunity for convenient medical care. Many clinics provide both treatment and educational services. For families who cannot afford medical care, this may be their only means to health care.

The fourth component, physical education, promotes regular exercise in schools as part of a healthful lifestyle. Approximately 75 percent of all

junior high schools and high schools offer physical education classes lasting twenty minutes or more, three times per week. Physical education is important to develop strength and improve body image.

The fifth component, nutrition services, encourages balanced, appealing, and varied meals and snacks for students. The CSHP realizes the importance of good nutrition to prevent future illnesses.

The sixth component, counseling services, supports evaluations and counseling for students. By including services from guidance counselors and social workers, students' mental and emotional health is addressed.

The seventh component, community and family involvement, encourages the involvement of parents and the community in the schools. This program recognizes the need for schools to have good relationships with parents and community groups, which can be very beneficial in assisting schools and students with making decision and providing resources.

The final component, health promotion for faculty and staff, promotes a healthy staff. The many benefits of a healthy staff include less sick days, increased productivity, and positive role models for students.

wellness: related to health promotion

The CSHP encourages all schools to address their students' health on various levels. The program's mission is to promote **wellness**, motivate health improvement, and offer educational opportunities for students, families, and community members. By implementing the planned, ongoing services of the CSHP, schools have the ability to improve both education and the health of students and school personnel. SEE ALSO AMERICAN SCHOOL HEALTH ASSOCIATION; SCHOOL-AGE CHILDREN, DIET OF.

Elise M. Howard-Barr

Bibliography

Allensworth, Diane D., and Kolbe, Lloyd J. (1987). "The Comprehensive School Health Program: Exploring an Expanded Concept." *Journal of School Health* 57(10):409–412.

Butler, J. Thomas, ed. (2001). *Principles of Health Education and Health Promotion*, 3rd edition. Belmont, CA: Wadsworth.

Cottrell, Randal R.; Girvan, James T.; and McKenzie, James F., eds. (2002). *Principles and Foundations of Health Promotion and Education*, 2nd edition. San Francisco: Benjamin Cummings.

Internet Resource

American School Health Association. "About ASHA." Available from <http://www.ashaweb.org/>

Convenience Foods

Convenience foods are foods that have had preparation steps incorporated into their processing, or have been completely prepared during processing. This decreases preparation steps and time for the consumer. The "convenience" can mean the premixing of the ingredients for a cake or offering a fully prepared frozen meal. The term convenience food is generic and can apply to just about any food, but it is generally used in reference to canned items, instant foods or mixes, frozen foods or meals, and fast foods. Although they can be more costly than home-cooked meals, the trend is toward their

increased use throughout the world. SEE ALSO DIETARY TRENDS, AMERICAN; DIETARY TRENDS, INTERNATIONAL; FAST FOODS.

Judith C. Rodriguez

Bibliography

Anderson, J., and Deskins, B. (1995). *The Nutrition Bible.* New York: William Morrow.

Labensky, S.; Ingram, G. G.; Labensky, S. R. (1997). *Webster's New World Dictionary of Culinary Arts.* Upper Saddle River, NJ: Prentice Hall.

Corn- or Maize-Based Diets

Maize, the American Indian word for corn, literally means "that which sustains life." After wheat and rice, it is the most important cereal grain in the world, providing **nutrients** for humans and animals. It also serves as a basic raw material for the production of starch, oil, **protein**, alcoholic beverages, food sweeteners, and fuel. Maize has the highest average yield per hectare.

Maize is an important food in Asia, Africa, Latin America, and parts of the former Soviet Union. Each country has one or more maize dishes that are unique to its culture. Examples are *ogi* (Nigeria), *kenkey* (Ghana), *koga* (Cameroon), *tô* (Mali), *injera* (Ethiopia), and *ugali* (Kenya). Most of these products are processed in traditional ways. In Africa, ground maize is cooked into a paste or mush and eaten while still warm, accompanied by a thick low-alcoholic beer. In some areas of Africa, maize mush is fried or baked. In Central and Latin American, maize is consumed in the form of maize bread or tortillas.

Maize is also used as animal feed and raw material for industrial use. In industrialized countries, a larger proportion of the grain is used as livestock feed and as industrial raw material for food and nonfood uses. On the other hand, the bulk of maize produced in developing countries is used as human food, although its use as animal feed is increasing. Maize is the largest food crop of the United States, which is responsible for 40 percent of the world's production.

Maize constitutes an important source of **carbohydrates**, protein, vitamin B, and **minerals**. As an **energy** source, it compares favorably with root and **tuber** crops, and it is similar in energy value to dried **legumes**. Furthermore, it is an excellent source of carbohydrate and is complete in nutrients compared to other cereals.

Varieties of Maize

Six general varieties of maize or corn are differentiated by the characteristics of the kernel. Dent corn is the leading type of corn grown on U.S. farms. The sides of the kernel consist of hard, so-called horny starch, and the crown contains soft starch. As the grain matures, this soft starch shrinks, forming the characteristic dent. In flint corn, the horny starch extends over the top of the kernel, so there is no denting. Popcorn, a light, highly popular snack throughout the United States, is a variant of flint corn with small kernels of great hardness. When heated, the moisture in the kernels expands, causing the kernels to pop open. Flour corn contains a preponderance of soft or less densely packed starch, and it is readily ground into meal. Sweet corn is

nutrient: dietary substance necessary for health

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

mineral: an inorganic (non-carbon-containing) element, ion or compound

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

tuber: swollen plant stem below the ground

legumes: beans, peas, and related plants

Many Africans depend on some variation of this mush, which is made with water and ground maize. It can be eaten as a porridge or a dumpling, depending on the thickness of the batter and the cooking method. *[AP/Wide World Photos. Reproduced by permission.]*

the type commonly grown in the United States for human consumption. The sugar produced by the sweet-corn plant is not converted to starch during growth, as it is in other types. Pod corn is seldom used as food but is often grown as a decorative plant—each kernel is enclosed in its own set of diminutive husks. Another decorative corn, commonly called Indian corn, consists of multicolored varieties of flour and flint types.

Protein Quality

amino acid: building block of proteins, necessary dietary nutrient

The nutritional quality of maize is determined by the **amino acid** makeup of its protein. Maize is deficient in two essential amino acids: lysine and tryptophan, making it a poor protein food. The kernel is made up of the endosperm, the germ, the pericap, and the tip cap. The protein concentration is highest in the germ, but the quality is better in the endosperm. The germ proteins contribute significantly to essential amino acids, so maize food products without the germ, including quality protein maize (QPM) endosperm, are lower in protein quality compared to the whole kernel.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

nitrogen: essential element for plant growth

metabolic: related to processing of nutrients and building of necessary molecules within the cell

The germ contributes most of the oil, sugar, **vitamins**, and minerals of the kernel. The germ also has a lower leucine to isoleucine ratio, giving it a higher biological value. Biological value is defined as the amount of absorbed **nitrogen** needed to provide the necessary amino acids for the different **metabolic** functions in the body.

The high consumption of maize by the human population and the well-established lysine and tryptophan deficiencies in maize protein motivated researchers to develop the QPM to increase concentrations of these essential amino acids in its protein. Newer varieties provide higher protein content (18%) by increasing the prolamine (zein) fraction in maize endosperm. An example of QPM is one opaque-2 maize.

QPM varieties have almost double the percentages of lysine and tryptophan compared to normal maize, but are similar in overall protein content. However, the QPM varieties have a greatly reduced amount of the major storage protein, zein. The biological value of common maize is 45 percent whereas the QPM is about 80 percent. Hence the production and consumption of QPM maize in countries that use maize as their chief grain crop would have a beneficial effect on the nutritional state of the people and significant economic implications from the better use of what is produced and consumed.

Compared to normal maize, production of QPM varieties may have some disadvantages. QPM varieties have softer, floury endosperms, providing a slightly lower yield and making the plant more susceptible to storage insects. Furthermore, QPM varieties have lower zein content, which is associated with lysine deficiency and a higher imbalance of essential amino acids. Hence they are considered to be of a lower quality. They are also susceptible to weevils in storage.

Minerals and Vitamins

niacin: one of the B vitamins, required for energy production in the cell

The nutritional disease pellagra, which is caused by a deficiency in **niacin**, is associated with maize-based diets in the Americas and Africa. While niacin is readily available in corn, it exists in a bound form (niacytin) that is not biologically available to monogastric (single-stomach) animals. Furthermore,

In the early twentieth century, hundreds of thousands of people in the southern United States suffered from pellagra, a serious disease that affects people whose diet does not include enough niacin. Pellagra occurs in cultures that depend on corn as a dietary staple, because the niacin in corn is difficult to digest and is often removed during processing. *[Photograph by Ed Bohon. Corbis. Reproduced by permission.]*

most of the niacin in the kernel (63%) occurs in the outermost layer of the endosperm. This layer is often removed with the pericarp during dehulling. In Mexico, Guatemala, and other countries, maize is treated with an alkaline solution of lime, which releases the niacin and helps prevent pellagra. Furthermore, pellagra seldom occurs among people in Latin America, since they eat tortillas—tortilla preparation greatly increases the **bioavailability** of the niacin in maize.

bioavailability: availability to living organisms, based on chemical form

Persons suffering from pellagra usually appear to be poorly nourished, and they are often weak and underweight. They also exhibit dermatitis, diarrhea, and **dementia**. If untreated, pellagra can result in death. Niacin supplements

dementia: loss of cognitive abilities, including memory and decision-making

are available to aid in the treatment of the disease. There are also several methods of increasing niacin content in maize-based diets, including:

- Complementing maize-based diets with nuts and fish, which are rich in niacin.
- Preparing maize in a way that retains the outer layer of the endosperm, contributing more niacin to the **diet**.
- Cooking maize in alkaline solution to increase niacin availability, a procedure commonly used in Latin America in the preparation of tortillas.

diet: the total daily food intake, or the types of foods eaten

Maize is a good source of vitamin B and B_{12}. Yellow maize can provide substantial amounts of vitamin A, and the maize germ is rich in vitamin E. Furthermore, maize oil contains a high level of **polyunsaturated fatty acids** and natural **antioxidants** (Okoruwa, 1996). However, of the three major cereal grains (wheat, maize, and rice), maize has the lowest concentration of protein, **calcium**, and niacin.

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

fatty acids: molecules rich in carbon and hydrogen; a component of fats

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

calcium: mineral essential for bones and teeth

Dietary preferences, processing, and mode of preparation affect the contributions of maize in human **nutrition**. For example, the nutritive value of the grain may increase or decrease depending upon the method in which it is processed (the milling of maize reduces the concentration of protein, **lipids**, and **fiber**). Diets that rely heavily on corn may require the consumption of complementary foods to supplement its deficiency in certain amino acids and vitamins. SEE ALSO NATIVE AMERICANS, DIET OF; RICE-BASED DIETS.

nutrition: the maintenance of health through proper eating, or the study of same

lipid: fats, waxes and steroids; important components of cell membranes

fiber: indigestible plant material which aids digestion by providing bulk

Ranjita Misra

Bibliography

Latham, Michael C. (1997). *Human Nutrition in the Developing World.* Rome: FAO Publishing.

Internet Resources

Eastern and Central Africa Maize and Wheat Research Network. "About ECAMAW." Available from <http://www.asareca.org/ecamaw>

Okoruwa, Augustine (1996). "Nutrition and Quality of Maize." International Institute of Tropical Agriculture. Available from <http://www.iita.org/info>

Food and Agriculture Organization of the United Nations. *Maize in Human Nutrition.* Available from <http://www.fao.org/docrep>

Cravings

Most people, at some time, have a strong desire for some particular food, such as ice cream or pizza. Such a desire for a particular food, even when one is not hungry, is called a craving. There are a number of theories as to why people crave certain foods, including:

- Self-imposed food restriction.
- A **psychological** desire for a "comfort" food.
- Hormonal changes.
- Gender differences.
- Response to **stress**.

psychological: related to thoughts, feelings, and personal experiences

stress: heightened state of nervousness or unease

Food Restriction. The theory of food restriction holds that people desire those foods that they feel should be avoided. According to the dietitian Debra Waterhouse, food cravings do not cause weight gain, but denying the cravings does. This creates a vicious cycle. For example, a person may feel guilty for wanting a giant cinnamon roll that he or she smells upon entering a shopping mall. The urge is avoided, but a couple of hours later, the person may want the cinnamon roll more than ever, give in to the craving, and quickly eat the entire cinnamon roll. This leads to even stronger feelings of guilt, along with the resolve not to eat anything remotely similar for some period of time. Soon, however, the craving strikes again. The cycle becomes one of denial leading to deprivation, then to overindulgence, and then back to denial. This denial-deprivation-overindulgence pattern confirms the negative view of all food as either good or bad. It would be better, however, to imagine a world where foods are not designated as bad and not allowed, but where reasonable portions of any food can be part of a healthful **diet**. Portion control is the key.

Comfort Foods. Certain foods are usually served during holidays or special occasions. These foods become associated with comfort and happy times, eliciting feelings of relaxation and reduced stress, and are thus called "comfort foods." Some common comfort foods are ice cream, macaroni and cheese, meatloaf, pudding, cookies, and chicken. One's cultural background plays a large part in comfort-food choices. Mood also plays a roll in cravings for comfort food. Women are more likely to eat when they are sad, mad, or anxious, while men look to food when bored or lonely.

Those who find themselves reaching for comfort foods frequently should ask themselves if they are truly hungry, or whether they are using food to soothe their mood. For those who are feeding emotions with food, it is helpful to begin to replace the food with healthier activities, such as taking a walk, participating in a favorite form of exercise, or reading a good book.

Hormones and Cravings. How do **hormone** changes affect food cravings? For women, these cravings can be more intense than for men. Hormonal changes tied to the menstrual cycle are often a cause of cravings. Immediately prior to the menstrual period, the body's **estrogen** level drops, as does the **serotonin** level in the brain.

Serotonin is a **neurotransmitter**, or brain chemical, that plays a role in maintaining a relaxed feeling. When the level decreases, irritability and mood swings increase as does the craving for carbohydrate- and fat-rich foods such as chocolate, cookies, cake, potato chips, and roasted nuts. There is nothing wrong with eating a piece of chocolate, of course, but when chocolate and other craved foods become the mainstay of the diet and healthier choices get overlooked, then the cravings have gotten out of control and health may be compromised.

Gender Differences. Is there a difference between the sexes when it comes to food cravings? According to Waterhouse, the foods most frequently craved or preferred by men include hot dogs, eggs, and meat, which are all **protein** foods, while women reach for chocolate, ice cream, and bread. She attributes these differences to sex hormones and body composition. Men have larger amounts of the hormone **testosterone** and about forty pounds

Pregnancy Cravings

Is there any truth to the belief that pregnant women suffer intense cravings for particular foods, sometimes in odd combinations? Absolutely. According to medical researchers, pregnant women experiencing changes in hormones and an increased need for calories frequently exhibit changes in the types of foods they prefer. Common cravings include fruit, milk products, salty foods, chocolate, and other sweets. In the early stages of pregnancy, women often have a strong aversion to bitter tastes, which scientists think may serve as a warning against ingesting toxic plants or fruits during the period when a fetus is most vulnerable. In later stages of pregnancy, women often exhibit preferences for salty foods (which satisfy their increased need for sodium) and sour foods (which contribute to a varied diet). Thus the lure of pickles and potato chips.

—Paula Kepos

diet: the total daily food intake, or the types of foods eaten

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

serotonin: chemical used by nerve cells to communicate with one another

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

testosterone: male sex hormone

Women may crave ice cream when they're feeling anxious, and men may hunger for hot dogs when they get bored. These food cravings can be quieted by eating regular, healthy meals. *[Photograph by Mark Peterson. Corbis. Reproduced by permission.]*

more muscle mass than women. They eat increased amounts of protein to build, repair, and synthesize muscle.

Stress Response. Many people today lead stressful lives, which can lead to stress eating. Increased stress results in a need for carbohydrates to provide **energy** for the stress response, also known as the *fight-or-flight* response (a defense reaction of the body that prepares it to fight or flee by triggering certain **cardiovascular**, hormonal, and other changes). When coping with stress, a person needs increased energy to deal with the demands placed on the body. Carbohydrates provide a fairly rapid source of fuel to the body by raising blood-glucose levels. However, when life becomes hectic and feels out of control, it is common to reach for any available food regardless of **calories** or nutritional content.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

cardiovascular: related to the heart and circulatory system

calorie: unit of food energy

Conquering Cravings

Life will always have its stresses, but dealing with stress in a healthful, nutritional way can have a positive impact on self-esteem, energy level, emotional outlook, and weight. There are a number of positive ways to deal with cravings, including:

- Start the day off with breakfast, which helps prevent overwhelming hunger later in the day.
- Eliminate feelings of guilt related to labeling food as either good or bad. Some choices are healthier than others, but snacks and treats can be consumed in reasonable amounts.
- Plan ahead for each new week. Think about one's school, work, and activity schedule and how healthful snacks can be incorporated into it.
- Keep healthful snacks close at hand, both at home and at work.
- Try not to go for long periods of time without eating.

- Combine lean protein foods with high-fiber carbohydrate sources to provide energy that lasts for several hours, such as a slice of vegetable pizza or a bean burrito.

Cravings can be the exception instead of the rule when it comes to one's diet. Developing a lifestyle that includes healthful food selections and regular meals and snacks can help control cravings. The extra time it takes in planning meals or snacks, whether eating at home or eating on the run, is easily made up for in increased energy and improved mood. SEE ALSO EATING DISORDERS; PICA; WEIGHT MANAGEMENT.

Susan Mitchell

Bibliography

Waterhouse, Debra (1995). *Why Women Need Chocolate.* New York: Hyperion.

Mitchell, Susan, and Christie, Catherine (1997). *I'd Kill for a Cookie.* New York: Dutton.

Internet Resources

American Dietetic Association. "Eating in Stressful Times." Available from <http://www.eatright.org/pr.html>

Hellmich, Nanci. "Stress Can Put on Pounds." *USA Today.* Available from <http://usatoday.com/news>

Cultural Competence

Despite notable progress in the overall health of Americans, there are continuing disparities in health status among African Americans, Hispanics, Native Americans, and Pacific Islanders, compared to the U.S. population as a whole. In addition, the health care system is becoming more challenged as the population becomes more ethnically diverse. Therefore, the future health of the U.S. population as a whole will be influenced substantially by improvements in the health of racial and ethnic minorities.

Cultural, ethnic, linguistic, and economic differences impact how individuals and groups access and use health, education, and social services. They can also present barriers to effective education and health care interventions. This is especially true when health educators or health care practitioners stereotype, misinterpret, make faulty assumptions, or otherwise mishandle their encounters with individuals and groups viewed as different in terms of their backgrounds and experiences. The demand for culturally competent health care in the United States is a direct result of the failure of the health care system to provide adequate care to all segments of the population.

Cultural Competence, Cultural Sensitivity, and Culturally Effective Health Care

The term *cultural competence* refers to the ability to work effectively with individuals from different cultural and ethnic backgrounds, or in settings where several cultures coexist. It includes the ability to understand the language, culture, and behaviors of other individuals and groups, and to make appropriate recommendations. Cultural competence exists on a continuum from incompetence to proficiency.

Cultural sensitivity, which is a necessary component of cultural competence, means that health care professionals make an effort to be aware of

Cultural competence cannot be achieved through short workshops or classes. A long-term commitment is required to learn a second language and become familiar with other cultures to deliver effective health care for the ethnically diverse U.S. population. *[AP/Wide World Photos. Reproduced by permission.]*

diversity: the variety of cultural traditions within a larger culture

pluralistic: of many different sources

monocultural: from a single culture

the potential and actual cultural factors that affect their interactions with a client. It also means that they are willing to design programs and materials, to implement programs, and to make recommendations that are culturally relevant and culturally specific.

The terms *cultural competence* and *culturally effective health care* are sometimes used synonymously. Culturally effective health care is, indeed, related to cultural competence and cultural sensitivity. However, it goes beyond these concepts in describing the dynamic relationship between provider and client. Effective communication between providers and clients may be even more challenging when linguistic barriers exist.

Becoming Culturally Competent

Cultural competence is a developmental process that requires a long-term commitment. It is not a specific end product that occurs after a two-hour workshop, but it is an active process of learning and practicing over time. Becoming culturally competent is easier to talk about than to accomplish. Individuals working with different ethnic and cultural groups can become more culturally competent by advancing through three main stages: developing awareness, acquiring knowledge, and developing and maintaining cross-cultural skills.

Developing Awareness.

Developing cultural awareness includes recognizing the value of population **diversity**. It also means an honest assessment of one's biases and stereotypes.

Acquiring Knowledge.

One can never learn everything about another culture. However, acquiring knowledge about other groups is the foundation of cultural competence. In addition to understanding other cultures, it is essential to understand how different cultural groups view one's own culture. Knowledge of another culture includes assessments of facts not only about relevant norms, values, worldviews, and the practicality of everyday life, but also about how one's culture and the services one provides are viewed.

Developing and Maintaining Cross-Cultural Skills.

Even though the United States is a **pluralistic** society, most health professionals have been trained in a **monocultural** tradition. In addition, many continue to practice as if ethnic and cultural differences are insignificant. Cross-cultural skills are developed through formal coursework, informal interaction and networking, and experience.

Organizational Responsibilities

It is important for health care organizations and professional preparation programs to articulate a commitment to cultural competence and to initiate cultural-competence initiatives. Many organizations are getting social and legal pressures to do this from different segments of the population. In addition to the social impact of diversity, these organizations are beginning to realize that a commitment to diversity makes good business sense.

Professional preparation programs can play a significant role in providing the knowledge and skills for culturally competent health professionals. These programs can provide courses and other formats developed with the sole purpose of addressing cultural competence and/or cultural sensitivity.

Steps to Becoming Culturally Competent

Developing Awareness

- Admitting personal biases, stereotypes, and prejudices
- Becoming aware of cultural norms, attitudes, and beliefs
- Valuing diversity
- Willingness to extend oneself psychologically and physically to the client population
- Recognizing comfort level in different situations

Acquiring Knowledge

- Knowing how your culture is viewed by others
- Attending classes, workshops, and seminars about other cultures
- Reading about other cultures
- Watching movies and documentaries about other cultures
- Attending cultural events and festivals
- Sharing knowledge and experiences with others
- Visiting other countries

Developing and Maintaining Cross-Cultural Skills

- Making friends with people of different cultures
- Establishing professional and working relationships with people of different cultures
- Learning another language
- Learning verbal and nonverbal cues of other cultures
- Becoming more comfortable in cross-cultural situations
- Assessing what works and what does not
- Assessing how the beliefs and behaviors of the cultural group affect the client or family
- Learning to negotiate between the person's beliefs and practices and the culture of your profession
- Being more flexible
- Attending continuing education seminars and workshops
- Learning to develop culturally relevant and appropriate programs, materials, and interventions
- Learning to evaluate culturally relevant and appropriate programs, materials, and interventions
- Ongoing evaluation of personal feelings and reactions
- Overcoming fears, personal biases, stereotypes, and prejudices

They also can provide specific educational components on cultural competence and/or cultural sensitivity within the curricula, **internship** and residency programs, continuing education programs, and in-service programs. Organizations need to go beyond educating their employees and providing workshops on cultural sensitivity, however. They must also change institutional policies and procedures.

internship: training program

The Office of Minority Health and the Department of Health and Human Services made specific recommendations for culturally effective health care in the document, "Assuring Cultural Competence in Health Care: Recommendations for National Standards and an Outcomes-Focused Research Agenda." Some of these recommendations include:

- Developing and implementing a strategy to recruit, retain, and promote qualified, diverse, and culturally competent administrative, **clinical**, and support staff
- Promoting and supporting the necessary attitudes, behaviors, knowledge, and skills for staff to work respectfully and effectively with patients and each other in a culturally diverse work environment

clinical: related to hospitals, clinics, and patient care

- Developing a comprehensive strategy to address culturally and linguistically appropriate services, including strategic goals, plans, policies, and procedures
- Hiring and training interpreters and bilingual staff
- Providing a bilingual staff or free interpretation services to clients with limited English skills
- Translating and making available signage and commonly used educational materials in different languages
- Developing structures and procedures to address cross-cultural ethical and legal conflicts, complaints, or grievances by patients and staff
- Preparing and distributing an annual progress report documenting the organizations' progress in implementing these standards, including information on programs, staffing, and resources

While cultural competence has increased significantly, there is still much to be done on the personal, organizational, and societal levels. Education and training to enhance the provision of culturally effective health care must be integrated into lifelong learning. Through these activities, current and future health professionals will be prepared to meet the needs of clients from all segments of the population.

Delores C. S. James

Bibliography

American Academy of Pediatrics (1999). "Culturally Effective Pediatric Care: Education and Training Issues." *Pediatrics* 103:167–170.

Chin, Jean Lauu (2000). "Culturally Competent Health Care." *Public Health Report* 115:25–33

Kumanyika, Shiriki, and Morssink, Christian (1999). "Working Effectively in Cross-Cultural and Multicultural Settings." In *Nutrition and the Community*, 4th edition, ed. Anita Owen, Patricia Splett, and George Owen. Boston: WCB McGraw-Hill.

Internet Resource

Office of Minority Health. "Assuring Cultural Competence in Health Care: Recommendations for National Standards and an Outcomes-Focused Research Agenda." Available from <http://www.omhrc.gov/clas>

Dehydration

Dehydration is the excessive loss of water from the body. Water can be lost through urine, sweat, feces, respiration, and through the skin. Symptoms of dehydration in order of severity are: thirst, **nausea**, chills, clammy skin, increased heart rate, muscle pain, reduced sweating, dizziness, headache, shortness of breath, dry mouth, **fatigue**, lack of sweating, hallucinations, fainting, and loss of consciousness. Dehydration can affect mental alertness, renal function, circulation, and total physical capacity.

dehydration: loss of water

nausea: unpleasant sensation in the gut that precedes vomiting

fatigue: tiredness

The following can help to avoid dehydration:

1. Drink before feeling thirsty
2. Drink enough fluid to have pale yellow urine
3. Avoid caffeine and alcohol, which act as **diuretics**

diuretic: substance that depletes the body of water

4. Drink two to three cups of fluid two hours before exercise or heavy outside work in hot temperatures
5. Drink one to two cups of fluid every fifteen minutes during exercise or heavy outside work in hot temperatures
6. Avoid exercising during midday heat, and wear appropriate clothing that allows airflow around the body

Athletes, elderly persons, young children, and those with specific illnesses that affect fluid balance, such as severe diarrhea, are at higher risk for dehydration than the average person. SEE ALSO MALNUTRITION; ORAL REHYDRATION THERAPY; SPORTS NUTRITION.

Mindy Benedict

Bibliography

Dorland's Pocket Medical Dictionary, 23d edition (1982). Philadelphia: W. B. Saunders.

Berning, Jacqueline R., and Steen, Suzanne Nelson (1998). *Nutrition for Sport and Exercise*, 2nd edition. Gaithersburg, MD: Aspen.

Diabetes Mellitus

Diabetes mellitus is a common **metabolic** disorder resulting from defects in **insulin** action, insulin production, or both. Insulin, a **hormone** secreted by the pancreas, helps the body use and store **glucose** produced during the digestion of food. Characterized by **hyperglycemia**, symptoms of diabetes include frequent urination, increased thirst, **dehydration**, weight loss, blurred vision, **fatigue**, and, occasionally, coma. Uncontrolled hyperglycemia over time damages the eyes, nerves, blood vessels, kidneys, and heart, causing organ dysfunction and failure. A number of risk factors are attributed to the **incidence** of diabetes, including family history, age, ethnicity, and **social group** characteristics, as well as **behavioral**, lifestyle, **psychological**, and clinical factors.

The World Health Organization estimates that 150 million people had diabetes worldwide in 2002. This number is projected to double by the year 2025. Much of this increase will occur in developing countries and will be due to population growth, aging, unhealthful diets, **obesity**, and **sedentary** lifestyles. In the United States, diabetes is the sixth leading cause of death. While 6.2 percent of the population has diabetes, an estimated 5.9 million people are unaware they have the disease. In addition, about 19 percent of all deaths in the United States for those age twenty-five and older are due to diabetes-related complications.

The **prevalence** of diabetes varies by age, gender, race, and ethnicity. In the United States, about 0.19 percent of the population less than twenty years of age (151,000 people) have diabetes, versus 8.6 percent of the population twenty years of age and older. In addition, adults sixty-five and older account for 40 percent of those with diabetes, despite composing only 12 percent of the population. Considerable variations also exist in the prevalence of diabetes among various racial and ethnic groups. For example, 7.8 percent of non-Hispanic whites, 13 percent of non-Hispanic blacks, 10.2 percent of Hispanic/Latino Americans, and 15.1 percent of American Indians and Alaskan Natives have diabetes. Among Asian Americans and Pacific

diabetes: inability to regulate level of sugar in the blood

metabolic: related to processing of nutrients and building of necessary molecules within the cell

insulin: hormone released by the pancreas to regulate level of sugar in the blood

hormone: molecules produced by one set of cells that influence the function of another set of cells

glucose: a simple sugar; the most commonly used fuel in cells

hyperglycemia: high level of sugar in the blood

dehydration: loss of water

fatigue: tiredness

incidence: number of new cases reported each year

social group: tribe, clique, family, or other group of individuals

behavioral: related to behavior, in contrast to medical or other types of interventions

psychological: related to thoughts, feelings, and personal experiences

obesity: the condition of being overweight, according to established norms based on sex, age, and height

sedentary: not active

prevalence: describing the number of cases in a population at any one time

The standard method of measuring blood glucose level is called a *fingerstick,* which is a small blood sample taken from the fingertip. Diabetics must monitor their blood glucose levels daily in order to avoid dire complications such as kidney disease, blindness, stroke, and poor blood circulation. *[Photograph by Tom Stewart. Corbis. Reproduced by permission.]*

Islanders, the rate of diabetes varies substantially and is estimated at 15 to 20 percent. The prevalence of diabetes is comparable for males and females—8.3 and 8.9 percent respectively. Nevertheless, the disease is more devastating and more difficult to control among women, especially African-American and non-Hispanic white women. In fact, the risk for death is greater among young people (3.6 times greater for people from 25 to 44 years of age) and women (2.7 times greater for women ages 45 to 64 than men of the same age).

Types of Diabetes

Diabetes mellitus is classified into four categories: type 1, type 2, gestational diabetes, and other. In type 1 diabetes, specialized cells in the pancreas are destroyed, leading to a deficiency in insulin production. Type 1 diabetes frequently develops over the course of a few days or weeks. Over 95 percent of people with type 1 diabetes are diagnosed before the age of twenty-five. Estimates show 5.3 million people worldwide live with type 1 diabetes. Although the diagnosis of type 1 diabetes occurs equally among men and women, an increased prevalence exists in the white population. Type 1 diabetes in Asian children is relatively rare.

diet: the total daily food intake, or the types of foods eaten

toxins: poison

Family history, **diet**, and environmental factors are risk factors for type 1 diabetes. Studies have found an increased risk in children whose parents have type 1 diabetes, and this risk increases with maternal age. Environmental factors such as viral infections, **toxins**, and exposure to cow's milk are being contested as causing or modifying the development of type 1 diabetes.

Type 2 diabetes is characterized by insulin resistance and/or decreased insulin secretion. It is the most common form of diabetes mellitus, accounting for 90 to 95 percent of all diabetes cases worldwide. Risk factors for type 2 diabetes include family history, increasing age, obesity, physical inactivity, ethnicity, and a history of gestational diabetes. Although type 2

diabetes is frequently diagnosed in adult populations, an increasing number of children and adolescents are currently being diagnosed. Type 2 diabetes is also more common in blacks, Hispanics, Native Americans, and women, especially women with a history of gestational diabetes.

Genetics and environmental factors are the main contributors to type 2 diabetes. Physical inactivity and adoption of a Western lifestyle (particularly choosing foods with more animal **protein**, animal fats, and processed **carbohydrates**), especially in indigenous people in North American and within ethnic groups and migrants, have contributed to weight gain and obesity. In fact, obesity levels increased by 74 percent between 1991 and 2003. Increased body **fat** and abdominal obesity are associated with insulin resistance, a precursor to diabetes. Impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) are two prediabetic conditions associated with insulin resistance. In these conditions, the blood glucose concentration is above the normal range, but below levels required to diagnose diabetes. Subjects with IGT and/or IFG are at substantially higher risk of developing diabetes and **cardiovascular** disease than those with normal glucose tolerance. The conversion of individuals with IGT to type 2 diabetes varies with ethnicity, **anthropometric** measures related to obesity, fasting blood glucose (a measurement of blood glucose values after not eating for 12 to 14 hours), and the two-hour post-glucose load level (a measurement of blood glucose taken exactly two hours after eating). In addition to IGT and IFG, higher than normal levels of fasting insulin, called *hyperinsulinemia*, are associated with an increased risk of developing type 2 diabetes. Insulin levels are higher in African Americans than in whites, particularly African-American women, indicating their greater predisposition for developing type 2 diabetes.

The complexity of inheritance and interaction with the environment makes identification of **genes** involved with type 2 diabetes difficult. Only a small percentage (2–5%) of diabetes cases can be explained by single gene defects and are usually atypical cases. However, a "thrifty gene," although not yet identified, is considered predictive of weight gain and the development of type 2 diabetes. Thrifty-gene theory suggests that indigenous people who experienced alternating periods of feast and **famine** gradually developed a way to store fat more efficiently during periods of plenty to better survive famines. Regardless of the thrifty gene, the contribution of **genetic** mutations in the development of type 2 diabetes has not been established, due to the number of genes that may be involved.

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy. This definition applies regardless of whether insulin or diet modification is used for treatment, and whether or not the condition persists after pregnancy. GDM affects up to 14 percent of the pregnant population—approximately 135,000 women per year in United States. GDM complicates about 4 percent of all pregnancies in the U.S. Women at greatest risk for developing GDM are **obese**, older than twenty-five years of age, have a previous history of abnormal glucose control, have first-degree relatives with diabetes, or are members of ethnic groups with a high prevalence of diabetes. Infants of a woman with GDM are at a higher risk of developing obesity, impaired glucose tolerance, or diabetes at an early age. After a pregnancy with GDM, the mother has an increased risk of developing type 2 diabetes.

Type 1 diabetics are more likely than other diabetics to require insulin injections to regulate blood glucose levels. Insulin pumps like the one shown here can provide an extra measure of control by administering a very accurate dose of insulin on a set schedule. *[Photograph by Paul Sakuma. AP/Wide World Photos. Reproduced by permission.]*

genetics: inheritance through genes

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

cardiovascular: related to the heart and circulatory system

anthropometric: related to measurement of characteristics of the human body

gene: DNA sequence that codes for proteins, and thus controls inheritance

famine: extended period of food shortage

genetic: inherited or related to the genes

obese: above accepted standards of weight for sex, height, and age

Other forms of diabetes are associated with genetic defects in the specialized cells of the pancreas, drug or chemical use, infections, or other diseases. The most notable of the genetically linked diabetes is *maturity onset diabetes of the young* (MODY). Characterized by the onset of hyperglycemia before the age of twenty-five, insulin secretion is impaired while minimal or no defects exist in insulin action. **Drugs**, infections, and diseases cause diabetes by damaging the pancreas and/or impairing insulin action or secretion.

drugs: substances whose administration causes a significant change in the body's function

Diabetes Complications

People with diabetes are at increased risk for serious long-term complications. Hyperglycemia, as measured by fasting **plasma** glucose concentration or glycosylated **hemoglobin** (HbA1c), causes structural and functional changes in the retina, nerves, kidneys, and blood vessels. This damage can lead to blindness, numbness, reduced circulation, amputations, kidney disease, and cardiovascular disease. Type 1 diabetes is more likely to lead to kidney failure. About 40 percent of people with type 1 diabetes develop severe kidney disease and kidney failure by the age of fifty. Nevertheless, between 1993 and 1997, more than 100,000 people in the United States were treated for kidney failure caused by type 2 diabetes.

plasma: the fluid portion of the blood, distinct from the cellular portion

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

African Americans experience higher rates of diabetes-related complications such as eye disease, kidney failure, and amputations. They also experience greater disability from these complications. The frequency of diabetic retinopathy (disease of the small blood vessels in the retina causing deterioration of eyesight) is 40 to 50 percent higher in African Americans than in white Americans. In addition, the rate of diabetic retinopathy among Mexican Americans is more than twice that of non-Hispanic white Americans. Furthermore, African Americans with diabetes are much more likely to undergo a lower-extremity amputation than white or Hispanic Americans with diabetes. Little is known about these complications in Asian and Pacific Islander-Americans.

Diabetic **ketoacidosis** (DKA) and hyperosmolar hyperglycemia state (HHS) are serious diabetic emergencies and the most frequent cause of mortality. Both DKA and HHS result from an insulin deficiency and an increase in counter-regulatory hormones (a.k.a. hyperglycemia). Hyperglycemia leads to glycosuria (glucose in the urine), increased urine output, and dehydration. Because the glucose is excreted in the urine, the body becomes starved for **energy**. At this point, the body either continues to excrete glucose in the urine making the hyperglycemia worse (HHS), or the body begins to break down **triglycerides** causing the release of **ketones** (by-products of fat breakdown) into the urine and bloodstream (DKA). The mortality rate of patients with DKA is less than 5 percent while the mortality rate of HHS patients is about 15 percent. Infection (urinary tract infections and **pneumonia** account for 30 to 50 percent of cases), omission of insulin, and increased amounts of counter-regulatory hormones contribute to DKA and HHS. Type 1 and type 2 diabetic patients may experience DKA and HHS. However, DKA is more common in type 1 diabetic patients, while HHS is more common in type 2 diabetic patients. Treatment of DKA and HHS involves correction of dehydration, hyperglycemia, ketoacidosis, and **electrolyte** deficits and imbalances.

ketoacidosis: accumulation of ketone bodies along with high acid levels in the body fluids

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

triglyceride: a type of fat

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

pneumonia: lung infection

electrolyte: salt dissolved in fluid

Diabetes, Heart Disease, and Stroke

Many people with diabetes are not aware that they are at particularly high risk for heart disease and stroke, which can result from the poor blood flow that is a symptom of diabetes. In addition, people with type 2 diabetes have higher rates of hypertension and obesity, which are additional risk factors. Diabetics are two to four times more likely to have a heart attack than nondiabetics, and at least 65 percent of people with diabetes die from heart attack or stroke. While deaths from heart disease have been declining overall, deaths from heart disease among women with diabetes have increased, and deaths from heart disease among men with diabetes have not declined nearly as rapidly as they have among the general male population. The National Diabetes Education Program has launched a campaign to bring the problem to public attention. Patients are advised to work with medical personnel to control their glucose level, blood pressure, and cholesterol level and, of course, to avoid smoking.

Treatment for Diabetes

Treatment for diabetes involves following a regimen of diet, exercise, self-monitoring of blood glucose, and taking medication or insulin injections. Although type 1 diabetes is primarily managed with daily insulin injections, type 2 diabetes can be controlled with diet and exercise. However, when diet and exercise fail, medication is added to stimulate the production of insulin, reduce insulin resistance, decrease the liver's output of glucose, or slow **absorption** of carbohydrate from the **gastrointestinal** tract. When medication fails, insulin is required.

absorption: uptake by the digestive tract

gastrointestinal: related to the stomach and intestines

Following the diagnosis of diabetes, a diabetic patient undergoes medical **nutrition** therapy. In other words, a registered dietician performs a nutritional assessment to evaluate the diabetic patient's food intake, metabolic status, lifestyle, and readiness to make changes, along with providing dietary instruction and goal setting. The assessment is individualized and takes into account cultural, lifestyle, and financial considerations. The goals of medical nutrition therapy are to attain appropriate blood glucose, lipid, **cholesterol**, and triglyceride levels, which are critical to preventing the **chronic** complications associated with diabetes. For meal planning, the diabetic exchange system provides a quick method for estimating and maintaining the proper balance of carbohydrates, fats, proteins, and **calories**. In the exchange system, foods are categorized into groups, with each group having food with similar amounts of carbohydrate, protein, fat, and calories. Based on the individual's diabetes treatment plan and goals, any food on the list can be exchanged with another food within the same group.

nutrition: the maintenance of health through proper eating, or the study of same

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

chronic: over a long period

calorie: unit of food energy

Exercise and blood glucose monitoring are also critical components of a diabetic patient's self-management. Exercise improves blood glucose control, increases sensitivity to insulin, reduces cardiovascular risk factors, contributes to weight loss, and improves well-being. Exercise further contributes to a reduction in the risk factors for diabetes-related complications. Daily self-monitoring of blood glucose levels allows diabetic patients to evaluate and make adjustments in diet, exercise, and medications. Self-monitoring also assists in preventing **hypoglycemic** episodes.

hypoglycemic: related to low level of blood sugar

Diabetes mellitus is a chronic and debilitating disease. Attributed to genetics, physical inactivity, obesity, ethnicity, and a number of environmental

factors, diabetes requires lifestyle changes and medication adherence in order to control blood glucose levels. Due to the damage caused by hyperglycemia, diabetic patients also experience a number of complications related to the disease. With good self-management practices, however, individuals with diabetes can live a long and productive life. SEE ALSO CARBOHYDRATES; EXCHANGE SYSTEM; GLYCEMIC INDEX; HYPERGLYCEMIA; HYPOGLYCEMIA; INSULIN.

Julie Lager

Bibliography

American Diabetes Association (2003) "Gestational Diabetes Mellitus." *Diabetes Care* 26(1):S103–S105.

American Diabetes Association (2003) "Hyperglycemic Crises in Patients with Diabetes Mellitus." *Diabetes Care* 26(1):S109–S117.

American Diabetes Association (2003) "Physical Activity/Exercise and Diabetes Mellitus." *Diabetes Care* 26(1):S73–77.

American Diabetes Association (2003) "Standards of Medical Care for Patients with Diabetes Mellitus." *Diabetes Care* 26(1):S33–S50.

Atkinson, Mark A., and Eisenbarth, George S. (2001). "Type 1 Diabetes: New Perspectives on Disease Pathogenesis and Treatment." *Lancet* 358:221–229.

Black, Sandra A. (2002). "Diabetes, Diversity, and Disparity: What Do We Do with the Evidence?" *American Journal of Public Health* 92(4):543–548.

Chiasson, Jean-Louis; Aris-Jilwan, Nahla; Belanger, Raphael; Bertrand, Sylvie; Beauregard, Hugues; Ekoe, Jean-Marie; Fournier, Helene; and Havrankova, Jana (2003). "Diagnosis and Treatment of Diabetic Ketoacidosis and the Hyperglycemic Hyperosmolar State." *Canadian Medical Association Journal* 168(7):859–866.

Green, Anders (1996). "Prevention of IDDM: The Genetic Epidemiologic Perspective." *Diabetes Research and Clinical Practice* 34:S101–S1006.

Mandrup-Paulson, Thomas (1998). "Recent Advances: Diabetes." *British Medical Journal* 316(18):1221–1225.

Mokdad, Ali H.; Ford, Earl S.; Bowman, Barbara A.; Dietz, William, H.; Vinicor, Frank; Bales, Virginia, S.; and Marks, James S. (2003). "Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors, 2001." *Journal of the American Medical Association* 289(1):76–79.

Jovanovic, Lois, and Pettitt, David J. (2001). "Gestational Diabetes Mellitus." *Journal of the American Medical Association* 283(20):2516–2518.

Kitabchi, Abbas E.; Umpierrez, Guillermo E.; Murphy, Mary Beth; Barrett, Eugene J.; Kreisberg, Robert A.; Malone, John I.; and Wall, Barry M. (2001). "Management of Hyperglycemic Crises in Patients with Diabetes." *Diabetes Care* 24(1):131–153.

Simpson, R. W.; Shaw, J. E.; and Zimmet, P. Z. (2003). "The Prevention of Type 2 Diabetes—Lifestyle Change or Pharmacotherapy? A Challenge for the 21st Century." *Diabetes Research and Clinical Practice* 59:165–180.

Yki-Jarvinen, Hannele (1998). "Toxicity of Hyperglycemia in Type 2 Diabetes." *Diabetes/Metabolism Reviews* 14:S45–S50.

Internet Resources

American Diabetes Association. "Basic Diabetes Information." Available from <http://www.diabetes.org>

Centers for Disease Control and Prevention. "Diabetes Public Health Resource." Available from <http://www.cdc.gov/diabetes>

National Diabetes Information Clearinghouse (NDIC). "Diabetes." Available from <http://diabetes.niddk.nih.gov>

World Health Organization. "Fact Sheets: Diabetes Mellitus." Available from <http://www.who.int>

Diarrhea

Diarrhea, a condition that has a major impact on global health, is highly correlated with nutritional status. It is an important area of focus due not only to its high worldwide **prevalence** and health costs, but also because it can be significantly reduced by appropriate interventions and treatment.

prevalence: describing the number of cases in a population at any one time

Diarrhea has various causes and symptoms, resulting in a wide range of definitions for this illness. The U.S. National Institutes of Health (NIH) defines diarrhea as loose, watery stools occurring more than three times a day, which is the most common definition. The term **acute** *diarrhea* is used to describe an episode lasting less than three weeks. *Persistent diarrhea* is an episode that lasts more than fourteen days, and **chronic** *diarrhea* is the term for recurring episodes of diarrhea. *Dysentery* is diarrhea that contains blood. The severity of diarrhea ranges from **asymptomatic** to severe **dehydration** resulting in death.

acute: rapid-onset and short-lived

chronic: over a long period

asymptomatic: without symptoms

dehydration: loss of water

Causes of Diarrhea

Diarrhea can present in many ways because it has many potential causes. Most cases of diarrhea are caused by some type of infection. For example, surveillance studies in rural Bangladesh have cited infection as the cause of 86 percent of the cases of diarrhea in that population. This is the case in much of the developing world. Regardless of the cause, diarrhea results from an alteration of the lining of the wall of the **intestines**. Normal digestion occurs when there is a balance of fluid and **nutrients** across the **bowel** wall. Disruption of this process can be caused directly by organisms, **toxins**, or immune reactions. Any imbalance alters the composition of the stool and the motility (motion) of the bowel wall, resulting in an increased loss of fluid and nutrients. Dehydration is the result of loss of body fluids and **electrolytes**. A loss of 5 percent of body weight can result in a rapid heart rate, dizziness, decreased urination, disorientation, and even coma. A 10 percent loss of body weight caused by severe diarrhea can lead to **acidosis**, **shock**, and death.

intestines: the two long tubes that carry out the bulk of the processes of digestion

nutrient: dietary substance necessary for health

bowel: intestines and rectum

toxins: poison

electrolyte: salt dissolved in fluid

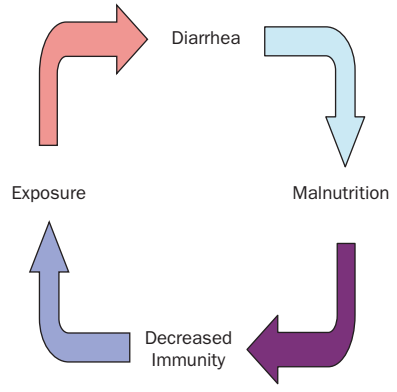
acidosis: elevated acid level in the blood

shock: state of dangerously low blood pressure and loss of blood delivered to the tissues

socioeconomic status: level of income and social class

People in developing countries suffer most from infectious forms of diarrhea. Most infections pass through a fecal-oral route. This results from environmental causes such as poor sanitation, decreased access to clean water, and a poor understanding of transmission and treatment of disease. These are conditions that arise most frequently in the developing world, though they affect both rural and urban populations. Improvements in these areas result in a dramatic reduction of cases of infectious diarrhea, as shown in studies in numerous developing nations, such as India, Gambia, and elsewhere, where poor **socioeconomic status** affects a large percentage of the population. *Traveler's diarrhea* is the result of exposure to such infectious agents when visiting countries where sanitation is inadequate.

THE CYCLE OF DIARRHEAL ILLNESS



Diarrhea in Developing Nations

Diarrhea is a major cause of death in much of the world, particularly in developing nations, where the effect is greatest among the young. The World Health Organization (WHO) attributes 3.5 million deaths a year to diarrhea, with 80 percent of these deaths occurring in children under the age of five, and most occurring in children between six months and three years of age. Children are the most susceptible because a smaller amount of fluid

CAUSES OF DIARRHEA

Causes	Examples
Viral infections	Rotavirus, Norwalk virus
Bacterial infections	E. coli, Vibrio cholerae, Campylobacter, Shigella
Parasites	Giardia, Entamoeba
Helminths (intestinal worms)	Strongyloides
Allergic	Lactose intolerance, celiac sprue, medication side effects
Autoimmune	Ulcerative colitis, Crohn's disease
Malabsorptive	Pancreatic deficiency, biliary disease
Nutritional	Zinc deficiency, vitamin A deficiency, enteral feedings consisting of liquid nutritional formulas delivered straight to the bowels
Functional	Irritable bowel syndrome, short bowel syndrome, cancer

loss is necessary to result in significant dehydration, because they have fewer internal resources, and because their **energy** requirements are higher.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Children in developing nations suffer from an average of four cases of diarrhea a year. Most of these cases are infectious diarrhea. Infectious diarrhea also contributes to **malnutrition** due to a decreased nutritional intake and diminished **absorption** of vital nutrients during the acute episode and recovery period. Malnutrition, in turn, decreases the ability of the **immune system** to fight further infections, making diarrheal episodes more frequent.

malnutrition: chronic lack of sufficient nutrients to maintain health

absorption: uptake by the digestive tract

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

Studies have shown that poor nutritional status can double the risk of contracting diarrhea when exposed to an infectious agent. In addition, the duration of the acute episode can be up to three times as long in **malnourished** children. In addition, reduced immunity and deficiencies of nutrients such as vitamin A and **zinc**, which are common in malnourished individuals, can increase the health risks from diarrhea. Diarrhea also causes decreased appetite and food intake, decreased absorption of nutrients from the food that is ingested, and increased **catabolism** of body **proteins**. The resulting **undernutrition** stunts future mental and physical development.

malnourished: lack of adequate nutrients in the diet

zinc: mineral necessary for many enzyme processes

catabolism: breakdown of complex molecules

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

Eating patterns before and after diarrheal episodes play an important role in this cycle. In developing countries, environmental factors, such as pervasive bacterial contamination of water used for drinking, cooking, and cleaning, contribute to continued exposure to agents that cause diarrhea. Maternal practices related to feeding are also a factor. Reduced breastfeeding rates in developing nations mean that fewer children receive the protective and nutritional benefits of breast milk. Nursing allows for the delivery of milk high in fats, proteins, and **calories** in a sterile fashion. When illness causes mothers to **wean** their children too early, nutritious breast milk is replaced with cereals and gruels that are often low in calories and proteins and are made with contaminated water. Commercial formulas are also often diluted with contaminated water and put in bottles that are not sterile.

calorie: unit of food energy

wean: cease breastfeeding

A lack of maternal education often leads to the common practice of withholding food during acute episodes of diarrhea out of fear that eating will exacerbate the symptoms. Because of the nutritional losses from diarrhea, children actually need up to a 30 percent increase in calories and a 100 per-

cent increase in protein intake during the acute and recovery stages of diarrhea. Studies have shown that children who receive increased nourishment during this time suffer less from the acute and long-term effects of diarrhea. The WHO recommends the continuation of breastfeeding throughout an acute episode, as well as the use of mixed food cereals high in calories and protein. There is also evidence to support zinc supplementation, which can reduce the **morbidity** rates from diarrhea.

morbidity: illness or accident

Treatment

The mainstay of treatment for diarrhea is rehydration to replace the fluid and electrolyte losses. This is the cornerstone of oral rehydration therapy (ORT), which has greatly reduced the morbidity and mortality from diarrheal illnesses throughout the world. Rehydration must be combined with the fulfillment of increased nutritional demands. **Antibiotics** have a very limited role in effectively reducing morbidity and mortality from diarrhea, and antimotility and absorbent agents have virtually no role.

antibiotic: substance that kills or prevents the growth of microorganisms

It is evident that the morbidity and mortality from diarrhea results from a complex interplay of environmental hazards, risk factors, and treatment response. Interventions to reduce the global impact of diarrhea must therefore be multifactorial in their approach. This is an illness that imposes a large health burden on society, but has avenues for effective intervention. SEE ALSO MALNUTRITION; ORAL REHYDRATION THERAPY.

Seema Pania Kumar

Bibliography

Basch, Paul (1999). *Textbook of International Health.* New York: Oxford University Press.

Chen, Lincoln, and Scrimshaw, Nevin (1983). *Diarrhea and Malnutrition: Interactions, Mechanisms, and Interventions.* New York: Plenum Press.

Semba, Richard, and Bloem, Martin (2000). *Nutrition and Health in Developing Countries.* Totowa, NJ: Humana Press.

Internet Resources

National Institutes of Health. <http://www.nih.gov>

World Health Organization. <http://www.who.int>

Diet

The term *diet* refers to a person's pattern of eating and drinking. Diet is influenced by many factors, including income, culture, religion, geographic location, and lifestyle. A balanced diet contains food from several food groups and supplies the body with the **energy** and essential **nutrients** it needs (as defined by the Food Guide Pyramid and **Dietary Reference Intakes**).

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

nutrient: dietary substance necessary for health

Dietary Reference Intakes: set of guidelines for nutrient intake

Recommended Dietary Allowances: nutrient intake recommended to promote health

The Food Guide Pyramid lists food categories and serving recommendations. Dietary Reference Intake values provide a range of dietary recommendations, including the **Recommended Dietary Allowances** (RDAs), which provide the daily intake needed to meet the needs of "nearly all healthy persons." Dietary recommendations, and how they are represented, vary around the world. Most, however, convey a common message: balance,

variety, and moderation in food choices. SEE ALSO EATING HABITS; DIETARY REFERENCE INTAKES; FOOD GUIDE PYRAMID; RECOMMENDED DIETARY ALLOWANCES.

Delores Truesdell

Bibliography

Brown, Judith (2002). *Nutrition through the Life Cycle.* Belmont, CA: Wadsworth.

Internet Resource

United States Department of Agriculture, Food and Nutrition Center. "Food Guide Pyramid." Available from <http://nal.usda.gov/fnic>

Dietary Assessment

nutrition: the maintenance of health through proper eating, or the study of same

clinical: related to hospitals, clinics, and patient care

anthropometric: related to measurement of characteristics of the human body

body mass index: weight in kilograms divided by square of the height in meters times 100; a measure of body fat

diet: the total daily food intake, or the types of foods eaten

biochemical: related to chemical processes within cells

chronic: over a long period

malnutrition: chronic lack of sufficient nutrients to maintain health

anemia: low level of red blood cells in the blood

A dietary assessment is a comprehensive evaluation of a person's food intake. It is one of four parts of a **nutrition** assessment done in a **clinical** setting. These four parameters of assessment include: (1) an assessment of **anthropometrics** (weight, height, weight-to-height ratio, head circumference, **body mass index**, etc.); (2) dietary assessment, which includes a **diet** history or food frequency analysis; (3) a physical examination with a medical history; and (4) **biochemical** exams or blood/urine tests.

Reviewing a person's dietary data may suggest risk factors for **chronic** diseases and help to prevent them. Laboratory tests may uncover **malnutrition** and detect problems before any side effects appear, such as the tiredness and apathy associated with iron-deficiency **anemia**. The strengths of a simple blood test and food intake record are that these are easy to do and are affordable and appropriate for most people.

Problems with using diet histories can occur because a person's memory about what he or she ate earlier may not be accurate. It can also be time-consuming to collect food intake records. There are also problems with interpreting food intakes, laboratory values, and appropriate weights and heights.

A final area of concern related to dietary assessment is what to do with the information once it has been gathered. Providing nutrition education and counseling to people of different ages and from different backgrounds requires a great deal of skill and a good understanding of diet quality, normal eating, and normal physical and psychosocial development. It is important to treat people as individuals with unique needs and concerns. Dietitians are trained to do this, but many health care workers are not trained to measure diet quality, define dietary moderation, or provide counseling. SEE ALSO NUTRITIONAL ASSESSMENT.

Delores Truesdell

Internet Resources

American Heart Association. "Healthy Lifestyle: Diet and Nutrition." Available from <http://www.americanheart.org>

U.S. Department of Agriculture (2000). "Dietary Guidelines for Americans," 5th edition. Available from <http://www.usda.gov/cnpp>

U.S. Department of Agriculture, Food and Nutrition Information Center. "Dietary Assessment." Available from <http://www.nal.usda/fnic>

Dietary Guidelines

The Dietary Guidelines for Americans are the foundation of national **nutrition** policy for the United States. They are designed to help Americans make food choices that promote health and reduce the risk of disease. The guidelines are published jointly by the U.S. Department of Agriculture (USDA) and U.S. Department of Health and Human Services (HHS). The first set of guidelines was published as *Nutrition and Your Health: Dietary Guidelines for Americans* in 1980. Since then, an advisory committee has been appointed every five years to review and revise the guidelines based on the latest research in nutrition and health.

nutrition: the maintenance of health through proper eating, or the study of same

Early Dietary Advice in the United States

The first half of the twentieth century was a period of enormous growth in nutrition knowledge. The primary goal of nutrition advice at this time was to help people select foods to meet their **energy** (**calorie**) needs and prevent **nutritional deficiencies**. During the Great Depression of the 1930s, food was rationed and people had little money to buy food. They needed to know how to select an adequate **diet** with few resources, and the USDA produced a set of meal plans that were affordable for families of various incomes. To this day, a food guide for low-income families—the Thrifty Food Plan—is issued regularly by the USDA and used to determine food stamp allotments. In addition to meal plans, the USDA developed food guides—tools to help people select healthful diets. Over the years the food guides changed, based on the current information available.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

calorie: unit of food energy

nutritional deficiency: lack of adequate nutrients in the diet

diet: the total daily food intake, or the types of foods eaten

Food Guides versus Dietary Guidelines

Food guides are practical tools that people can use to select a healthful diet. Food guide recommendations, such as how many servings of grains to eat, are based on dietary guidelines that are overall recommendations for healthful diets. For example, the Dietary Guidelines for Americans include the recommendation that Americans "choose a variety of grains daily, especially whole grains." To help people reach this goal, the USDA's Food Guide Pyramid is built on a base of grain foods and recommends six to eleven servings daily with several servings from whole grains. Thus, the Food Guide Pyramid supports the recommendations of the Dietary Guidelines.

Evolution of the Dietary Guidelines

During the 1970s, scientists began identifying links between people's usual eating habits and their risk for **chronic** diseases such as **heart disease** and **cancer**. They realized that a healthful diet was important not only to prevent **nutrient** deficiencies, but because it might play a role in decreasing the risk for chronic diseases. Since heart disease and cancer were, and still are, major causes of death and disability in the United States, there was a need to help Americans select health-promoting diets.

The first major step in federal dietary guidance was the 1977 publication of *Dietary Goals for the United States* by the Senate Select Committee on Nutrition and Human Needs, which recommended an increased intake of **carbohydrates** and a reduced intake of **fat**, **saturated fat**, **cholesterol**,

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cancer: uncontrolled cell growth

nutrient: dietary substance necessary for health

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

salt, and sugar. There was heated debate among nutrition scientists when the Dietary Goals were published. Some nutritionists believed that not enough was known about effects of diet and health to make suggestions as specific as those given.

In 1980, the first edition of Dietary Guidelines for Americans was released by the USDA and HHS. The seven guidelines were: (1) Eat a variety of foods; (2) Maintain ideal weight; (3) Avoid too much fat, saturated fat, and cholesterol; (4) Eat foods with adequate starch and **fiber**; (5) Avoid too much sugar; (6) Avoid too much sodium; and (7) If you drink alcohol, do so in moderation. The second edition, released in 1985, made a few changes, but kept most of the guidelines intact. Two exceptions were the weight guideline, which was changed to "Maintain desirable weight" and the last guideline, in which "alcohol" was changed to "alcoholic beverages."

fiber: indigestible plant material that aids digestion by providing bulk

Following publication of the second edition of the Dietary Guidelines, two influential reports concerning diet and health were issued. The *Surgeon General's Report on Nutrition and Health* was published in 1988, and the National Research Council's report *Diet and Health—Implications for Reducing Chronic Disease Risk* was published in 1989. These two reports supported the goal of the Dietary Guidelines to promote eating habits that can help people stay healthy. In 1990, the third edition of the guidelines took a more positive tone than previous editions, using phrases such as "Choose a diet..." or "Use ... only in moderation," rather than "Avoid too much..." This was seen as a positive step by many nutrition educators.

The fourth edition was the first to include the Food Guide Pyramid, which had been introduced in 1992. It also was the first edition to address vegetarian diets and the recently introduced "Nutrition Facts" panel for food labels. The fifth edition, issued in 2000, expanded the number of guidelines to ten and organized them into three messages: "Aim for Fitness, Build a Healthy Base, and Choose Sensibly" (ABC).

The Dietary Guidelines for Americans have evolved since they were first published in 1980. Their recommendations represent the latest research in diet and health promotion, and, as new research emerges, the guidelines will continue to change to reflect new insights into diet and health. People can take steps toward healthier lifestyles by following the recommendations of the Dietary Guidelines and using tools like the Food Guide Pyramid to guide their food choices. SEE ALSO DIETARY TRENDS, AMERICAN; FOOD GUIDE PYRAMID.

Linda Benjamin Bobroff

The 2000 Dietary Guidelines for Americans

Aim for Fitness

- Aim for a healthy weight
- Be physically active each day

Build a Healthy Base

- Let the Pyramid guide your food choices
- Choose a variety of grains daily, especially whole grains
- Choose a variety of fruits and vegetables daily
- Keep food safe to eat

Choose Sensibly

- Choose a diet that is low in fat and cholesterol and moderate in fat
- Choose beverages and foods to moderate your intake of sugar
- Choose and prepare foods with less salt
- If you drink alcoholic beverages, do so in moderation

Bibliography

Cronin, Frances J., and Shaw, Anne M. (1988). "Summary of Dietary Recommendations for Healthy Americans." *Nutrition Today* 23:26–34.

National Research Council (1989). *Diet and Health: Implications for Reducing Chronic Disease Risk*. Washington, DC: National Academy Press.

U.S. Department of Agriculture, and U.S. Department of Health and Human Services (1980). *Nutrition and Your Health: Dietary Guidelines for Americans.* (Home and Garden Bulletin 232.) Washington, DC: U.S. Government Printing Office.

U.S. Department of Agriculture, and U.S. Department of Health and Human Services (2000). *Nutrition and Your Health: Dietary Guidelines for Americans*, 5th ed. Washington, DC: Government Printing Office.

U.S. Department of Health and Human Services, Public Health Service (1988). *The Surgeon General's Report on Nutrition and Health*. (DHHS [PHS] Publication No. 88-50210.) Washington, DC: U.S. Government Printing Office.

Dietary Reference Intakes

Dietary Reference Intakes (DRIs) are a set of **nutrient** reference values. They are used to help people select healthful diets, set national **nutrition** policy, and establish safe upper limits of intake. DRIs include four sets of nutrient standards: Estimated Average Requirement (EAR), Recommended Dietary Allowance (RDA), Adequate Intake (AI), and Tolerable Upper Intake Level (UL). Starting in the mid-1990s, DRIs began to replace RDAs and Recommended Nutrient Intakes for Canadians, which had been the standards for the United States and for Canada, respectively.

nutrient: dietary substance necessary for health

nutrition: the maintenance of health through proper eating, or the study of same

Each component of the DRIs has a unique purpose. The EARs are average nutrient requirements for a population group (e.g., females ages 19–30). They are used in nutrition research and to set nutrition policy. RDA values are based on the EARs. RDA values represent a level of nutrient intake that would meet the needs of about 97 percent of people in a particular group.

If there is not enough information to set RDA values, then an AI may be established for that nutrient. The AI is based on information about average intake of the nutrient by a healthy group of people. RDA and AI are both used to plan healthful diets for individuals.

Not only is it important to know how much of a nutrient is needed for good health, it is also critical to know how much of a nutrient is too much. The UL is the highest intake of a nutrient that does not pose a threat to health for most people. Intake higher than the UL can cause adverse health effects, especially over time. SEE ALSO DIETARY ASSESSMENT; RECOMMENDED DIETARY ALLOWANCES; NUTRIENTS.

Linda Benjamin Bobroff

Bibliography

Insel, Paul; Turner, R. Elaine; and Ross, Don (2001). *Nutrition.* Sudbury, MA: Jones and Bartlett.

Sizer, Frances, and Whitney, Eleanor (2000). *Nutrition Concepts and Controversies*, 8th edition. Belmont, CA: Wadsworth/Thomson Learning.

Internet Resource

Food and Nutrition Information Center, U.S. Department of Agriculture. "Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA)." Available from <http://www.nal.usda.gov/fnic>

Dietary Supplements

The demand for dietary supplements in the United States catapulted what was once a cottage industry into a $14 billion per year business in the year 2000. In 1994, the U.S. Congress formally defined the term *dietary supplement* as a product taken by mouth that contains a "dietary ingredient" intended to supplement the **diet**. The dietary ingredients in these products may include **vitamins**, **minerals**, herbs, **amino acids**, **enzymes**, organ tissues, glandulars, and **metabolites**. Dietary supplements can also be extracts or concentrates, and may be found in many forms, such as tablets, capsules, liquids, or powders.

diet: the total daily food intake, or the types of foods eaten

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

amino acid: building block of proteins, necessary dietary nutrient

enzyme: protein responsible for carrying out reactions in a cell

metabolite: the product of metabolism, or nutrient processing within the cell

The use of dietary supplements is widespread—they are taken by half of American adults. But the use of supplements is not limited to adults. A study

Baby Boomers and Nutritional Supplements

Informed, prosperous, and health-conscious, the baby boomers are known as a generation that plans to fight vigorously against the encroachments of age. During the 1990s, as the boomers began reaching their fifties, they increasingly turned to supplements to ward off osteoporosis, memory loss, and a host of other ailments. With increased demand, the vitamins, minerals, and herbs they sought migrated from health food stores to mass merchandisers. Between 1997 and 2002 the supplement industry experienced a 34 percent jump in sales, to more than $19 billion annually.

—Paula Kepos

published in the November 2001 *Journal of the American Dietetic Association* showed that dietary supplement use is prevalent among students as well, with 17.6 percent of 1,532 eighth-graders reporting the use of a vitamin-mineral supplement. Herbs, one type of dietary supplement, are widely used throughout the world. In China, traditional medicine encompasses a holistic approach to healing, and herbal remedies are routinely included in self-care. The World Health Organization (WHO) estimates that in developing countries up to 80 percent of indigenous populations rely on herbs for primary health care needs. In France and Germany, 30 to 40 percent of all medical doctors rely on herbal preparations as their primary medicines.

Regulation of Dietary Supplements

In 1994 the U.S. Congress passed the Dietary Supplement Health and Education Act (DSHEA), which President Bill Clinton signed into law the same year. One provision of DSHEA clarified the definition for dietary supplements outlined above. DSHEA also mandated the establishment of the Office of Dietary Supplements (ODS) within the National Institutes of Health. The ODS coordinates research on dietary supplements and acts as a clearinghouse for regulatory issues. It also maintains an excellent resource for consumers, the International Bibliographic Information on Dietary Supplements (IBIDS), which is a database that contains citations published in scientific journals on the topic of dietary supplements. The public can access IBIDS on the ODS website.

DSHEA established a new regulatory framework for supplement safety and for the labeling of dietary supplements by the U.S. Food and Drug Administration (FDA). Dietary supplements are regulated under food law, but with certain provisions that apply only to dietary supplements. For example, dietary supplements escape the stringent approval process that **food additives** and **drugs** must go through before being marketed to the public, unless the manufacturer of a dietary supplement makes a claim for therapeutic **efficacy**.

DSHEA also gave manufacturers the freedom to provide information about product benefits on labels through three types of claims. *Health claims* describe a relationship between a food substance and a disease or health-related condition. For example, the health claim "diets high in **calcium** may reduce the risk of **osteoporosis**" has been authorized by the FDA and may appear on the labels of dietary supplements. *Structure function claims* may state a benefit related to a nutrient-deficiency disease (such as **scurvy**, which is caused by a deficiency of vitamin C), as long as the statement tells how widespread the disease is. These claims may also describe the role of a nutrient intended to affect a structure or function—for example, "**antioxidants** maintain cell integrity," or "calcium builds strong bones." *Nutrient content claims* describe the level of a nutrient or dietary substance in a product, using FDA-regulated terms such as "good source," "high," or "free." For example, if a label claims a dietary supplement is fat-free, the supplement must contain less than 0.5 grams of fat per serving.

However, information on supplement labels cannot be false or misleading. For example, statements that a product will treat, cure, or diagnose a disease are reserved for drugs. That is why the label of the popular herbal extract echinacea may boast that the herb "supports good immune function" but will not claim to "cure your cold."

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

drugs: substances whose administration causes a significant change in the body's function

efficacy: effectiveness

calcium: mineral essential for bones and teeth

osteoporosis: weakening of the bone structure

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

Because they are not regulated as strictly as drugs, dietary supplements can cause unpredictable side effects. For example, studies have shown an increased risk of prostate cancer among men who take beta-carotene supplements and drink alcohol, and an increased risk of lung cancer among people who take beta-carotene supplements and smoke. *[Photograph by Robert J. Huffman. Field Mark Publications. Reproduced by permission.]*

In Germany, herbs and herbal products are regulated in a different way than in the United States. In 1978, the German Federal Health Agency established the German Commission E to investigate the safety and efficacy of herbal remedies commonly used in Germany. The commission weighed evidence from the literature, from anecdotal reports, and from clinical studies. They subsequently developed monographs on over 400 herbs. These monographs are now used worldwide as essential references on herbal therapy. The commission also established indications (how an herb is used medicinally) and dosage recommendations, resulting in the successful mainstreaming of herbs into medical practice. German physicians frequently prescribe the herbs ginkgo biloba, hawthorn, St. John's wort, horse chestnut, and saw palmetto. Unlike U.S. law, German law allows herb manufacturers to market herbs with drug claims if the herb is proven safe and effective.

Controversies Surrounding the Use of Dietary Supplements

Opponents of DSHEA claim that the issue of public safety is their primary concern. Steven H. Zeisel, of the University of North Carolina School of

Public Health and School of Medicine, writes that "DSHEA modifies the regulatory environment so that it becomes possible, even likely, that products will be marketed that inadvertently harm people" (Zeisel, p. 1855). Zeisel believes that the DSHEA legislation makes it easy for small enterprises to market products without investing the time and money needed to prove their product's safety and efficacy. He contrasts the development of a new dietary supplement to that of a new drug or food additive, for which there is a formal process to evaluate safety.

A manufacturer developing a new drug or food additive must conduct safety studies following FDA procedures. Results must be submitted to the FDA for review and approval before the ingredient or drug can be sold to the public. This is not the case for dietary supplements, however, because under DSHEA they are legally in a class by themselves. The FDA must simply be notified of the new product, and the notification must provide information that supports the manufacturer's claim that its product is safe. Once the product is marketed, the FDA is responsible for proving that a dietary supplement is unsafe before it can take action to restrict that product's use or remove it from the marketplace.

Another issue critics of DSHEA cite is the scant quality control of dietary supplements. Quality control is important to assure consumers that a product contains the ingredients stated on the label in the stated amounts. Neither the FDA nor any other federal or state agency routinely tests dietary supplements for quality prior to sale. But some manufacturers of dietary supplements do adhere to Good Manufacturing Practices (GMPs) and make every effort to produce a quality product. Also, the FDA has assisted the industry by proposing GMPs that focus on ensuring the identity, purity, quality, strength, and composition of dietary supplements.

DSHEA supporters fear that increased regulation of dietary supplements will decrease access to beneficial products. National opinion surveys show that many supplement users feel so strongly about the potential health benefits of supplements that they would continue to use them even if the supplements were shown to be ineffective in clinical studies. Consumers value freedom of choice, and many view regulation as an attempt by the government and medical establishment to monopolize treatment options. Clearly, a balance needs to be reached between preserving freedom of choice and ensuring that dietary supplements are safe and effective. SEE ALSO ALTERNATIVE MEDICINES AND THERAPIES; FOOD LABELS; HEALTH CLAIMS; QUACKERY; VITAMINS, FAT-SOLUBLE; VITAMINS, WATER-SOLUBLE.

Jackie Shank

Bibliography

Blendon, R. J.; DesRoches, C. M.; Benson, J. M.; Brodie, M.; and Altman, D. E. (2001). "American's Views on the Use and Regulation of Dietary Supplements." *Archives of Internal Medicine* 161(6):805–10.

Dwyer, Johanna T.; Garceau, Anne O.; Evans, Marguerite; Li, Donglin; Lytle, Leslie; Hoelscher, Deanna; Nicklas, Theresa A.; and Zive, Michelle (2001). "Do Adolescent Vitamin-Mineral Supplement Users Have Better Nutrient Intakes than Nonusers? Observations from the CATCH Tracking Study." *Journal of the American Dietetic Association* 101(11):1340–1346.

Fleming, Thomas, ed. (1998). *PDR for Herbal Medicines.* Montvale, NJ: Medical Economics.

Sarubin, Allison (2000). *The Health Professional's Guide to Popular Dietary Supplements.* Chicago: American Dietetic Association.

Skidmore-Roth, Linda (2001). *Mosby's Handbook of Herbs & Natural Supplements.* St. Louis, MO: Mosby.

Somer, Elizabeth (1996). *The Essential Guide to Vitamins and Minerals*, 2nd edition. New York: HarperPerennial.

Zeisel, Steven H. (1999). "Regulation of Nutraceuticals." *Science* 285:1853–55.

Internet Resources

National Institutes of Health, Office of Dietary Supplements. <http://ods.od.nih.gov>

U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition (2001). "Overview of Dietary Supplements." Available from <http://www.cfsan.fda.gov/~dms>

Dietary Trends, American

Americans have become more aware of what they eat, and how it might affect their health. Concerns about the safety of the food supply are on the rise, and increasing nutritional awareness has led to an increase in vegetarian, organic, and health-food options in supermarkets. "Lite" food is in, and indulgence is out. But are Americans practicing what they preach? A closer look at American dietary trends reveals that parts of the American **diet** are still lacking in nutritional quality, despite consumer demand for healthier options.

diet: the total daily food intake, or the types of foods eaten

Dietary Patterns

Fruit and vegetable intake, although rising, is still below the five servings per day recommended in the USDA's Dietary Guidelines for Americans. The average American eats one and one-half servings of vegetables and one serving of fruit per day. Since the beginning of the twentieth century, consumption of milk and eggs has been declining, while cheese consumption has gone up. Meat, poultry, and fish intake has climbed dramatically. Grain and cereal consumption has also risen. Vegetable fats are increasingly being used instead of animal fats, but total **fat** consumption is still high.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Sixty percent of Americans eat snack food regularly, consuming about 20 percent of their **calories** from snacks. Because half of young adults skip breakfast, and one-fourth skip lunch, between-meal eating contributes significantly to the daily **nutrient** intakes of Americans. Children, in particular, require several small meals per day, as their stomachs cannot hold large amounts of food at one time. Carefully chosen snacks can add to good dietary habits. Most Americans, however, do not snack wisely.

calorie: unit of food energy

nutrient: dietary substance necessary for health

More than 30 percent of men and more than 40 percent of women take a daily multivitamin/mineral supplement. Doses of about 100 percent of the Daily Value (DV) of most nutrients are common in these supplements. Although **nutrition** experts agree that the average American does not need supplements, there is little harm in taking them. Problems can arise, however, when individual nutrients are taken. Megadoses of certain **minerals** and relatively low supplemental doses of certain fat-soluble **vitamins** can lead to toxicity. For example, a surplus of vitamin A can lead to cheilitis (cracking and inflammation of the lips), dryness of the nasal **mucosa** and eyes, hair loss, and, eventually, liver damage. Megadoses of **vitamin D** can lead to the calcification of soft tissues, such as the lungs, heart, and kidneys.

nutrition: the maintenance of health through proper eating, or the study of same

mineral: an inorganic (non-carbon-containing) element, ion or compound

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mucosa: moist exchange surface within the body

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

An average American consumes more than fifty pounds of artificial sweeteners per year, which is a 300 percent increase since 1965. Much of the increase is due to the popularity of diet soft drinks. *[Photograph by Kelly A. Quin. Reproduced by permission.]*

overweight: weight above the accepted norm based on height, sex, and age

calcium: mineral essential for bones and teeth

convenience food: food that requires very little preparation for eating

fast-food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Sweet, Quick, and Easy

Since 1965, artificial sweetener use has increased threefold. At the same time, there has been a 14 percent increase in sugar use. It seems Americans are using sugar substitutes in addition to, rather than in place of, sugar. The current consumption of all types of sweeteners is 150 pounds per capita, 99 pounds of which is sugar. According to the USDA Food Guide Pyramid, sugar and sweets should be consumed sparingly. America's preference for sweets only adds to the growing problem of an **overweight** population.

Most sweeteners are consumed in soft drinks. According to the United States Department of Agriculture (USDA) 1998 Continued Survey of Food Intakes by Individuals (CSFII), soft-drink intake has surpassed both men's and women's milk intake (since the 1989–1991 survey). Given that milk is the primary dietary **calcium** source, this trend has contributed to low calcium levels. Total soft-drink use has increased by 300 percent since the 1950s. In 1974 alone, nearly 4.5 billion cases of soft drinks were sold. It has since become nearly impossible to estimate the annual soft-drink consumption of the United States.

The introduction of the Swanson TV dinner in 1953 started the trend for **convenience foods**. In addition, fewer meals are prepared at home as more women have joined the workforce. About 25 percent of calories eaten by adult men and women are eaten away from home (according to the 1998 CSFII, which covered the years 1994–1996). "Home-cooked" meals now often come prewashed, precooked, prebaked, preprocessed, and presliced. Toaster ovens, microwaves, and other home appliances have further reduced preparation times.

The completion of the national highway system in the 1950s triggered the rise of McDonald's and other road-side hamburger chains across the nation. Many meals eaten away from home now come from **fast-food** eateries. In 1978, fast-food sales totaled $9 billion—a figure that rose to $106 billion in 1998. Fast-food restaurants have beaten sit-in restaurants in sales since 1994. In addition, serving sizes have continued to increase dramatically, and fast-food diets are low in calcium, riboflavin, vitamin A, folic acid, and vitamin C, as well as being high in fat and **saturated fat**.

Portion Sizes, Caloric Intake, and Obesity

Scientists have begun to trace the link between portion sizes and increased obesity in the United States. According to the Centers for Disease Control and Prevention, between 1971 and 2000 American women increased the number of calories they consumed by 22 percent (from 1,542 to 1,877 per day), while men increased their intake by 7 percent (from 2,450 to 2,618 calories). Government recommendations, by contrast, are a mere 1,600 calories a day for women and 2,200 a day for men. Many of the additional calories consumed have come from carbohydrates, which has led some scientists to theorize that an increased emphasis on reducing saturated fat in diets led people to believe they could consume all the carbohydrates they wanted. Moreover, many more meals are now consumed outside the home, and serving sizes at national restaurant chains have become two to five times larger than they were in the 1970s. Cookbook publishers have followed suit by increasing portion sizes in recipes. During the thirty-year period covered by the study, obesity rates doubled, and two-thirds of Americans are now considered overweight.

—Paula Kepos

AMERICAN DIETARY TRENDS, BY DECADE

	Historical Events	Food Trends of the Time
1950–1959	- Mothers returning to the home after the war effort - Postwar baby boom - Construction of the national highway system	- Packaged meals available - First TV dinner (Swanson), 1953 - Rise of hamburger chains along highways; Oscar Mayer "Wiener-Mobile"
1960–1969	- Growing middle class with money to spend - Growing social unrest over the Vietnam War in late 1960s	- Introduction of Julia Child's French cooking - "Hippies" bring back demand for unprocessed, made-from-scratch foods - Vegetarian trend starts
1970–1979	- End of Vietnam War - Watergate scandal - Growing inflation - Major influx of Asians due to Immigration Act of 1965	- Continued demand for organic and fresh: "California Cuisine" - Elaborate dinner parties with ethnic dishes - Growing appetite for Asian cuisine
1980–1989	- Stock market plummet of 1987	- "Nouvelle Cuisine" is the thing du jour–diners willing to pay more to eat less - Return to simplicity in late 1980s - Exploration of different tastes (e.g., TexMex, Ethiopian, Southwestern)
1990–1999	- Introduction of the Internet puts foods at consumers fingertips	- Everything reduced-fat, low-fat, fat-free - Naturally healthy cuisines (Mediterranean) - New movement toward simplicity

Nutritional Adequacy

Many adult women fail to meet the **Recommended Dietary Allowances** (RDAs) for calcium, vitamin E, vitamin B_6, magnesium, and **zinc**. Adult men fall short on vitamin E, magnesium, and zinc. Men consume about 4,000 milligrams of sodium each day, while women consume about 3,000. Both exceed the recommended level of no more than 2,400 milligrams of sodium per day.

All age groups above age two exceed the recommended intake of fat (no more than 30 percent of calories) and saturated fat (no more than 10 percent of calories). **Cholesterol** consumption is within the recommendation of no more than 300 milligrams per day. **Iron** intake is often low, especially in adolescents and adult women, and iron-deficiency **anemia** is higher in these groups than in any other. Low calcium intake is of particular concern in adolescent girls and pregnant women.

The main shortcoming of the American diet is the surplus of **energy** (calories). Over one third of adult Americans are **obese** (and many more are overweight), and a growing number of children are overweight. The reason for this increasing trend is two-fold: energy consumption is up, and activity levels are down.

The Third National Health and Nutrition Examination Survey (NHANES III), carried out between 1988 and 1994, showed an increase of between 100 and 300 calories in daily energy intake since NHANES II (1976 to 1980). In addition, a 1993 survey of 87,000 adults undertaken by the Center for Disease Control and Prevention (CDC) showed that 58.1 percent of Americans engaged in little or no physical activity. This lack of exercise, coupled with increased food intake, contributes to many **chronic** diseases, such as **cardiovascular** disease, certain types of **cancer**, and **diabetes**.

Although awareness about proper diet has increased, most Americans do not follow the recommended guidelines for healthful eating. Fast-food

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

Recommended Dietary Allowances: nutrient intake recommended to promote health

zinc: mineral necessary for many enzyme processes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

iron: nutrient needed for red blood cell formation

anemia: low level of red blood cells in the blood

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

obese: above accepted standards of weight for sex, height, and age

chronic: over a long period

cardiovascular: related to the heart and circulatory system

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

and convenience-food consumption, snacking, supplementation, and soft-drink use have all increased. Many Americans do not meet the RDAs for key nutrients, yet they exceed their caloric requirements, leading to an increasingly overweight population. Future trends will likely include a higher demand for safer, quicker, and more convenient fast foods that also provide the health benefits Americans need. SEE ALSO CONVENIENCE FOODS; FAST FOODS; OBESITY; RECOMMENDED DIETARY ALLOWANCE.

Kirsten Herbes

Bibliography

Duyff, Roberta L. (1998). *The American Dietetic Association's Complete Food & Nutrition Guide.* Minneapolis, MN: Chronimed.

Mahan, L. Kathleen, and Escott-Stump, Sylvia, eds. (2000). *Krause's Food, Nutrition, & Diet Therapy*, 10th edition. Philadelphia: W. B. Saunders.

McIntosh, Elaine N. (1995). *American Food Habits in Historical Perspective.* Westport, CT: Praeger.

Root, Waverley, and de Rochemont, Richard (1995). *Eating in America: A History.* Hopewell, NJ: Ecco Press.

Internet Resources

Clagett Farm. "From Farm to Table: Dietary Trends." Available from <http://www.clagettfarm.org>

Food Surveys Research Group. "What We Eat in America." Available from <http://www.barc.usda.gov/bhnrc/foodsurvey>

National Center for Health Statistics. "Survey and Data Collection Systems." Available from <http://www.cdc.gov/nchs>

Tufts Center on Nutrition Communication. "Nutrition Navigator." Available from <http://www.navigator.tufts.edu>

Wilkinson Enns, Cicilia; Goldman, Joseph D.; and Cook, Annetta (1997). "Trends in Food and Nutrition Intakes by Adults: NCFS 1977-78, CSFII 1989-91, and CSFII 1994-95." Family Economics and Nutrition Review 10(4):2–15. Available from <http://www.barc.usda.gov/bhnrc/foodsurvey>

Dietary Trends, International

What foods an individual eats is affected by the ability to access foods. Economic status, geography, and politics have influenced the diets of people throughout history. Poverty is linked to **malnutrition**, while economic growth and a rise in population pose new nutritional problems. Ironically, diets high in complex **carbohydrates** and **fiber** in poor economic times give way to consumption of foods high in sugars and **fat** when economic conditions improve.

malnutrition: chronic lack of sufficient nutrients to maintain health

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fiber: indigestible plant material that aids digestion by providing bulk

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

diet: the total daily food intake, or the types of foods eaten

Between 1995 and 1997, among countries that showed an increase in per capita incomes, average caloric consumption also showed a significant increase. Between 1970 and 1972, and between 1996 and 1997, world consumption of **calories** from complex carbohydrates fell by 30 percent while the consumption of calories from meat increased by a third (33%) and those from vegetable oil by almost half (46.2%). As nations become wealthier, people move from eating "a poor man's **diet**" of high levels of grains, fruits, and vegetables to consuming diets with more fats and sugar. Fat still remains the food for the rich—with more income, people start to eat more meat and poultry, and vegetable oils become more available. Combined with cane and corn sugars, vegetable oils are used to produce baked goods and snack foods high in calories.

Young Chinese attend a weight-loss lecture in Shanghai. A trend toward obesity in many nations is accompanied by obsession over body image. During 2002, several citizens of Asian nations died and hundreds were sickened when they took a popular diet pill that was known to cause health problems. *[AP/Wide World Photos. Reproduced by permission.]*

The Westernization of Dietary Patterns

Toward the end of the twentieth century, economic growth among developing countries caused the phenomenon of the Westernization of traditional eating patterns. Industrialization and modern transportation brought baking technology and Western food styles to developing countries. New and tasty foods high in fat, sugar, and salt became the choice of the new rich. Trendy fast foods, soft drinks, and meat products replaced traditional ethnic foods.

Fortunately, in many emerging societies the poor are still unable to afford Western fast foods, and are thus spared the ills of high consumption of fats, meat, and sugars. For example, many people in India still spend more than half their income on food consumed at home, compared to the average American, who spends less than 8 percent of his or her disposable income on home-cooked food.

The American diet, much like that of many industrialized nations, derives its calories from fats, sugars, and animal products in foods prepared or processed away from home. One out of every three meals in America is consumed away from home. From 1990 to 2000 there was a 14 percent decrease in the number of meals eaten at home. In 1977 only 16 percent of all meals and snacks were eaten way from home. By 1995, this rose to 27 percent. In 1995, away-from-home foods provided 34 percent of total caloric intake, an increase from 18 percent in 1977. In addition, eating at home does not always mean cooking. Supermarkets and grocery stores provide thousands of ready-made meals, frozen foods, and processed meals that require little preparation at home.

Total fat consumption in the United States increased from 18 percent in 1977 to 38 percent in 1995. According to Lin and Frazao, away-from-home foods deliver more calories in fat and **saturated fat** and are lower in fiber and **calcium** than home-cooked foods. The average total calories consumed by Americans rose from 1,807 calories in 1987 to 2,043 calories in

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

calcium: mineral essential for bones and teeth

1995. Since away-from-home foods deliver more fat and more calories, the trend of eating out can become a health hazard. People tend to eat more from restaurants and **fast-food** places because many eating establishments "supersize" their portions. Customers feel that they get their money's worth when they receive more food than they need.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Influence of Diet on Health

Childhood and adulthood **obesity** are on the rise. Between 1988 and 1994, 11 percent of U.S. children and adolescents aged six to nine years of age were **overweight** or **obese**. During this same period, 35 percent of the American adult population aged twenty and over were obese, compared to 25 percent during the years 1976 through 1980. The rising trend in obesity pervades the Middle East, the Caribbean, Europe, Latin America, Brazil, Japan, South East Asia, Australia, and China.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

Since being overweight is associated directly with many **chronic** illnesses, such as **heart disease**, **hypertension**, **hyperlipidemia**, **cancer**, **stroke**, and **type II diabetes**, an increase in the **incidence** of overweight and obesity is a serious concern. The top three leading causes of death in the United States during the 1990s were heart disease, cancer, and stroke. Diabetes ranked seventh in 1997—it was not even in the top ten in 1987. The U.S. Surgeon General reported in 1998 that type II diabetes, an adult health problem related to obesity, was being seen in children as young as four years old. Diabetes among adults increased by 70 percent between 1990 and 1998 among individuals 30 to 39 years of age; by 41 percent among individuals 40 to 49; and by 31 percent among those 50 to 59. By 1998, 16 million American adults suffered from diabetes. In addition to the health threat, obesity can cause emotional pain due to social stigmatization, discrimination, and lowered self-esteem. In 2000, the World Health Organization estimated that there are 1.2 billion obese individuals around the world.

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

hyperlipidemia: high levels of lipids (fats or cholesterol) in the blood

cancer: uncontrolled cell growth

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

type II diabetes: Inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

incidence: number of new cases reported each year

Food Safety

The increase in the number of fast-food restaurants, supermarkets, and restaurants in developing countries, and the rising trend of eating meals away from home, present a global challenge to ensure that food is appealing and safe. Many countries have agencies that set and regulate standards for food safety. In the United States, the U.S. Department of Agriculture (USDA) has the task of regulating and inspecting meats and poultry during slaughter and processing, while the Food and Drug Administration (FDA) is responsible for conducting tests, setting standards, and enforcing laws regulating food quality and processing. FDA inspectors check restaurants to make sure that they practice food safety regulations. FDA officials also review the safety of chemicals that manufacturers use as **food additives**. Importing foods from countries where food safety is not strictly monitored presents a global health threat.

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

The biggest problem with food safety is **food poisoning**. Some **bacteria** and **viruses** that cause food poisoning are: *Escherichia coli*, *Salmonella*, *Listeria monocytogenes*, *Shigella*, *Campylobacter*, and *yersinia*. Bacteria, viruses, **toxins**, **parasites**, and chemical contaminants can all cause food-borne illnesses, and it takes only a small amount of contaminated food to cause severe food illnesses.

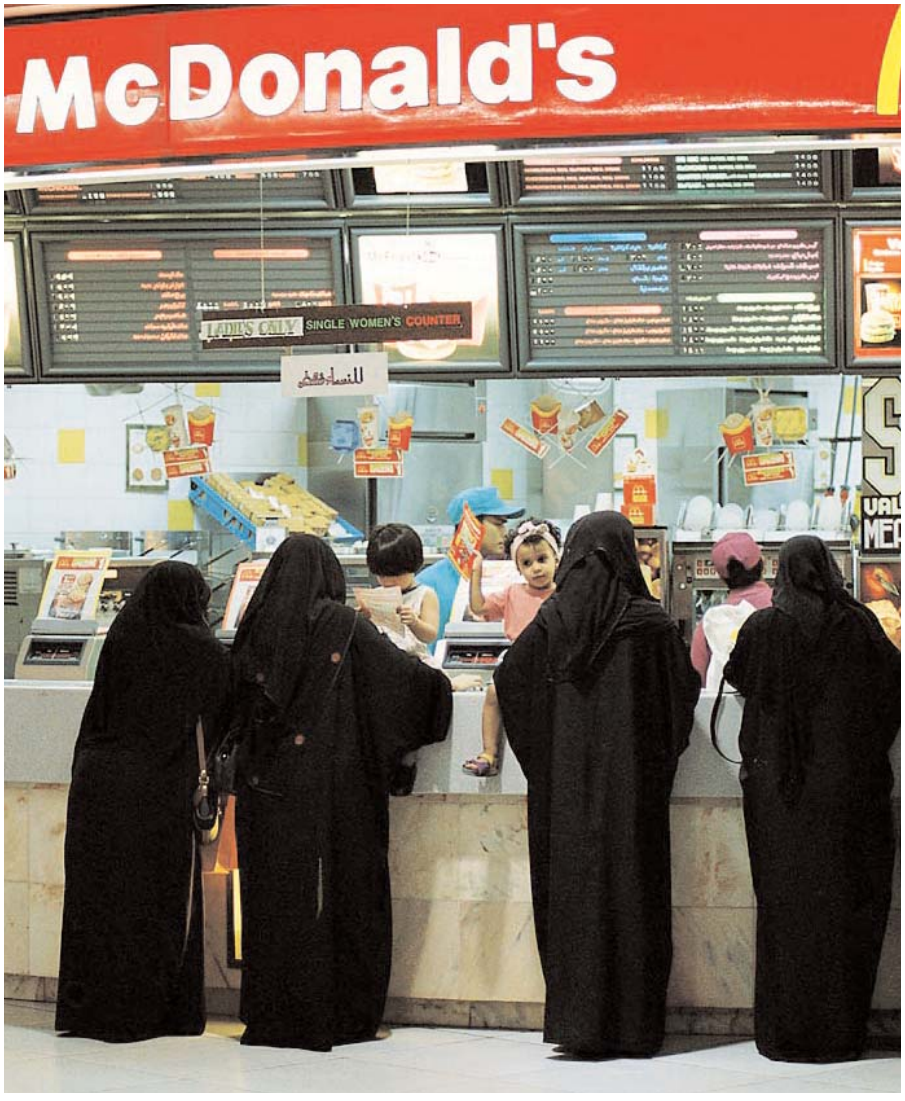
food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

toxins: poison

parasite: organism that feeds off of other organisms



Abaya-wearing women in Saudi Arabia wait in the ladies-only line to order a quick meal. In developing nations, the popularity of fast-food alternatives to traditional cuisines has prompted debate over the nutritional and cultural impacts of Westernization. *[Photograph by Saleh Rifai. AP/Wide World Photos. Reproduced by permission.]*

Signs and symptoms of food-borne illness may present within thirty minutes of eating contaminated food, or they may not show up for up to three weeks. While some food-borne illnesses may last for a couple of days, some may last for weeks. Severe cases can be life threatening. SEE ALSO CONVENIENCE FOODS; FAST FOODS; OBESITY.

Kweethai C. Neill

Bibliography

Centers for Disease Control and Prevention (1997). "Update: Prevalence of Overweight Among Children, Adolescents, and Adults—United States, 1988–1994." *Mortality and Morbidity Weekly Report* 46:199–202.

Lin, B. H., and Frazao, E. (1977). "The Nutritional Quality of Foods at and Away from Home." *Food Review* 20:33–40.

Internet Resources

Centers for Disease Control and Prevention (2000). "Major Increase in Diabetes among Adults Occurred Nationwide between 1990 and 1998." Available from <http://www.cdc.gov>

International Obesity Task Force. "The Global Epidemic of Obesity." Available from <http://www.iotf.org/publications/Newsletter/spring97.htm>

Dietetic Technician, Registered (DTR)

nutrition: the maintenance of health through proper eating, or the study of same

diet: the total daily food intake, or the types of foods eaten

A dietetic technician, registered (DTR) is a professional who is knowledgeable about food, **nutrition**, and **diet** therapy, which is the use of diet and nutrition in the treatment of diseases. A person seeking DTR credentials must complete a two-year associate's degree in an accredited dietetic technician (DT) program, a minimum of 450 hours of supervised practice experience (gained under the direction of an accredited DT program), and successfully complete the national registration examination for DTR.

The goal of a DTR is to provide safe and effective food and nutrition services to the public. DTRs work independently or with registered dietitians in a variety of settings, such as hospitals, food service operations, and public health. Thus, they may provide nutrition services to individuals, manage food service operations, or provide nutrition education. SEE ALSO American Dietetic Association; Careers in Dietetics.

Susan Himburg

Bibliography

Payne-Palacio, June, and Canter, Deborah D. (2000). *The Profession of Dietetics: A Team Approach*, 2nd edition. Upper Saddle River, NJ: Prentice Hall.

Winterfeldt, Esther A.; Bogle, Margaret L.; and Ebro, Lea L. (1998). *Dietetics: Practice and Future Trends.* Gaitherburg, MD: Aspen.

Internet Resources

American Dietetic Association. "Careers in Dietetics." Available from <http://www.eatright.org/>

Florida Area Health Education Center. "Careers in Health." Available from <http://www.flahec.org/hlthcareers>

Dietetics

nutrient: dietary substance necessary for health

Dietetics is the study of food, food science, and nutrition, and of the interactions of food and **nutrients** in people and populations. It can also refer to the management of food service and the provision of health guidance in a variety of settings, including hospitals, nursing homes, health departments, clinics, and in private practice.

The study of dietetics prepares students to apply the principles of food, nutrition, and food service management to caring for the health of individuals and groups of people. Individuals who graduate from an approved dietetics program are eligible to take the RD (registered dietitian) examination. The goal of dietetics programs, which are offered at both undergraduate and graduate levels, is to promote health and decrease disease by training health care professionals in nutrition science, thus enabling them to foster good nutritional health for individuals and diverse populations across the lifespan. These programs also provide information on health care policy and administration, delivery systems, reimbursement issues, and regulations. SEE ALSO American Dietetic Association; Careers in Dietetics; Dietetic Technician, Registered; Dietitian; Nutritionist.

Delores Truesdell

Bibliography

Payne-Palacio, June, and Canter, Deborah D. (2000). *The Profession of Dietetics: A Team Approach*, 2nd edition. Upper Saddle River, NJ: Prentice Hall.

Internet Resource

American Dietetic Association. "Careers in Dietetics." Available from <http://www.eatright.org>

Dieting

The term *dieting* refers to restrictive eating or nutritional remedies for conditions such as iron-deficiency **anemia**, **gastrointestinal** diseases, pernicious anemia, **diabetes**, **obesity**, or **failure to thrive**. Someone can be on a heart-healthy **diet** that encourages the consumption of reasonable amounts of whole grains and fresh fruits, vegetables, beans, and fish, but limits foods high in **saturated fat** and sodium, or one can be on a weight loss diet. Examples of weight loss diets include: the Atkins New Diet Revolution, the Calories Don't Count Diet, the Protein Power Diet, the Carbohydrate Addict's Diet, and Weight Watchers. There is a lack of research, however, on whether these diets (except for Weight Watchers) are helpful, especially over the long term (defined as two to five years from the date of weight loss).

anemia: low level of red blood cells in the blood

gastrointestinal: related to the stomach and intestines

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

failure to thrive: lack of normal developmental progress or maintenance of health

diet: the total daily food intake, or the types of foods eaten

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

The recommended approach to dieting for weight loss is to eat in moderation so as to control calories (do not go below 1,200 per day) and to increase activity to lead to a gradual, safe weight loss. A recommended method is to decrease calories each day by 125 (the amount in a small soft drink or full cup of juice) and to increase **energy** expenditure by 125 (walking for about 30 minutes). That is, a 250-calorie deficit a day should result in about a one- to two-pound weight loss over the course of a month. The goal is to slowly change eating and exercise routines and maintain a lifelong healthy weight. Quicker weight losses are hard to maintain. Most people can lose weight on any diet, even on fad diets, but the trick is to keep the weight off.

So-called fad diets are diets that come and go in the marketplace and are typically deficient in various ways. For example, they may lack variety (e.g., the Grapefruit Diet, the Cabbage Soup Diet), be too low in calories and protein (the Rice Diet), and/or simply too bizarre (the Rotation Diet for food **allergies**). People should be especially wary of any "breakthrough" quick-fix diets. If a diet sounds too good to be true, it probably is.

allergy: immune system reaction against substances that are otherwise harmless

Delores Truesdell

Bibliography

Alford, B. B.; Blankenship, A. C.; and Haen, R. D. (1990). "The Effects of Variations in Carbohydrate, Protein, and Fat Content of the Diet upon Weight Loss, Blood Values, and Nutrient Intake of Adult Obese Women." *Journal of the American Dietetic Association* 90:534–540.

Golay, A., et al. (1996). "Similar Weight Loss with Low- or High-Carbohydrate Diets." *American Journal of Clinical Nutrition* 63:174–176

Leeds, M. J. *Nutrition for Healthy Living.* WCB McGraw-Hill.

Ornish, D.; Scherwitz, L. W.; Billings, J. H.; et al. (1998). "Intensive Lifestyle Changes for Reversal of Coronary Heart Disease." *Journal of the American Medical Association* 280:2001–2007.

Internet Resource

Larsen, Joanne. "Fad Diets." Available from <www.dietitian.com>

Dietitian

nutrition: the maintenance of health through proper eating, or the study of same

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

internship: training program

A dietitian is a professional nutritionist—an educated food and **nutrition** specialist who is qualified by training and examination to evaluate people's nutritional health and needs. Most dietitians are registered and are referred to as RDs. To become an RD, a person must earn an undergraduate degree in nutrition, food science, or food management, including courses in several other related subjects (chemistry, anatomy and **physiology**, management, psychology, etc.); complete a 900-hour **internship**; pass a national exam administered by the Commission on Dietetic Registration (the credentialing arm of the American Dietetic Association), and maintain up-to-date knowledge and registration by participating in required continuing education activities, such as attending workshops, doing research, taking courses, or writing professional papers.

entrepreneur: founders of new businesses

clinical: related to hospitals, clinics, and patient care

diabetes: inability to regulate level of sugar in the blood

cancer: uncontrolled cell growth

Administrative dietitians are sometimes called dietary directors. They are **entrepreneurs**, disturbance handlers, resource allocators, and negotiators who work in local health departments or manage the **clinical** and food service systems in hospitals, correctional facilities, or long-term care institutions. Clinical dietitians or nutrition managers provide patient care in hospitals and in outpatient clinics especially related to **diabetes** and **cancer**. Nutrition-support-team dietitians coordinate nutrition care with other health care professionals; they may work in teaching hospitals, outpatient clinics, or in pediatric and diabetes clinics. In school food service, dietitians manage the overall operation, including the purchasing of food. In the food and pharmaceutical industry, dietitians conduct research, develop and market products, and represent companies at various food and health shows.

A clinical dietitian helps her patient design a nutritious weight-loss program. Such work is increasingly valuable in the United States, where three out of five adults are overweight or obese. *[© 1992 SIU Biomed Comm. Custom Medical Stock Photo. Reproduced by permission.]*

Some states require people who provide nutrition advice to be licensed, but not necessarily registered. Others allow anyone to use the title *nutritionist*. However, the title *registered dietitian* is usually used only by those who have completed the appropriate course work. The purpose of registration is to protect the health and welfare of the public by encouraging high standards of performance. SEE ALSO AMERICAN DIETETIC ASSOCIATION; CAREERS IN DIETETICS; DIETETICS.

Delores Truesdell

Bibliography

Hudson, Nancy R. (2000). *Management Practice in Dietetics*. Belmont, CA: Wadsworth.

Whitney, Eleanor N., and Rolfes, Sharon R. (2002). *Understanding Nutrition*, 9th edition. Belmont, CA: Wadsworth.

Digestion and Absorption

Digestion is the breakdown of food into smaller particles or individual **nutrients**. It is accomplished through six basic processes, with the help of several body fluids—particularly digestive juices that are made up of compounds such as saliva, mucus, **enzymes**, hydrochloric acid, bicarbonate, and **bile**.

The six processes of digestion involve: (1) the movement of food and liquids; (2) the lubrication of food with bodily secretions; (3) the mechanical breakdown of **carbohydrates**, fats, and **proteins**; (4) the reabsorption of nutrients—especially water; (5) the production of nutrients such as vitamin K and **biotin** by friendly **bacteria**; and (6) the excretion of waste products. Comprehension of the tasks or processes needed to break down food are essential to an understanding of how and when food really begins to function within the body. For example, not understanding that carbohydrates break down into **glucose** could lead one to believe that the best source of glucose is in liquid form such as a soft drink. This could cause one to miss out on the nutrients (and great taste) in fruits, vegetables, and grains. Likewise, not understanding the digestion process could lead a person to believe in the myth of "food combining," or perhaps to think it is normal to be hungry all the time. But, in fact, the digestive processes normal to human **physiology** can simultaneously handle carbohydrates, fats, and proteins—and allow people to go several hours between meals, especially if meals are balanced in **fiber** and the individual nutrients needed.

nutrient: dietary substance necessary for health

enzyme: protein responsible for carrying out reactions in a cell

bile: substance produced in the liver which suspends fats for absorption

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

bacteria: single-celled organisms without nuclei, some of which are infectious

glucose: a simple sugar; the most commonly used fuel in cells

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

fiber: indigestible plant material that aids digestion by providing bulk

GI Tract Physiology

Digestion begins in the mouth with the action of salivary amylase. The food material then progresses past the esophagus and into the stomach. A bolus (soft mass) of chewed food moves by muscular wave actions, called *peristalsis*, from the mouth to the pharynx, and then past the epiglottis that covers the larynx. The epiglottis closes off the air passage so that one doesn't choke. The cardiac sphincter prevents reflux of stomach contents into the esophagus.

From the Stomach to the Small Intestine

Food mixtures leaving the stomach are called *chyme*, and this empties into the small intestine after about two to four hours in the stomach. The small

intestine is where most digestion takes place. A pyloric sphincter controls the rate of flow of chyme from the stomach into the small intestine.

Most digestion occurs in the upper portion of the small intestine, called the *duodenum*. Below the duodenum is the *jejunum*, and then there is the last segment, called the *ileum*. About 5 percent of undigested food products are broken down in the ileum. This is why some people can have a small part of their intestine removed and still seem to digest most foods with little problem.

Digestion of food that enters the small intestine is usually complete after three to ten hours. Once digestion is essentially finished, waste products leave the ileum with the help of fiber, and these solids then enter the large intestine (the colon). In the colon, water is reabsorbed; some nutrients are produced by friendly bacteria (vitamin K, biotin, vitamin B_{12}); fibers are digested to various acids and gases; and **minerals**, such as potassium and sodium, are reabsorbed (when needed). Any fiber that is not broken down—and small amounts of other undigested products—are excreted in the feces.

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Protective Factors

During digestion in the stomach, large proteins break down into smaller protein forms, and harmful bacteria can become inactive. Hydrochloric acid is especially important for this because it lowers the **pH** of the stomach contents below 2. Along with the uncoiling of protein in the stomach, a little carbohydrate and lipid are broken down with the help of enzymes (called *amylase* and *lipase*, respectively).

pH: level of acidity, with low numbers indicating high acidity

In the stomach, carbohydrates in foods turn to starch, but it is not until the chyme reaches the small intestine and becomes more neutralized that starch turns to simple sugars that are then absorbed into the portal vein, which transports them to the liver. Also in the small intestine, lipids (mostly in the form of **triglycerides**) are emulsified and form **monoglycerides** and free **fatty acids** that can then go through the **lymph system** to the heart and bloodstream.

triglyceride: a type of fat

monoglyceride: breakdown product of fats

fatty acids: molecules rich in carbon and hydrogen; a component of fats

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

As previously mentioned, the mouth, stomach, small intestine, and colon are the major organs of digestion. However, the liver, gallbladder, and pancreas are also important to the process. The liver detoxifies foreign compounds, such as natural **toxicants** in foods and **drugs**. The liver also makes bile, an emulsifier, which enters the small intestine and prepares fats and oils for digestion. This bile is stored in the gallbladder prior to delivery to the small intestine. A **hormone** called *cholecystokinin* helps control the release of bile.

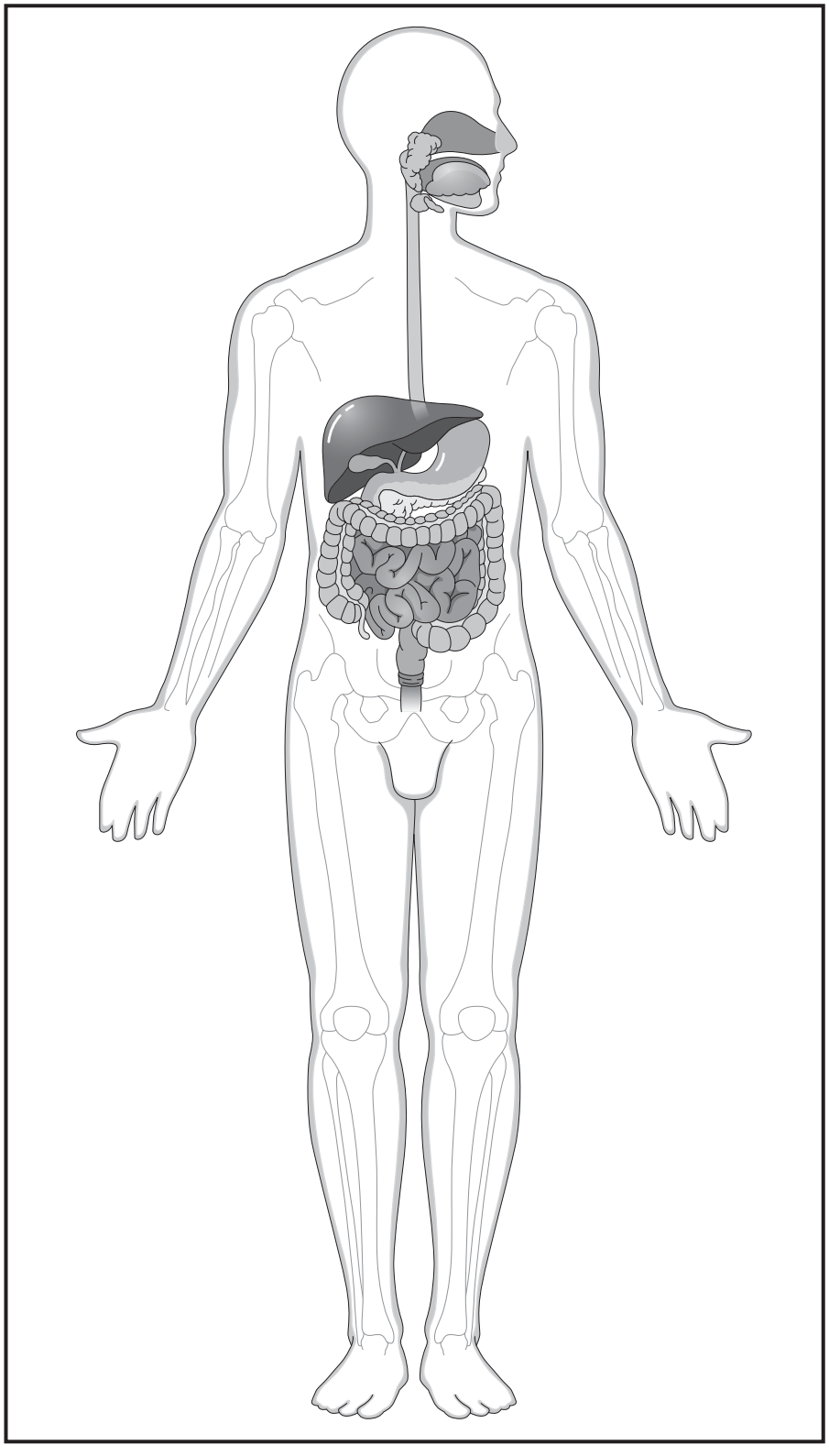
toxicant: harmful substance

drugs: substances whose administration causes a significant change in the body's function

hormone: molecules produced by one set of cells that influence the function of another set of cells

The pancreas makes pancreatic juice consisting of enzymes (amylases, lipases, and proteases) and bicarbonate, which helps neutralize acidic secretions produced during digestion. The pancreas delivers the pancreatic juice to the small intestine, in response to a signal of food in the intestine and the release of the hormone *secretin*. The pancreas also has another function, the secretion of the hormones *insulin* and *glucagon*, which helps maintain a steady state of blood sugar in the body (insulin decreases blood glucose concentration, while glucagon increases it).

Food moves from the mouth to the epiglottis, bypassing the trachea, into the esophagus, past the cardiac sphincter into the stomach, past the pyloric valve into the small intestine (duodenum, jejunum, ileum), and then



The tract running from the esophagus to the large intestine is called the alimentary canal, and it is where most digestion occurs. As food is pushed through the system, it encounters numerous specialized processes that act on it in different ways, extracting nutrients and rejecting waste. *[Illustration by Argosy. The Gale Group.]*

past the ileocecal valve into the colon. Waste then leaves the colon through the rectum and anus. When chyme reaches the small intestine, the pancreas and liver contribute to the digestion by providing products such as bicarbonate, enzymes, and bile.

Absorption

molecule: combination of atoms that form stable particles

gastrointestinal: related to the stomach and intestines

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Absorption is the movement of **molecules** across the **gastrointestinal** (GI) tract into the circulatory system. Most of the end-products of digestion, along with **vitamins**, minerals, and water, are absorbed in the small intestinal lumen by four mechanisms for absorption: (1) active transport, (2) passive diffusion, (3) endocytosis, and (4) facilitative diffusion. Active transport requires **energy**.

Nutrient absorption is efficient because the GI tract is folded with several surfaces for absorption and these surfaces are lined with villi (hairlike projections) and microvilli cells. As one nutrition textbook puts it, each person has a surface area "equivalent to the surface of a tennis court" packed into his or her gut (Insel et al., p. 81). Efficient absorption can be compromised due to **lactose intolerance**. Lactose intolerance is not uncommon in the world, affecting about 25 percent of the U.S. population and 75 percent of the worldwide population. It is usually due to the lack or absence of the enzyme *lactase*, which breaks down milk sugar.

lactose intolerance: inability to digest lactose, or milk sugar

allergy: immune system reaction against substances that are otherwise harmless

Lactose intolerance is not a food **allergy**. Food allergies are serious, even life threatening, but most people with lactose intolerance can digest small amounts of milk, especially in yogurt and cheese.

amino acid: building block of proteins, necessary dietary nutrient

lipid: fats, waxes, and steroids; important components of cell membranes

Protein, carbohydrate, lipid, and most vitamin absorption occur in the small intestine. Once proteins are broken down by proteases they are absorbed as dipeptides, tripeptides, and individual **amino acids**. Carbohydrates, including both sugar and starch molecules, are broken down by enzymes in the intestine to disaccharides called *sucrose*, *lactose*, and *maltose*, and then finally into the end-products known as *glucose*, *fructose*, and *galactose*, which are absorbed mostly by active transport. Lipase, an enzyme in the pancreas and the small intestine, and bile from the liver, break down **lipids** into fatty acids and monglycerides; these end-products then are absorbed through villi cells as triglycerides.

Alcohol is not a nutrient, but 80 percent of consumed alcohol is absorbed in the small intestine. The other 20 percent is absorbed into the stomach. Alcohol is absorbed by simple diffusion, which explains why **gastric ulcers** are not uncommon in people who drink excessively.

gastric: related to the stomach

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

Coordination and Transport of Nutrients into the Blood or to the Heart

nervous system: the brain, spinal cord, and nerves that extend throughout the body

stress: heightened state of nervousness or unease

Hormones and the **nervous system** coordinate digestion and absorption. The presence of food, or the thought or smell of food, can cause a positive response from these systems. Factors that can inhibit digestion include **stress**, cold foods, and bacteria.

water-soluble: able to be dissolved in water

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

After foods are digested and nutrients are absorbed, they are transported to specific places throughout the body. **Water-soluble** nutrients leave the GI tract in the blood and travel via the portal vein, first to the liver and then to the heart. Unlike the vascular system for water-soluble nutrients, the **lymphatic system** has no pump for fat-soluble nutrients; instead, these nutrients eventually enter the vascular system, though they bypass the activity of the liver at first. SEE ALSO Bioavailability; Eating Habits; Insulin; Nutrition.

Delores Truesdell

Bibliography

Insel, Paul; Turner, Elaine; and Ross, Don (2004). *Nutrition*, 2nd edition. Sudbury, MA: Jones and Bartlett.

Wardlaw, Kessel (2002). *Perspectives in Nutrition*, 5th edition. Boston: McGraw-Hill.

Whitney, E. N., and Rolfes, S. R. *Understanding Nutrition*, 9th edition. Belmont, CA: Wadsworth.

Disaster Relief Organizations

Natural disasters, as well as some human-caused disasters, lead to human suffering and create needs that the victims cannot alleviate without assistance. Examples of disasters include hurricanes, tornadoes, floods, earthquakes, drought, blizzards, **famine**, war, fire, volcanic eruption, a building collapse, or a transportation wreck. When any such disaster strikes, a variety of international organizations offer relief to the affected country. Each organization has different objectives, expertise, and resources to offer, and several hundred may become involved in a single major disaster. International disaster relief on such a large scale must be properly coordinated to avoid further chaos and confusion both during and after the disaster.

famine: extended period of food shortage

Assessment

In the event of a disaster, the government of the affected country must conduct a **needs assessment** to determine what emergency supplies and personnel are required. These needs should be communicated to those relief organizations that will potentially provide assistance. The process of requesting and receiving supplies is lengthy and includes many events that could delay the arrival of assistance. Requests for assistance must first be reviewed and approved by relief organizations, and then supplies and personnel must be collected and transported to the disaster site. Effective management of relief assistance depends on anticipating and identifying problems, and on delivering specific supplies and personnel at the times and places they are needed.

needs assessment: formal procedure for determining needs

Health Risks

Disasters often pose significant health threats. One of the most serious concerns after a disaster, especially a natural disaster, is sanitation. Disruptions in water supplies and sewage systems can pose serious health risks to victims because they decrease the amount and quality of available drinking water and create difficulties in waste disposal. Drinking water can be contaminated by breaks in sewage lines or the presence of animal cadavers in water sources. These factors can facilitate the spread of disease after a disaster. Providing **potable** drinking water to victims and adopting alternative methods of sanitation must be a priority after a disaster.

potable: safe to drink

Food shortages are often an immediate health consequence of disasters. Existing food stocks may be destroyed or disruptions to distribution systems may prevent the delivery of food. In these situations, food relief programs should include the following elements: (1) assessment of food supplies available after the disaster, (2) determination of the nutritional needs of victims, (3) calculation of daily food needs, and (4) surveillance of victims' nutritional

A woman gets her monthly distribution of food at a disaster-relief center in Baghdad. Following the 2003 war in Iraq, hundreds of relief agencies provided support to affected citizens. *[Photograph by Caroline Penn. Corbis. Reproduced by permission.]*

status. Some populations are particularly susceptible to **malnutrition**, such as children under five years of age and pregnant women. In addition to food, these populations should be given nutritional supplements whenever possible.

malnutrition: chronic lack of sufficient nutrients to maintain health

After a disaster, victims must be protected from hazardous climatic conditions, such as severe temperatures or precipitation. People should be kept dry, reasonably well clothed, and able to access emergency shelter.

Disasters can also cause disruptions to the health care infrastructure. Hospitals and health centers may suffer structural damage, or health personnel may be among the casualties, limiting the ability to provide health services to disaster victims. Emergency Health Kits that contain essential medical supplies and **drugs** are often provided to victims as part of the immediate response to disasters. Developed through the collaboration of various relief organizations, these kits are designed to meet the primary health care needs of people without access to medical facilities. Each kit covers the needs of about 10,000 persons for three months, at a cost of about fifty cents per person. The twelve essential drugs in the basic kit include anti-inflammatories, an antacid, a disinfectant, oral **dehydration** salts, an antimalarial, a basic **antibiotic** (effective against the most common **bacteria**), and an ointment for eye infections. These medicines can treat the most common illnesses of disaster victims, such as **anemia**, pain, diarrhea, fever, respiratory tract infections, eye and ear infections, measles, and skin conditions. The basic kit also includes simple medical supplies such as cotton, soap, bandages, thermometers, some medical instruments, health cards and record books, and items to help create a clean water supply.

drugs: substances whose administration causes a significant change in the body's function

dehydration: loss of water

antibiotic: substance that kills or prevents the growth of microorganisms

bacteria: single-celled organisms without nuclei, some of which are infectious

anemia: low level of red blood cells in the blood

Risk of Disease

Natural disasters do not usually result in infectious disease outbreaks. However, certain circumstances can increase the chance for disease transmission. Immediately after a disaster, most increases in disease **incidence** are caused

incidence: number of new cases reported each year

INTERNATIONAL DISASTER RELIEF ORGANIZATIONS AND AGENCIES

Organization or Agency Name	Services
Adventist Development and Relief Agency International (ADRA)	Provides immediate disaster relief; supports development programs in community development, construction, and agriculture
Church World Service (CWS)	Provides material aid to refugees and disaster victims; supports development programs in agriculture, energy, soil conservation, reforestation, preventive medicine, sanitation, and potable water supply
Cooperative for Assistance and Relief Everywhere (CARE)	Provides refugee and disaster relief; supports development programs in reforestation, conservation, and agriculture
Direct Relief International (DRI)	Specializes in emergency health care, providing pharmaceuticals, medical supplies, and equipment in famine, refugee, and disaster-affected areas
Disaster Preparedness and Emergency Response Association (DERA)	Assists international communities in disaster preparedness, response, and recovery; serves as a professional association linking disaster relief personnel
Food for the Hungry (FH)	Provides food aid and disaster relief supplies; provides technological support to eliminate hunger
League of Red Cross and Red Crescent Societies (LICROSS)	Coordinates relief activities for disaster victims; provides assistance to refugees; helps countries increase their capacity to respond to humanitarian needs of victims
Lutheran World Federation (LWF)	Provides emergency relief for disaster victims; supports refugee settlement programs and a variety of development assistance activities
OXFAM International (formerly Oxford Committee for Famine Relief)	Provides assistance to people affected by emergencies, disease, famine, earthquakes, war, and civil conflict; supports long-term development programs in impoverished nations
Salvation Army World Service Office (SAWSO)	Supports a variety of programs in disaster relief, community development, food production, public health, and social welfare
United Nations Children's Fund (UNICEF)	Provides disaster and refugee assistance, particularly to children; supports programs in sanitation and water supply; promotes training and education to improve child health care
United Nations Office for the Coordination of Humanitarian Affairs (OCHA)	Responsible for the coordination of UN assistance in humanitarian crises; provides support for international policy development; advocates humanitarian issues
United States Agency for International Development (USAID)	Provides humanitarian, economic, and development assistance to the international community; houses the Office of U.S. Foreign Disaster Assistance

by fecal contamination of water and food supplies. This contamination usually results in intestinal disease. Outbreaks of communicable diseases are directly associated with population density and displacement. If disaster victims live in overcrowded conditions or are forced to leave their homes, the risk of a disease outbreak increases. An increased demand on water and food supplies, elevated risk of contamination, and disruption of sanitation services all contribute to the risk of a disease outbreak.

In the longer term after a disaster, the risk for vector-borne diseases increases. Vector-borne diseases are spread to humans by insects and other arthropods, such as ticks or mosquitoes. Vector-borne diseases are of particular concern following heavy rains and floods. Insecticides may be washed away from buildings and the number of mosquito breeding sites may increase. In addition, wild or domestic animals that have been displaced can introduce infection to humans.

International disaster relief organizations play an important role in the response to disasters. They provide valuable supplies and personnel to victims and help to minimize the social, economic, and health consequences of a disaster. Health concerns, such as potential disease outbreak, malnutrition, and poor sanitation, should be addressed immediately after a disaster to avoid serious health consequences. International relief organizations help victims fulfill unmet needs and play a vital role in effective disaster management. SEE ALSO EMERGENCY NUTRITION NETWORK; FAMINE.

Karen Bryla

Bibliography

Gorman, R. F. (1994). *Historical Dictionary of Refugee and Disaster Relief Organizations*. Metuchen, NJ: Scarecrow Press.

Internet Resources

Pan American Health Organization. "Natural Disasters: Protecting the Public's Health." Available from <http://www.paho.org>

Grantmakers Without Borders. "International Emergency Relief Links." Available from <http://www.internationaldonors.org>

Disaster Center. "Disaster Relief Agencies." Available from <http://www.disastercenter.com/agency.htm>

Pan American Health Organization. "Disasters and Humanitarian Assistance." Available from <http://www.paho.org/disasters>

UNICEF. "Emergency Health Kits." Available from <http://www.supply.unicef.dk/emergencies/healthkit.htm>

Eating Disorders

Eating disorders affect both the mind and the body. Although deviant eating patterns have been reported throughout history, eating disorders were first identified as medical conditions by the British physician William Gull in 1873. The **incidence** of eating disorders increased substantially throughout the twentieth century, and in 1980 the American Psychiatric Association formally classified these conditions as mental illnesses.

incidence: number of new cases reported each year

Diagnosis

Individuals with eating disorders are obsessed with food, body image, and weight loss. They may have severely limited food choices, employ bizarre eating **rituals**, excessively drink fluids and chew gum, and avoid eating with others. Depending on the severity and duration of their illness, they may display physical symptoms such as weight loss; **amenorrhea**; loss of interest in sex; low **blood pressure**; depressed body temperature; **chronic**, unexplained vomiting; and the growth of soft, fine hair on the body and face.

ritual: ceremony or frequently repeated behavior

amenorrhea: lack of menstruation

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

chronic: over a long period

There are various types of eating disorders, each with its own physical, **psychological**, and **behavioral** manifestations. They are classified into four distinct diagnostic categories by the American Psychiatric Association: **anorexia nervosa**, **bulimia** nervosa, **binge eating disorder**, and eating disorder not otherwise specified.

psychological: related to thoughts, feelings, and personal experiences

behavioral: related to behavior, in contrast to medical or other types of interventions

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

binge: uncontrolled indulgence

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

hormone: molecules produced by one set of cells that influence the function of another set of cells

Anorexia nervosa.

Clinically, anorexia nervosa is diagnosed as intentional weight loss of 15 percent or more of normal body weight. The anorexic displays an inordinate fear of weight gain or becoming fat, even though he or she may be extremely thin. Food intake is strictly limited, often to the point of life-threatening starvation. Sufferers may be unaware of or in denial of their weight loss, and may therefore resist treatment.

Peak ages of onset are between 12 and 13 and at age 17. Among women of menstruating age, menstruation ceases due to weight-related declines in female **hormones**.

This illness has two subtypes: the *restricting type*, in which weight loss is achieved solely via reduction in food intake, and the *binge eating/purging type*, in which anorexic behavior is accompanied by recurrent episodes of binge eating or purging.

Bulimia nervosa.

Bulimia nervosa is characterized by repeated episodes of bingeing followed by compensatory behaviors to prevent weight gain. Compensatory behaviors include vomiting, diuretic and laxative abuse, fasting, or excessive exercise. Like the anorexic, the typical bulimic has an unusual concern about body weight and weight loss. Unlike the anorexic, he or she is acutely aware of this condition and has a greater sense of guilt and loss of self control.

Bulimia typically develops during the late teens and early twenties. In contrast to the typically emaciated anorexic, most bulimics are of normal body weight, although weight may fluctuate frequently. Physically, the bulimic may have symptoms such as erosion of tooth enamel, swollen salivary glands, potassium depletion, bruised knuckles, and irritation of the esophagus.

To qualify for a clinical diagnosis of bulimia nervosa, binge eating and related compensatory behaviors must take place at least two times a week for a minimum of three months. Sufferers are classified into one of two subtypes: the *purging type*, which employs laxatives, **diuretics**, or self-induced vomiting to compensate for bingeing, or the *nonpurging type*, which relies on behaviors such as excessive exercising or fasting to offset binges.

diuretic: substance that depletes the body of water

Binge eating disorder.

Binge eating disorder is characterized by eating binges that are not followed by compensatory methods. This condition, which frequently appears in late adolescence or the early twenties, affects between 15 and 50 percent of individuals participating in diet programs and often develops after substantial diet-related weight loss. Of those affected, 50 percent are male.

Binge eating disorder is diagnosed when an individual recurrently (at least twice a week for a six month period) indulges in bingeing behavior. A clinical diagnosis also requires three or more of the following behaviors: (1) eating at an unusually rapid pace, (2) eating until uncomfortably full, (3) eating large quantities of food in the absence of physical hunger, (4) eating alone out

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

of shame, and (5) feelings of self-disgust, guilt, or **depression** subsequent to bingeing episodes.

Eating disorder not otherwise specified.

The category *eating disorder not otherwise specified* (EDNOS) is used to diagnose individuals whose eating disorders are equally as serious as anorexia nervosa, bulimia nervosa, or binge eating disorder, but do not meet all of the diagnostic criteria for these illnesses. An example of EDNOS might be a female who fulfills all of the criteria for anorexia but is still having regular menstrual periods, or an individual with all of the signs of bulimia who binges and purges less than twice a week.

Prevalence

Originally considered to be a disease targeting affluent white women and adolescents, eating disorders are now prevalent among both males and females, affecting people of all ages and from many ethnic and cultural groups. As many as 70 million people worldwide are estimated to suffer from these conditions, with one in five women displaying pathological eating patterns.

Most eating-disorder research focuses on females, who represent 90 percent of all cases. The additional 10 percent are males, a group that is often underdiagnosed due a widespread misperception that this disease only affects females. This belief also makes males less likely to seek treatment, frequently resulting in poor recovery. Among males, body image is a driving factor in the development of eating problems. Gender identity may also play a role in the evolution of eating disorders, with homosexual males more prone to this disorder than the overall male population.

Risk Factors

biological: related to living organisms

Environmental, social, **biological**, and psychological factors all contribute to eating-disorder risk. Early childhood environment and parenting may have a substantial impact. Many sufferers report dysfunctional family histories, with parents who were either emotionally absent or overly involved in their upbringing. As a result, these children may not tolerate **stress** well, they may have low self-esteem, and they may have difficulty in interpersonal relationships. Children who have been abused either physically, sexually, or psychologically are also highly vulnerable to eating disorders, particularly bulimia. Those raised by eating-disordered parents may be at heightened risk due to repeated exposure to maladaptive food-related behaviors.

stress: heightened state of nervousness or unease

Professions, activities, and dietary regimens that emphasize food or thinness may also encourage eating disorders. For example, athletes, ballet dancers, models, actors, diabetics, vegetarians, and food industry and **nutrition** professionals may have higher rates of disordered eating than the general population. In addition to environmental and social influences, biological and psychological factors may also increase risk for eating disorders in some people. Low levels of **serotonin**, a **neurotransmitter** involved in appetite regulation and satiety, may be indicative of a predisposition to pathological eating behaviors. Similarly, as many as 50 to 75 percent of those who are diagnosed with eating disorders suffer from depression, a mental illness also associated with abnormalities in serotonin balance. Other psychiatric disturbances, such as bipolar depression, obsessive-compulsive disorder,

nutrition: the maintenance of health through proper eating, or the study of same

serotonin: chemical used by nerve cells to communicate with one another

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

seasonal affective disorder, post-traumatic stress disorder, attention-deficit–hyperactivity disorder, and addictive behaviors, are also common in people with eating disorders.

Causes

Societal influences also contribute to this illness. Increasingly, Westernized culture portrays thinness as a coveted physical ideal associated with happiness, vitality, and well-being, while **obesity** is perceived as unhealthy and unattractive. This has encouraged a growing sentiment of body dissatisfaction, particularly among young women. Endless images of unrealistically thin models and actors in all forms of media further promote body dissatisfaction—one of the strongest risk factors for the development of disordered eating.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Abnormal eating patterns are most likely to develop during the mid- to late teens, a period of considerable physical, psychological, and social change. While the exact events that lead to the evolution of these disorders are unknown, there are two common milestones that can trigger disordered eating, especially in those with a biological predisposition. The first is the occurrence of a traumatic event, such as the death of a loved one or a divorce. The other is the adoption of a strict diet, which may be even more pivotal than a personal trauma. In fact, rigorous dieting has been identified again and again as the most common initiating factor in the establishment of an uncontrollable pattern of disordered eating.

Treatment Modalities

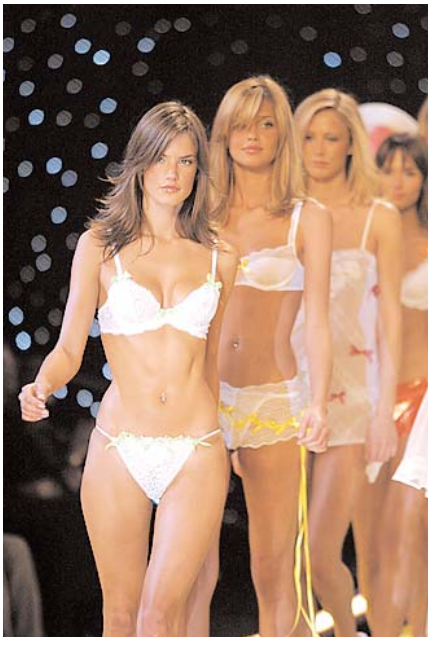
Treatment is based on a combination of psychotherapy, medication, and nutritional counseling. Goals include restoration of healthy body weight, correction of medical complications, adoption of healthful eating habits and treatment of maladaptive food-related thought processes, treatment of coexisting psychiatric conditions, and prevention of relapse. Depending on the severity of the illness, therapy may be conducted on an outpatient, day treatment, or inpatient basis.

Outpatient therapy.

Outpatient therapy provided by practitioners specializing in eating disorders is appropriate for highly motivated patients within 20 percent of their normal body weight and whose illness is mild or just developing. Treatment consists of cognitive-behavioral therapy, intensive nutritional counseling, support-group referrals, and medical monitoring. At the outset of treatment, a contract is established, outlining an anticipated rate of weight gain (usually between 0.5 and 2 pounds per week), target goal weight, and consequences if weight gain is not achieved. Vitamin and mineral supplementation and the use of liquid supplements to facilitate weight gain may also be indicated.

Day treatment programs.

Day treatment programs are being used with increasing frequency in place of inpatient hospitalization. This form of therapy provides an intermediate level of care for patients who require frequent monitoring but do not require treatment twenty-four hours a day. It may be used for patients who are not responding to outpatient therapy or who are stepping down from inpatient hospitalization. Treatment, which may take place four or five days per week from morning until evening, is similar in structure to outpatient therapy, but is provided on a more intensive level.



Idealized images of thinness can cause body dissatisfaction, which may lead to eating disorders. Such disorders may also be encouraged by professions that require a certain body type, such as modeling or gymnastics. *[Photograph by George De Sota. AP/Wide World Photos. Reproduced by permission.]*

Christy Henrich, a member of the U.S. gymnastics team, narrowly missed making the Olympics in 1988. Some say Henrich's anguish over that failure caused the eating disorder that killed her six years later, when she weighed less than fifty pounds. *[AP/Wide World Photos. Reproduced by permission.]*

Inpatient hospitalization. Inpatient hospitalization is indicated for patients whose eating disorder has reached life-threatening status. Criteria for admission to such programs are weight loss of 25 percent or more of ideal body weight or the presence of an eating disorder in a child or adolescent. It may also be necessary for individuals who are medically unstable. Usually, participants in inpatient programs are anorexic, although hospitalization for bulimia may be necessary if there is serious deterioration of vital signs, uncontrollable vomiting, or concurrent psychiatric illness.

The immediate goals of inpatient treatment are weight gain and stabilization of vital signs. In many cases, the patient is so fragile that complete bed rest is required. Eating is gently encouraged. In extreme medical situations refusal may be met with tube feeding or, in rare instances, intravenously.

Medication. Medication is increasingly becoming a routine part of treatment for eating disorders. Antidepressants, particularly the selective serotonin reuptake inhibitors (SSRIs), are the most effective and most commonly used medication in treating this spectrum of illnesses. They are found to be of greatest benefit when used in combination with therapy, and are of little

value if offered on their own. In the case of anorexia, these medications are most effective if employed after successful weight restoration is achieved, at which time they can be useful for relapse prevention and the treatment of coexisting psychiatric conditions. SSRIs are also used in preventing binge relapses among bulimics, although their effectiveness ceases once the medication is discontinued. Although antidepressants have also been employed in the treatment of binge eating disorder, outcomes have not been sufficiently positive to warrant recommendations for their use.

Outcomes

Individuals are usually considered to be ready to terminate therapy once they have achieved a healthy body weight and can eat all foods free of guilt or **anxiety**. For a complete recovery, extensive treatment may be required from six months to two years, and for as long as three to five years in cases where other psychiatric conditions are present. For some, eating disorders will be a lifelong struggle, with stressful or traumatic events triggering relapses that may require occasional check-in therapy to restore healthful eating patterns.

anxiety: nervousness

Of individuals with anorexia nervosa, 50 percent will have favorable outcomes, 30 percent will have intermediate results, and 20 percent will have poor outcomes. The prognosis for bulimics is slightly less favorable, with 45 percent achieving favorable outcomes, 18 percent having intermediate results, and 21 percent with poor results. Among both anorexics and bulimics, 5.6 percent will die of complications related to their illness. Those who receive treatment early in the course of their disease have a greater chance of full recovery on both a physical and an emotional level. A favorable prognosis is also likely with an early age at diagnosis, healthy parent-child relationships, and close supportive relationships with friends or therapists. With early identification and treatment, eating disorders can be prevented from becoming chronic and potentially lethal. SEE ALSO ADDICTION, FOOD; ANOREXIA NERVOSA; BULIMIA NERVOSA; EATING DISTURBANCES.

Karen Ansel

Bibliography

American Academy of Pediatrics (2003). "Policy Statement: Identifying and Treating Eating Disorders." *Pediatrics* 111(1):204–211.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC: Author.

Berkow, Robert M., ed. (1997). *The Merck Manual of Medical Information Home Edition.* Whitehouse Station, NJ: Merck Research Laboratories.

Cassell, Dana, and Gleaves, David (2000). *The Encyclopedia of Eating Disorders*, 2nd edition. New York: Facts on File.

Costin, Carolyn (1996). *The Eating Disorder Sourcebook.* Los Angeles: Lowell House.

Pritts, Sarah D., and Susman, Jeffrey (2003). "Diagnosis of Eating Disorders in Primary Care." *American Family Physician* January 15.

Rome, Ellen S., et al. (2003). "Children and Adolescents with Eating Disorders: The State of the Art." Pediatrics 111:e98–e108.

Stice, Eric; Maxfield, Jennifer; and Wells, Tony (2003). "Adverse Effects of Social Pressure to Be Thin on Young Women: An Experimental Investigation of the Effects of 'Fat Talk.'" *International Journal of Eating Disorders* 34:108–117.

Woolsey, Monika M. (2002). *Eating Disorders: A Clinical Guide to Counseling and Treatment.* Chicago: American Dietetic Association.

Eating Disorders throughout History

Although eating disorders first came to widespread attention in the 1970s, self-starvation and other pathological eating practices are found throughout recorded history. Bulimia was widely known in both Greek and Roman societies and was recorded in France as early as the eighteenth century. Self-starvation for religious reasons became widespread in Europe during the Renaissance, as hundreds of women starved themselves, often to death, in hopes of attaining communion with Christ. During the nineteenth century, as corpulence stopped being viewed as a symbol of prosperity, self-starvation became common again. The incidence of eating disorders varies widely among cultures and time periods, suggesting that they can be encouraged or inhibited by social and economic factors. Eating disorders have most often been seen in affluent societies and are rarely reported during periods of famine, plague, and warfare.

—Paula Kepos

Internet Resources

American Psychiatric Association (2001). "Men Less Likely to Seek Help for Eating Disorders." Available from <http://www.nlm.nih.gov/medlineplus>

American Psychiatric Association. "Practice Guideline for the Treatment of Patients with Eating Disorders." Available from <http://www.psych.org>

Anorexia Nervosa and Related Eating Disorders, Inc. (2002). "Males with Eating Disorders." Available from <http://www.anred.com/males.html>

Devlin, Michael J., and Walsh, Timothy B. (2000) "Psychopharmacology of Anorexia Nervosa, Bulimia Nervosa, and Binge Eating." American College of Neuropsychopharmacology. Available from <http://www.acnp.org/g>

National Eating Disorders Association (2002). "Males and Eating Disorders." Available from <http://www.nationaleatingdisorders.org>

National Eating Disorders Association (2002). "What Causes Eating Disorders?" Available from <http://www.nationaleatingdisorders.org>

Renfrew Center Foundation (2002). "Eating Disorders: A Summary of Issues, Statistics and Resources." Available from <http://www.renfrew.org>

Eating Disturbances

An eating disturbance shares many similar characteristics with eating disorders, but is less severe in scope. As a result, many abnormal dietary patterns and behaviors, such as **binge** eating, excessive exercising, weight cycling, and **chronic** dieting may involve many of the same attitudes and impulses as eating disorders, though they do not meet the clinical criteria for diagnosis.

binge: uncontrolled indulgence

chronic: over a long period

Eating disturbances usually develop during adolescence and early adulthood. While they occur in both males and females, they are far more prevalent among females. They are characterized by distorted eating patterns and usually occur in individuals of normal weight who have a history of dieting and a strong desire to become thin. As with eating disorders, body perception and self-esteem are closely intertwined. Many cases may start out innocently, with only small dietary changes such as eating smaller or larger portions of food, and eventually progress beyond the individual's control. For some, eating may become highly restrictive, accompanied by stringent elimination of certain high-calorie, high-fat foods. Others may consume these foods in excess, but only during episodes of gorging. Symptoms include obsession with food and calories, fear of specific **nutrients** (such as fat), rigid categorization of foods as "good" or "bad," irrational fear of weight gain, excessive weighing, avoidance of social situations where food is served, and denial of eating problems.

nutrient: dietary substance necessary for health

Binge Eating

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

Binge eating is a frequent precursor to **bulimia** nervosa and binge eating syndrome. Individuals who indulge in binge eating may eat tremendous quantities of food, well past the point of being comfortably full and possibly to the point of extreme discomfort or even pain. Bingeing may take place over a short period of time, or it may be prolonged—lasting for several hours, sometimes continuing from morning until nighttime. For individuals prone to binge eating, food becomes a focal point of life, with an obsession about what can or cannot be eaten. Eating may take place very quickly and is often unrelated to hunger. Although there may be variation in the types of food chosen, high-calorie, high-fat sweets are favored. Since bingeing is

Eating disturbances are milder than eating disorders, but both are characterized by a preoccupation with food, weight, fitness, or body image. *[Eric K. K. Yu/Corbis. Reproduced by permission.]*

How Many People Suffer from Eating Disorders?

According to the National Institute of Mental Health:

- Between .5 percent and 3.7 percent of women suffer from anorexia nervosa at some point in their lives.
- Between 1.1 and 4.2 percent of women suffer from bulimia nervosa at some point in their lives.
- Between 2 and 5 percent of Americans experience binge-eating disorder during any six-month period.

Women are more likely than men to develop eating disorders. Only 5 to 15 percent of those with anorexia or bulimia are men, and only 35 percent of those with binge-eating disorder are men.

—Paula Kepos

accompanied by a sense of shame, embarrassment, and lack of self-control, episodes usually take place alone, in secret.

Bingeing is frequently triggered by troubled relationships, extreme hunger subsequent to stringent dieting, or feelings of melancholy. While gorging on coveted foods may temporarily improve one's mood, it is usually followed by feelings of **depression** and low self-esteem. Although these incidents may contribute to **obesity**, they may also occur in individuals of normal body weight who compensate for binges with excessive exercising or even fasting.

Excessive Exercising

Also known as activity disorder, excessive exercising is an extreme method of weight control. Individuals suffering from this syndrome are compelled to exercise for prolonged periods on a daily basis and to indulge in constant activity to burn excess calories. Eventually they experience a loss of control over the desire to exercise, in the same way that a person with an **eating disorder** cannot control behaviors relative to eating.

Excessive exercisers suffer from the same obsession with body weight and shape as anorexics and bulimics, and exercise eventually becomes necessary not only for weight control, but also for mood stabilization and self-definition. Utterly powerless to restrain their urge to exercise, they will pursue daily activity in spite of injury or exhaustion, or in places and settings that are completely inappropriate. They are usually accomplished individuals, both professionally and academically, and they may appear to be vigorously fit and healthy. Despite their overtly sound appearance, however, over time they may suffer health consequences far more serious than routine athletic injuries. Drastic weight loss may lead to **amenorrhea**, which, in turn, may weaken bones and increase **osteoporosis** risk. Vitamin and mineral deficiencies may develop and **electrolyte** imbalances may occur, which may lead to cardiac arrest in extreme cases.

Cravings

Cravings for carbohydrate-rich foods cause many bulimics and binge eaters to center their binges around desserts and high-starch foods. Many individuals suffering from disordered eating commonly avoid foods low in carbohydrate and high in fat, and instead seek out excessive sugar, routinely using large quantities to sweeten foods and beverages. This may stem from a **physiological** and evolutionary need for ample carbohydrate to ensure proper **neurological** function. Large quantities of carbohydrate eaten in a short time frame are capable of altering **neurotransmitter** synthesis, producing a calming effect on the brain, and thus may be the impetus for such cravings in certain eating disorders and disturbances.

Weight Cycling

Also known as yo-yo dieting, weight cycling is common in Westernized nations, particularly among young women. Often observed among chronic dieters, weight cycling is an ongoing sequence of dieting, weight loss, cessation from dieting, and weight gain. This final stage of weight gain is particularly detrimental, as the amount regained often exceeds the quantity

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

obesity: the condition of being overweight, according to established norms based on sex, age, and height

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

amenorrhea: lack of menstruation

osteoporosis: weakening of the bone structure

electrolyte: salt dissolved in fluid

physiological: related to the biochemical processes of the body

neurological: related to the nervous system

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

originally lost, resulting in an increase in overall body weight. As muscle mass accounts for a portion of the lost weight, weight cycling may ultimately slow overall **metabolism**, with every 5 percent of body weight lost resulting in a 15 percent decrease in resting metabolism. This compensatory mechanism, adapted to help prevent weight loss during times of starvation, eventually prompts further weight gain, frequently initiating a renewed cycle of dieting.

metabolism: the sum total of reactions in a cell or an organism

Chronic Dieting

Many individuals with eating disorders report habitual dieting prior to the onset of their illness. Repeated dieting during adolescence increases the risk of eating disorders, with some patients reporting attempts at weight loss as early as age nine. The **incidence** of eating disorders may be as much as eight times greater among girls with a history of dieting, with the initiation of a weight loss regimen often marking the onset of the eating disorder itself. Dietary restriction may result in alterations in brain chemistry that can further increase anorexic tendencies, while hunger resulting from caloric restriction can set off binge eating, thus establishing a pattern. While most healthy individuals who attempt to lose weight can stop at any given time, depression and major life stresses in combination with habitual dieting can predispose others to develop an eating disorder. SEE ALSO ADDICTION, FOOD; ANOREXIA NERVOSA; BULIMIA NERVOSA; EATING DISORDERS.

incidence: number of new cases reported each year

Karen Ansel

Bibliography

American Dietetic Association (1998). *Nutrition Intervention in the Treatment of Anorexia Nervosa, Bulimia Nervosa, and Eating Disorder Not Otherwise Specified (EDNOS).* Chicago: Author.

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition. Washington, DC: Author.

Cassell, Dana, and Gleaves, David (2000). *The Encyclopedia of Eating Disorders*, 2nd edition. New York: Facts on File.

Cataldo, Corrine B.; Rolfes, Sharon R.; Whitney, Eleanor N. (1994). *Understanding Normal and Clinical Nutrition*, 4th edition. St. Paul, MN: West Publishing.

Costin, Carolyn (1996). *The Eating Disorder Sourcebook*. Los Angeles: Lowell House.

Dare, Chris; Szmukler, Georg; Treasure, Janet (1995). *Handbook of Eating Disorders: Theory, Treatment, and Research.* New York: Wiley.

Escott-Stump, Sylvia, and Mahan, L. Kathleen (1996). *Krause's Food, Nutrition, and Diet Therapy*, 9th edition. Philadelphia: W. B. Saunders.

Franseen, Lisa (1999). "Understanding and Identifying Eating Problems in Synchronized Swimmers, Part 1." *Synchro Swimming USA* (Winter).

Garfinkel, Paul E., and Garner, David M. (1997) *Handbook of Treatment for Eating Disorders*, 2nd edition. New York: Guilford Press.

Rosenbloom, Christine A., ed. (1999). *Sports Nutrition: A Guide for the Professional Working with Active People.* Chicago: American Dietetic Association.

Woolsey, Monika M. (2002). *Eating Disorders: A Clinical Guide to Counseling and Treatment.* Chicago: American Dietetic Association.

Internet Resources

McKinley Health Center, University of Illinois at Urbana. "Understanding Eating Disturbances and Disorders: A Guide for Helping Family and Friends." Available from <http://www.mckinley.uiuc.edu>

National Institute of Mental Health. "Eating Disorders: Facts about Eating Disorders and the Search for Solutions." Available from <http://www.nimh.nih.gov>

Eating Habits

The term *eating habits* (or *food habits*) refers to why and how people eat, which foods they eat, and with whom they eat, as well as the ways people obtain, store, use, and discard food. Individual, social, cultural, religious, economic, environmental, and political factors all influence people's eating habits.

Why and How People Eat

All humans eat to survive. They also eat to express appreciation, for a sense of belonging, as part of family customs, and for self-realization. For example, someone who is not hungry may eat a piece of cake that has been baked in his or her honor.

learned behaviors: actions that are acquired by training and observation, in contrast to innate behaviors

People eat according to **learned behaviors** regarding etiquette, meal and snack patterns, acceptable foods, food combinations, and portion sizes. *Etiquette* refers to acceptable behaviors. For example, for some groups it is acceptable to lick one's fingers while eating, while for other groups this is rude behavior. Etiquette and eating **rituals** also vary depending on whether the meal is formal, informal, or special (such as a meal on a birthday or religious holiday).

ritual: ceremony or frequently repeated behavior

A meal is usually defined as the consumption of two or more foods in a structured setting at a set time. Snacks consist of a small amount of food or beverage eaten between meals. A common eating pattern is three meals (breakfast, lunch, and dinner) per day, with snacks between meals. The components of a meal vary across cultures, but generally include grains, such as rice or noodles; meat or a meat substitute, such as fish, beans, or **tofu**; and accompaniments, such as vegetables. Various food guides provide suggestions on foods to eat, portion sizes, and daily intake. However, personal preferences, habits, family customs, and social setting largely determine what a person consumes.

tofu: soybean curd, similar in consistency to cottage cheese

What and how people eat is determined by a variety of factors, including economic circumstances, cultural norms, and religious restrictions. Here, an Iranian family sits on the floor and eats from a cloth laden with regional delicacies. *[Photograph by Earl and Nazima Kowall. Corbis. Reproduced by permission.]*

What People Eat

In each culture there are both acceptable and unacceptable foods, though this is not determined by whether or not something is edible. For example, alligators exist in many parts of the world, but they are unacceptable as food by many persons. Likewise, horses, turtles, and dogs are eaten (and even considered a delicacy) in some cultures, though they are unacceptable food sources in other cultures. There are also rules concerning with whom it is appropriate to eat. For example, doctors in a health facility may eat in areas separate from patients or clients.

Obtaining, Storing, Using, and Discarding Food

Humans acquire, store, and discard food using a variety of methods. People may grow, fish, or hunt some of their food, or they may purchase most of it from supermarkets or specialty stores. If there is limited access to energy sources, people may store small amounts of foods and get most of what they eat on a day-to-day basis. In homes with abundant space and energy, however, people purchase food in bulk and store it in freezers, refrigerators, and pantries. In either case there must also be proper disposal facilities to avoid environmental and health problems.

Exposure to Foods

There are innumerable flavors and food combinations. A liking for some flavors or food combinations is easily acceptable, but others must develop or be learned. Sweetness is a universally acceptable flavor, but a taste for salty, savory, spicy, tart, bitter, and hot flavors must be learned. The more a person is exposed to a food—and encouraged to eat it—the greater the chances that the food will be accepted. As the exposure to a food increases, the person becomes more familiar and less fearful of the food, and acceptance may develop. Some persons only eat specific foods and flavor combinations, while others like trying different foods and flavors.

Influences on Food Choices

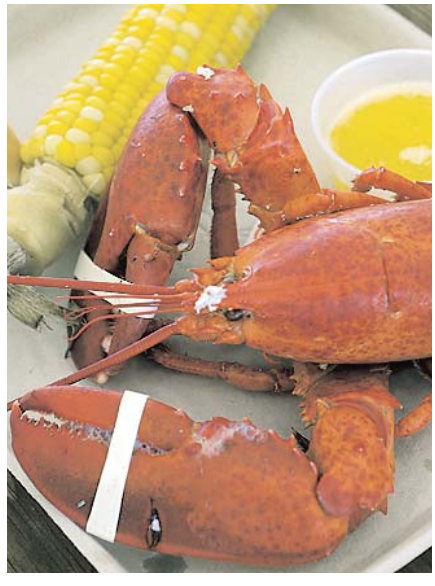
There are many factors that determine what foods a person eats. In addition to personal preferences, there are cultural, social, religious, economic, environmental, and even political factors.

Individual Preferences.

Every individual has unique likes and dislikes concerning foods. These preferences develop over time, and are influenced by personal experiences such as encouragement to eat, exposure to a food, family customs and rituals, advertising, and personal values. For example, one person may not like frankfurters, despite the fact that they are a family favorite.

Cultural Influences.

A cultural group provides guidelines regarding acceptable foods, food combinations, eating patterns, and eating behaviors. Compliance with these guidelines creates a sense of identity and belonging for the individual. Within large cultural groups, subgroups exist that may practice variations of the group's eating behaviors, though they are still considered part of the larger group. For example, a hamburger, French fries, and a soda are considered a typical American meal. Vegetarians in the United



Someone who is repeatedly exposed to certain foods is less hesitant to eat them. For example, lobster traditionally was only available on the coasts, and is much more likely to be accepted as food by coastal dwellers. *[AP/Wide World Photos. Reproduced by permission.]*

States, however, eat "veggie-burgers" made from mashed beans, pureed vegetables, or soy, and people on diets may eat a burger made from lean turkey. In the United States these are appropriate cultural substitutions, but a burger made from horsemeat would be unacceptable.

social group: tribe, clique, family, or other group of individuals

Social Influences. Members of a **social group** depend on each other, share a common culture, and influence each other's behaviors and values. A person's membership in particular peer, work, or community groups impacts food behaviors. For example, a young person at a basketball game may eat certain foods when accompanied by friends and other foods when accompanied by his or her teacher.

proscription: prohibitions, rules against

Religious Influences. Religious **proscriptions** range from a few to many, from relaxed to highly restrictive. This will affect a follower's food choices and behaviors. For example, in some religions specific foods are prohibited, such as pork among Jewish and Muslim adherents. Within Christianity, the Seventh-day Adventists discourage "stimulating" beverages such as alcohol, which is not forbidden among Catholics.

Economic Influences. Money, values, and consumer skills all affect what a person purchases. The price of a food, however, is not an indicator of its nutritional value. Cost is a complex combination of a food's availability, status, and demand.

ecological: related to the environment and human interactions with it

Environmental Influences. The influence of the environment on food habits derives from a composite of **ecological** and social factors. Foods that are commonly and easily grown within a specific region frequently become a part of the local cuisine. However, modern technology, agricultural practices, and transportation methods have increased the year-round availability of many foods, and many foods that were previously available only at certain seasons or in specific areas are now available almost anywhere, at any time.

Political Influences. Political factors also influence food availability and trends. Food laws and trade agreements affect what is available within and across countries, and also affect food prices. Food labeling laws determine what consumers know about the food they purchase.

Eating habits are thus the result of both external factors, such as politics, and internal factors, such as values. These habits are formed, and may change, over a person's lifetime. SEE ALSO DIET; POPULAR CULTURE, FOOD AND.

Judith C. Rodriguez

Bibliography

Haviland, William A. (1990). *Cultural Anthropology.* Chicago: Holt, Rinehart and Winston.

Kittler, Pamela G., and Sucher, Kathryn P. (1998). *Food and Culture in America: A Nutrition Handbook*, 2nd edition. Belmont, CA: West/Wadsworth.

Klimis-Zacas, Dorothy J., ed. (2001). *Annual Editions: Nutrition 01/02.* Guilford, CT: McGraw Hill/Dushkin.

Lowenberg, Miriam Elizabeth; Todhunter, Elizabeth Neige; Wilson, E. D.; Savage, J. R.; and Lubawski, J. L. (1979). *Food and People.* New York: Wiley.

Schlosser, Eric (2001). *Fast Food Nation: The Darker Side of the All American Meal.* New York: Houghton Mifflin.

Emergency Nutrition Network

The Emergency Nutrition Network (ENN) is a network of humanitarian agencies and researchers that supports and facilitates activities that increase the effectiveness of emergency food and nutrition interventions. The planning for the ENN was done in 1995 at a meeting sponsored by the United Nations High Commissioner for Refugees (UNHCR), and the network began operating in November 1996.

Humanitarian agencies sometimes provide interventions and food that are not always logistically or culturally appropriate. In addition, many agencies have high staff turnover, inadequate record keeping, and limited resources, all of which can delay access to appropriate information at critical times. The goal of the ENN is to improve the effectiveness of emergency food and nutrition programs by:

- Providing a forum for relief workers to exchange ideas and experiences
- Helping network agencies work more efficiently and effectively
- Providing field staff and relief workers with knowledge of current and relevant research
- Helping researchers to identify priorities and constraints of the emergency sector

ENN primarily operates through a newsletter, *Field Exchange*. The institutional base for ENN is Trinity College, Dublin. Project staff includes a full-time coordinator and a part-time technical consultant. Representatives from key agencies are available for technical support. ENN is currently funded by the Irish Department of Foreign Affairs, MSF International, Concern Worldwide, the Canadian International Development Agency, the U.S. Agency for International Development, the World Health Organization, UNHCR, and other organizations. Partnership in the network is not dependent on any financial contributions. SEE ALSO DISASTER RELIEF ORGANIZATIONS; FAMINE.

Delores C. S. James

Internet Resources

Dublin Business Innovation Center. "Company Profile: Emergency Nutrition Network (ENN)." Available from <http://www.dbic.ie/ENN.htm>

Emergency Nutrition Network. "About the ENN." Available from <http://www.ennonline.net>

One World. "Emergency Nutrition Network." Available from <http://www.oneworld.org>

Ergogenic Aids

Ergogenic aids are dietary supplements intended to enhance athletic performance. Athletes often look for a "magic bullet" that can give them an advantage over their opponents. However, while they tend to be highly disciplined regarding training, they are not always careful in their use of dietary supplements. The important points about supplement usage include:

- Supplements are not one size fits all
- Natural and safe are not synonymous terms

- Supplements may be age- and gender-specific
- Supplements are sports-specific, and may be position-specific
- The **efficacy** of supplements is contingent upon the underlying **hydration**, **diet**, and training
- The issue of "stacking" (using many different supplements) may create safety problems
- Supplements may interact with both prescription and **over-the-counter** medications

efficacy: effectiveness

hydration: degree of water in the body

diet: the total daily food intake, or the types of foods eaten

over-the-counter: available without a prescription

Ergogenic aids are not a substitute for food, fluid, or activity. Athletes who are already at the peak of physical ability and consume an optimal diet will, for the most part, realize little if any benefit from supplement use. The most commonly used supplements are **anabolic** agents, ginseng, ephedra, and caffeine.

anabolic: promoting building up

Anabolic Agents

The most frequently and widely used category of ergogenic aids is those with supposed anabolic effects; that is, they mimic the benefits of **steroids** (in a legal manner). Creatine is the most widely used supplement taken by both recreational and professional athletes. Creatine is synthesized in the kidneys, pancreas, and liver from **amino acid** precursors (methionine, arginine, and glycine), and is also found in meat, fish, and poultry. The ergogenic effect of supplemental creatine is attributed to its ability to increase tissue creatine levels beyond what the body can synthesize on its own, resulting in increased work capacity during intense activity requiring maximal or near maximal effort. It can also expedite the recovery rate following exercise. These benefits are most likely seen with a regimen of 20 to 25 grams of creatine over five to seven days, divided into four- or five-gram doses (this is called the *loading* phase). Creatine levels will fall to presupplementation levels six weeks later. For optimal effect, each dose of creatine should be consumed with a **carbohydrate** and without caffeine, which can counteract the ergogenic effect. Muscle **hypertrophy** and fluid retention can occur during the loading phase, causing a weight gain of four to seven pounds. This increase may be advantageous for the strength athlete, but less so for an athlete who relies on speed. Short-term studies have not shown an increase in muscle strains, cramps, or pulls with creatine, but it is critical for the athlete to maintain optimal hydration. There are some concerns with product contamination, as creatine supplements could be contaminated with herbs, or even with other anabolic agents not listed on the label.

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic processes

amino acid: building block of proteins, necessary dietary nutrient

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

hypertrophy: excess increase in size

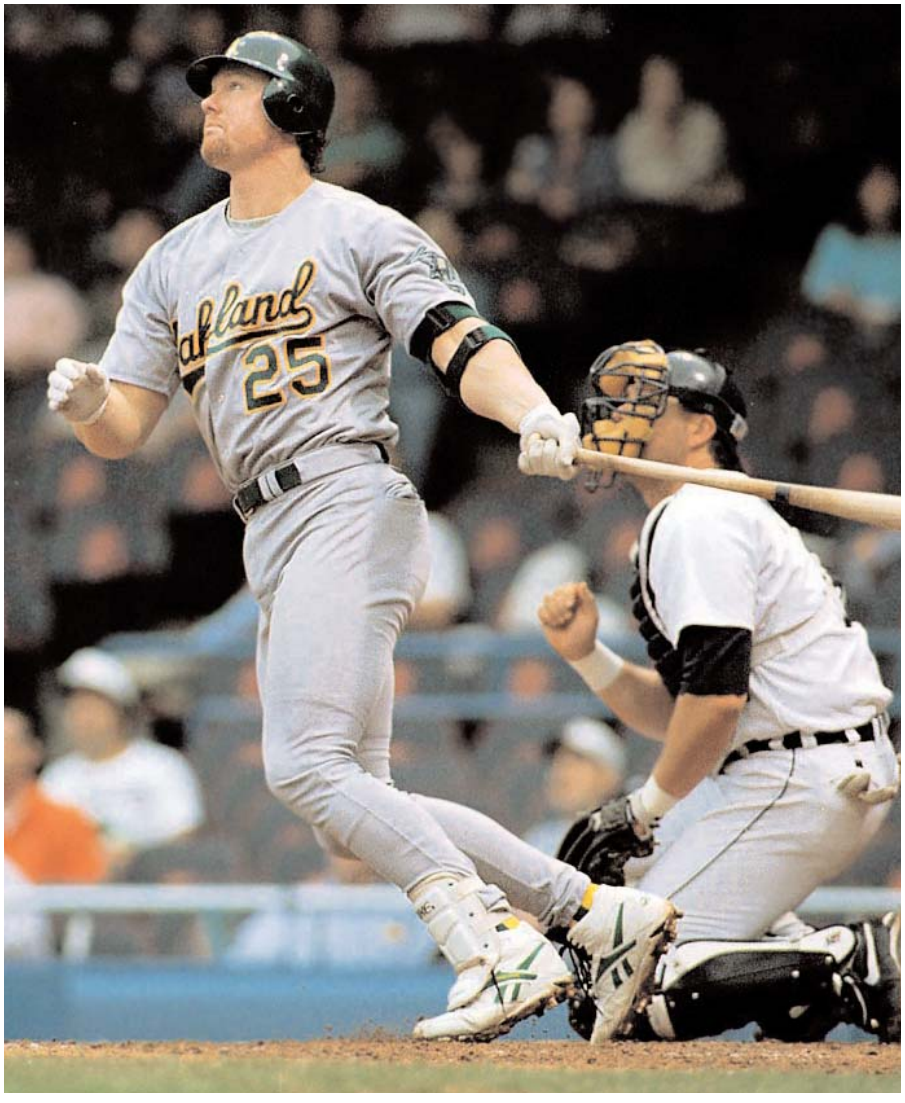
Other anabolic agents include HMB (beta-hydroxy beta-methylbutyrate), which, in clinical studies, has resulted in an increase in muscle mass. The number of studies has been quite small, however. Boron is a **trace** mineral involved in cellular functions, but it does not increase **testosterone** levels as some claims would suggest. It can suppress appetite and impair digestion in doses higher than 50 mg per day. Yohimbe is a supplement derived from the tree bark of a South American plant that confers a stimulant effect, not an anabolic effect. Ingestion of this product can cause dizziness, nervousness, headaches, **nausea**, vomiting, and an elevated **blood pressure**. It can also interact with blood-pressure medication and increase the toxicity of

trace: very small amount

testosterone: male sex hormone

nausea: unpleasant sensation in the gut that precedes vomiting

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels



Mark McGwire astounded baseball fans when he hit 70 home runs in 1998. But his use of legal performance-enhancing supplements, such as androstenedione, raised tough questions for athletes and trainers. *[AP/Wide World Photos. Reproduced by permission.]*

psychotherapeutic medications, and it may be harmful to the kidneys. Chromium is an essential mineral involved in blood **glucose** control. It can be taken in a dosage of between 50 and 300 micrograms per day, but it does not have any anabolic effects.

glucose: a simple sugar; the most commonly used fuel in cells

Other supposed anabolic agents include dehydroepiandrosterone (DHEA), androstenedione, and *Tribulus terrestris* (tribestan). All of these are banned by the U.S. Olympic Committee, the National Collegiate Athletic Association (NCAA), the National Football League, and the American Tennis Federation. Studies have demonstrated the ineffectiveness of androstenedione as an anabolic substance or strength enhancer, but they have demonstrated potentially worrisome side effects, including a decrease in **serum HDL** level and an increase in serum estrone and **estradiol**, which increases the likelihood of gynecomastia (breast enlargement). In addition, several laboratory tests have shown that the amount of actual product in these supplements can vary dramatically, and some are contaminated with **nandrolone**, an anabolic steroid that can cause a positive result in a drug test.

serum: non-cellular portion of the blood

HDL: high density lipoprotein, a blood protein that carries cholesterol

estradiol: female hormone; a type of estrogen

nandrolone: hormone related to testosterone

Protein Supplements

Protein is essential for muscle growth and development, but the maximum usable amount of protein is one gram per pound of body weight. Protein powders contain large quantities of protein, plus large doses of **vitamins**, **minerals**, and herbs. Amino acid supplementation has been associated with **gastrointestinal** side effects, such as nausea, diarrhea, or vomiting, that may negate any potential ergogenic benefits. In addition, selective amino acid supplementation is a very inefficient way to provide protein to the body and can create an amino-acid imbalance.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

gastrointestinal: related to the stomach and intestines

Energy Boosters

Many athletes take supplements to boost energy, particularly ginseng, ephedra, and caffeine. Ginseng functions as an adaptogen, or **immune system** stimulant, but it does not have an effect on athletic performance. (Athletes who choose to take ginseng should look for *Panax* ginseng standardized to 4–7 percent; ginsenosides, with the following dosing regimen: 100–200 milligrams per day for two–three weeks, then one–two weeks of no use before resuming).

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

Ephedra (also called Ma Huang, epitonin, and sida cordifolia) is a central **nervous system** stimulant that is sold as an energy booster or "fat-burning" supplement. Marketed as *Metabolife*, *Xenadrine*, *Herbal Rush*, *Energy Rush*, *Thermoburn*, or *Thermofuel* (among others), ephedra may delay **fatigue** by sparing the body's **glycogen** reserves during exercise. However, it can also increase blood pressure, respiration rate, heart rate, **anxiety**, migraines, and irregular heartbeat, and it can cause insomnia, psychosis, and nervousness. Ephedra and caffeine are often present in the same product, which can be detrimental to the heart. The maximum safe level of ephedra is 24 mg per day, but many products contain over 300 mg per dose. This supplement is **contraindicated** in those with a history of **heart disease** or **hypertension**, kidney or thyroid disease, seizure disorder, or **diabetes**.

nervous system: the brain, spinal cord, and nerves that extend throughout the body

fatigue: tiredness

glycogen: storage form of sugar

anxiety: nervousness

Caffeine is a stimulant that in certain athletes may increase free fatty-acid availability to delay fatigue, improve reaction time, and reduce the perceived effort of exertion. It tends to be most effective in caffeine-naïve, trained endurance athletes with a dose of 200 to 300 milligrams one hour prior to a sporting event. The legal limit of caffeine is 800 milligrams, but this level can cause nervousness, anxiety, irritability, headaches, increased urination, and diarrhea. In addition to products such as Vivarin, No-Doz, and Excedrin, caffeine can be found in herbal form in guarana, maté, and kola nut. Caffeine also augments the stimulatory effects of ephedra.

contraindicated: not recommended

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

diabetes: inability to regulate level of sugar in the blood

Weight Loss Agents

Weight loss agents contain ingredients such as L-carnitine, which may prevent **lactic acid** accumulation but does not promote fat loss; quercetin, an **antioxidant** that is important for the heart but does not aid the loss of body fat; hydroxycitrate (a diuretic); ephedra; caffeine, and senna and/or cascara (herbal laxatives). Chitin, or chitosan (advertised as a "fat trapper" or "fat blocker"), is made from the shells of insects and shellfish and may lower **cholesterol**, but it also does not lower body fat levels. It can bind with **calcium**, **iron**, and magnesium and interfere with the **absorption** of Vitamins A, D, E, and K. Any weight loss experienced with the use of these products is primarily due to water loss associated with the laxative/diuretic components.

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

absorption: uptake by the digestive tract

Dangerous Supplements

One of the more dangerous supplements is GBL/GHB (Gamma butyrolactone and gamma hydroxy butyric acid), which is marketed as *Rest-Eze*, *Blue Nitro*, *Revivarant G*, *Ecstasy*, *GH Revitalizer*, *GHR*, *Remforce*, *Renewtrient*, and *Gamma G*. As of December 2002, use of these products has resulted in three deaths and one hundred adverse reactions, including coma and breathing difficulties.

The potential harmful effects of yohimbe, ephedra, and excessive caffeine intake have already been mentioned. Kava is an herb used to treat anxiety, but it may cause liver failure. In addition, individuals on prescription or over-the-counter medications should be wary of supplements, as there may be adverse interactions.

Athletes at all levels should have their supplement use carefully monitored. Coaches, parents, or others working with athletes should ask what they take and in what dosage and frequency. Labels should be examined, and all information should be documented in the medical record. It is best if athletes try only one product at a time, and supplement use should be discontinued if any unusual dizziness, stomach upset, or headaches occur. All coaches should be familiar with the available supplements and their dangers. SEE ALSO DIETARY SUPPLEMENTS; SPORTS NUTRITION.

Leslie Bonci

Bibliography

Medical Economics Company (2001). *PDR for Nutritional Supplements.* Montvale, NJ: Medical Economics.

Williams, Melvin. *The Ergogenics Edge: Pushing the Limits of Sports Performance.* Champaign, IL: Human Kinetics.

Internet Resources

Alternative Medical Foundation. "Electronic Herbal Database." Available from <http://www.herbmed.org>

ConsumerLab.com. "Product Reviews" and "Natural Product Encyclopedia." Available from <http://www.consumerlab.com>

Gatorade Sports Science Institute. "Dietary Supplements." Available from <http://www.gssiweb.com>

National Center for Drug Free Sport. "Drug and Supplement Education." Available from <http://www.drugfreesport.com>

National Institutes of Health, Office of Dietary Supplements. "What Are Dietary Supplements." Available from <http://dietary-supplements.info.nih.gov>

Exchange System

Prior to the development of exchange lists in 1950, meal planning for persons in the United States with **diabetes** was chaotic, with no agreement among the major organizations involved with diabetes and **nutrition**. To solve this problem, the concept of "exchange," or "substitution," of similar foods was developed by the American Dietetic Association, the American Diabetes Association, and the U.S. Public Health Service. The goal was to develop an educational tool for persons with diabetes that would provide uniformity in meal planning and allow for the inclusion of a wider variety of foods.

diabetes: inability to regulate level of sugar in the blood

nutrition: the maintenance of health through proper eating, or the study of same

Definition

The word *exchange* refers to the fact that each item on a particular list in the portion listed may be interchanged with any other food item on the same list. An exchange can be explained as a substitution, choice, or serving. Each list is a group of measured or weighed foods of approximately the same nutritional value. Within each food list, one exchange is approximately equal to another in **calories**, **carbohydrate**, **protein**, and **fat**. To use the exchange lists, an individual needs an individualized meal plan that outlines the number of exchanges from each list for each meal and for snacks. The American Diabetes Association recommends that because of the complexity of nutrition issues, a registered dietitian, knowledgeable and skilled in implementing nutrition therapy into diabetes management and education, be the team member developing and implementing meal plans. The meal plan is developed in cooperation with the person with diabetes and is based on an assessment of eating changes that would assist the individual in achieving his or her target **metabolic** goals and of changes the individual is willing and able to make. Because of the accuracy and convenience of the exchange system, the exchange lists are used for weight management as well for diabetes management.

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fat: type of food molecule rich in carbon and hydrogen, with high energy content

metabolic: related to processing of nutrients and building of necessary molecules within the cell

The exchange system categorizes foods into three main groups: Carbohydrates, Meat and Meat Substitutes, and Fats. Foods are further subdivided in these three groups into specific exchange lists. The Carbohydrate Group contains the Starch, Fruit, Milk, Sweets and desserts (other carbohydrates), and Vegetable lists. Foods from the Starch, Fruit, Milk, and Sweets lists can be interchanged in the meal plan, as they each contain foods with 60 to 90 calories and approximately 15 grams of carbohydrate. The Meat and Meat Substitute Group contains food sources of protein and fat. The group is divided into four lists: Very Lean Meats, Lean Meats, Medium-Fat Meats, and High-Fat Meats, allowing the user to see at a glance which meats are low-fat and which meats are high-fat. The lists have foods containing 35, 55, 75, and 100 calories, and 1, 3, 5, and 8 grams of fat, respectively. The Fat Group contains three lists: Monounsaturated Fats, **Polyunsaturated** Fats, and Saturated Fats. Each food source contains an average of 45 calories and 5 grams of fat. The exchange lists also identify foods that contribute significant amounts of sodium. A sodium symbol is shown next to foods that contain 400 mg or more of sodium per exchange serving.

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

Advantages and Disadvantages

An advantage of the food exchange system is that it provides a system in which a wide selection of foods can be included, thereby offering variety and versatility to the person with diabetes. Other advantages of the lists are: (1) they provide a framework to group foods with similar carbohydrate, protein, fat, and calorie contents; (2) they emphasize important management concepts, such as carbohydrate amounts, fat modification, calorie control, and awareness of high-sodium foods; (3) by making food choices from each of the different lists a variety of healthful food choices can be assured; and (4) they provide a system that allows individuals to be accountable for what they eat. Furthermore, with an understanding of the **nutrient** composition of the exchange lists, nutrient values from food labels can be used and a wider variety of foods can be incorporated accurately into a meal plan.

nutrient: dietary substance necessary for health

Helpful Hints for Using the Exchange Lists

- Cereals, grains, pasta, breads, crackers, snacks, starchy vegetables, and cooked beans, peas, and lentils are on the starch list. In general, one starch exchange is ½ cup cereal, grain, or starchy vegetable; one ounce of a bread product, such as one slice of bread; one-third cup rice or pasta; or three-fourths to one ounce of most snack foods.
- Fresh, frozen, canned, and dried fruits and fruit juices are on the fruit list. In general, one fruit exchange is: one small to medium fresh fruit, one-half cup of canned or fresh fruit or fruit juice, or one-fourth cup of dried fruit.
- Different types of milk and milk products, such as yogurt, are on the milk list. One cup (eight fluid ounces) or two-thirds cup (six ounces) of fat-free or low-fat flavored yogurt sweetened with a non-nutritive sweetener are examples of one exchange.
- Vegetables are included in the Carbohydrate Group and are important components of a healthful diet. However, since three servings of vegetables are the equivalent of one carbohydrate serving, one or two servings per meal need not be counted. This was done to encourage consumption of vegetables and to simplify meal planning.
- Meat and meat substitutes that contain both protein and fat are on the meat list. In general, one exchange is: one ounce meat, fish, poultry, or cheese; or one-half cup beans, peas, lentils.
- In general, one fat exchange is: one teaspoon of regular margarine, mayonnaise, or vegetable oil; one tablespoon of regular salad dressings or reduced-fat mayonnaise; or two tablespoons of reduced-fat salad dressings.
- A *free food* is any food or drink that contains less than 20 calories or less than five grams of carbohydrate per serving. Foods with approximately 20 calories should be limited to three servings per day and spread throughout the day.
- Some foods are in one list, but they may fit just as appropriately in another list. For example, foods in the Starch, Fruit, and Milk lists of the Carbohydrate Group each contribute similar amounts of carbohydrates and calories and may be interchanged. If fruits or starches are regularly substituted for milk, calcium intake may be decreased. Conversely, regularly choosing milk instead of fruits or starches may result in inadequate fiber intake. Foods from the Other Carbohydrate list of the Carbohydrate Group, the Combination Foods list, and the fast foods list are also interchangeable with the Starch, Fruit, and Milk lists. However, most of the dessert-type foods on the Other Carbohydrate list are higher in sugars and fat and need to be eaten within the context of a healthful meal plan.
- Beans, peas, and lentils are included in the Starch list of the Carbohydrate Group. The serving size (usually one-half cup) is counted as one starch and one very lean meat for vegetarian meal planning. If individuals are not practicing vegetarians, or use these foods less frequently and often as side dishes rather than main dishes, the very lean meat exchange does not need to be counted—one-half cup is equivalent to one starch.
- Skim and reduced-fat milks are recommended for adults and children over two years of age, rather than whole milk.
- Meat choices from the Very Lean or Lean Meat lists are encouraged. However, it is not necessary to add or subtract fat exchanges when using meat lists that differ from those ordinarily consumed.
- Whenever possible, monounsaturated or polyunsaturated fats should be substituted for saturated fats.

The exchange lists are updated periodically and a database is kept of the **macronutrient** composition of each food, thus assuring the accuracy of the lists. For health professionals, the macronutrient and calorie values of the exchange lists provide a useful and efficient tool for evaluating food records and for assessing nutrition adequacy.

macronutrient: nutrient needed in large quantities

Despite the many advantages the exchange lists offer, they may not be the most appropriate meal-planning tool for many persons. For instance, they are not appropriate for those who cannot understand the concept of "exchanging" foods. Because the exchange booklets are written at a ninth- to tenth-grade reading level, individuals must be able to either read at this level or understand the concept of exchanging foods. For an individual to use them effectively, several educational sessions, and practice, may be required.

Historical Background

diet: the total daily food intake, or the types of foods eaten

In 1950, the following problems that had led to inconsistencies in food recommendations for persons with diabetes were identified: (1) methods used to estimate the composition of a **diet** were prolonged and needlessly precise; (2) there were many inconsistencies in the inclusion or restriction of foods; and (3) sizes of recommended portions were often stated in impractical amounts that were difficult to measure. Recognizing these facts, the food values given in table 1 were established. By combining foods of similar composition into food exchange lists, long and extensive lists of foods could be greatly abbreviated.

The first major revision of the exchange lists was published in 1976. The goals at that time were: to be more accurate in the caloric content of listed foods, to emphasize fat modification, and to provide for individualized meal plans to be used with the exchange lists.

The next revision of the exchange lists occurred in 1986. The goals of this revision were to ensure the exchange lists would reflect the principles of nutrition and to develop a database of the nutrient composition of the foods listed. Using the data from the database, revisions in the nutrient values assigned to some exchanges were made. For example, the Fruit list was changed from 10 grams of carbohydrate to 15 grams, with a subsequent increase in calories from 40 to 60 per exchange serving, to reflect the content of typical fruit portions.

The goals of the 1995 revision were: (1) to group carbohydrate food sources into one section to provide more flexibility in food choices; (2) to update the lists of foods and the database, primarily to add fat-modified foods, vegetarian food items, and fast foods; and (3) to allow for more accurate calculation of exchanges from nutrient information on labels, recipes, and prepared foods. The most significant revision in the 1995 revision was in the order and grouping of the lists. The Carbohydrate Group was listed

1950 FOOD VALUES FOR CALCULATING DIABETIC DIETS

Group	Amount	Weight (grams)	Carbohydrate (grams)	Protein (grams)	Fat (grams)	Energy (calories)
Milk, whole	½ pt	240	12	8	10	170
Vegetable, Group A	as desired	—	—	—	—	—
Vegetable, Group B	½ cup	100	7	2	—	36
Fruit	varies	—	10	—	—	40
Bread exchanges	varies	—	15	2	—	68
Meat exchanges	1 oz	30	—	7	5	73
Fat exchanges	1 tsp	5	—	—	5	45

SOURCE: Caso, E. K., *Journal of the American Dietetic Association.*

NUTRIENT VALUES IN ONE SERVING FROM EACH EXCHANGE LIST

Groups/Lists	Carbohydrate (grams)	Protein (grams)	Fat (grams)	Calories
Carbohydrate Group				
Starch	15	3	0–1	80
Fruit	15	—	—	60
Milk				
Fat-Free	12	8	0–3	90
Reduced-Fat	12	8	5	129
Whole	12	8	8	150
Sweets, Desserts, and Other Carbohydrates	15	varies	varies	varies
Vegetables	5	2	—	25
Meat and Meat Substitute Group				
Very Lean	—	7	0–1	35
Lean	—	7	3	55
Medium-Fat	—	7	5	75
High-Fat	—	7	8	100
Fat Group	—	—	5	45

SOURCE: American Dietetic Association and American Diabetes Association, 2003.

first and included the Other Carbohydrates list, which lists foods containing carbohydrate and fat, such as sweets, pie, cake, and ice cream. Foods on the Other Carbohydrate list usually provide 1 to 2 carbohydrate choices and 1 to 2 fat exchanges, and they may be interchanged with items on the Starch, Fruit, or Milk lists and the Fat list, if appropriate.

The American Diabetes Association and the American Dietetic Association published the latest version of the *Exchange Lists for Meal Planning* in January 2003. Food lists were updated and the Other Carbohydrate list was renamed the Sweets, Desserts, and Other Carbohydrates list. Each list begins with generalized servings of exchange. The nutrient values from the 1995 and 2003 exchange lists are the same and are listed in table 2. Also included in the booklet are a listing of free foods (foods containing less than 20 calories and 5 grams of carbohydrate); combination foods (entrees, frozen entrees, soups), and fast foods. SEE ALSO DIABETES.

Marion J. Franz

Bibliography

American Diabetes Association, and American Dietetic Association (2003). *Exchange Lists for Meal Planning*. Chicago and Alexandria, VA: American Dietetic Association and American Diabetes Association.

American Dietetic Association (2003). "Evidence-Based Nutrition Principles and Recommendations for the Treatment and Prevention of Diabetes and Related Complications." *Diabetes Care* 26(suppl. 1):S51–S61.

Caso, E. K. (1950). "Calculation of Diabetic Diets. Report of the Committee on Diabetic Diet Calculations, American Dietetic Association. Prepared Cooperatively with the Committee on Education, American Diabetes Association and Diabetes Branch, U.S. Public Health Service." *Journal of the American Dietetic Association* 26:575–582.

Franz, M. J.; Barr, P.; Holler, H.; Powers, M. A.; Wheeler, M. L.; Wylie-Rosett, J. (1987). "Exchange Lists, Revised 1985." *Journal of the American Dietetic Association* 87:28–34.

Wheeler, M. L.; Franz, M.; Barrier, P.; Holler, H.; Cronmiller, N.; Delahanty, L. (1996). "Macronutrient and Kilocalorie Database for the 1995 Exchange Lists for Meal Planning: A Rationale for Clinical Practice Decisions." *Journal of the American Dietetic Association* 96:1167–1171.

Exercise

sedentary: not active

More than 28 percent of Americans are completely **sedentary** (they engage in no physical activity), with an additional 60 percent being inadequately active (engaging in less than 30 minutes of activity per day). For those who strive to achieve and maintain a high quality of health, it must be recognized that physical activity is vital to optimal health. This is reaffirmed by numerous studies that have found an association between physical activity, health, longevity, and an improved quality of life. In addition, the number of deaths related to sedentary living or **obesity** is approximately a half-million per year. Physical activity may impact quality of life in several ways: it can be used to improve self-image and self-esteem, physical **wellness**, and health.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

wellness: related to health promotion

Participation in physical activity can be beneficial for anyone and can be started during any stage of life. One goal of *Healthy People 2010*, a set of national health objectives established by the U.S. Department of Health and Human Services, is to increase the number of people who participate in daily physical activity. This activity can take many forms, ranging from a regimented exercise program to daily life activities such as house or yard work, walking a pet, or walking around town to complete errands.

Definition of Terms

Physical activity is a broad term that encompasses all forms of muscle movements. These movements can range from sports to lifestyle activities. Furthermore, exercise can be defined as physical activity that is a planned, structured movement of the body designed to enhance physical fitness. Regimented or purposeful exercise consists of a program that includes twenty to sixty minutes of activity at least three to five days a week. Some examples of this type of activity include walking, running, cycling, or swimming.

anaerobic: without air, or oxygen

aerobic: designed to maintain adequate oxygen in the bloodstream

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

oxygen: O_2, atmospheric gas required by all animals

Exercise may be classified in one of two categories, **anaerobic** and **aerobic**, depending on where **energy** is derived from. There is a distinct difference between the two, and specific training techniques are used to enhance both. Anaerobic exercise does not require **oxygen** for energy. This is due to the intensity and duration of anaerobic events, which typically are high intensity and last only a few seconds to a minute or two. These activities range from a tennis serve to an eight-hundred-meter run.

Aerobic exercise does require oxygen for energy. This is observed during exercise that is less intense but of longer duration. This energy system is primarily used during events lasting longer than several minutes, such as a two-mile run or the Tour de France bicycle race. The potential does exist that one can use both systems, as in soccer, where a match requires ninety minutes of continual activity with short intense bursts of effort.

Benefits of Exercise

The American College of Sports Medicine (ACSM), the Centers for Disease Control and Prevention (CDC), and the Surgeon General have all issued statements that recommend placing an emphasis on adopting physical activity into one's lifestyle. Their intention is to make the public more aware of the health benefits associated with increased physical activity, as well as to

Female rugby players form a lineout, waiting for the ball to be thrown. Rugby can improve both aerobic and anaerobic fitness because, like many sports, it requires steady activity as well as frequent bursts of exertion. *[© Kevin Fleming/Corbis. Reproduced by permission.]*

highlight the amount and intensity of activity necessary to achieve optimal benefits.

There are numerous benefits associated with regular participation in an aerobic exercise program, including improved **cardiovascular** and respiratory functioning, reduced coronary **artery** disease (CAD) risk, and increased quality of life. Beneficial improvements in cardiovascular and respiratory function include an increased ability of exercising muscles to consume oxygen, lowered resting and exercise heart rates, increased stamina, resistance to **fatigue**, more effective management of **diabetes**, reduced bone-mineral loss, decreased **blood pressure**, and increased efficiency of the heart. Although it is recognized that specific exercises can be used for the purpose of increasing strength, muscular endurance, and flexibility, it is important to recognize that cardiovascular exercise has the most dramatic effect on the body. This is because cardiovascular exercise engages large muscle groups in an aerobic manner.

Role of Exercise in Disease Prevention

Studies have shown that exercise can have a direct effect on preventing **heart disease**, **cancer**, and other causes of premature death. Furthermore, participation in regular physical activity may reduce the rate of occurrence of these maladies. An inverse relationship exists between disease and exercise, meaning that with increased levels of physical activity there is a decreased **prevalence** for certain diseases. Currently, there is strong evidence that exercise has powerful effects on mortality, CAD (including blood lipid profiles), and colon cancer. Research has also confirmed that aerobic exercise can reduce **high blood pressure**, obesity, **type II diabetes,** and **osteoporosis**. In addition, **stroke** and several types of cancer (such as breast, **prostate**, and lung cancer) can also be reduced with regular physical activity.

Even more important, several of these factors are interrelated. For example, when an individual lowers his or her high blood pressure, the risk for heart disease, stroke, and kidney disease is also reduced. Another example is that exercise favorably alters blood lipid profiles. These profiles include

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carries blood away from the heart toward the body tissues

fatigue: tiredness

diabetes: inability to regulate level of sugar in the blood

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cancer: uncontrolled cell growth

prevalence: describing the number of cases in a population at any one time

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

osteoporosis: weakening of the bone structure

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

prostate: male gland surrounding the urethra that contributes fluid to the semen

Components of Physical Fitness

Cardiovascular Fitness

The ability of the body to perform prolonged, large-muscle, dynamic exercise at moderate to high levels of intensity. This is dependent on the ability of the heart and lungs to deliver oxygen to the working muscles. As fitness levels improve, the body functions more efficiently and the heart can better withstand the strains of everyday stress.

Muscular Strength

The maximal amount of force a muscle can exert with a single maximal effort. Strong muscles are important for carrying out everyday tasks, such as carrying groceries, doing yard work, and climbing stairs. Muscular strength can help to keep the body in proper alignment, prevent back and leg pain, and provide support for good posture.

Muscular Endurance

The ability of a muscle or group of muscles to perform repetitive contractions over a period of time. Endurance is a key for everyday life activities and operates with muscular endurance to help maintain good posture and prevent back and leg pain. In addition, endurance can enhance performance during sporting events, as well as help an individual cope with everyday stress.

Flexibility

This refers to the range of motion in a joint or group of joints, correlated with muscle length. This component becomes more important as people age and their joints stiffen up, preventing them from doing everyday tasks. Additionally, good range of motion will allow the body to assume more nautral positions to help maintain good posture. Stretching is therefore an important habit to start, as well as continue, as one ages.

Body Composition

The relative proportion of fat-free mass to fat mass in the body. Fat-free mass is composed of muscle, bone, organs, and water, whereas fat is the underlying adipose tissue. Excessive fat is a good predictor of health problems because it is associated with cardiovascular disease, high cholesterol, and high blood pressure. Higher proportions of fat-free mass indicate an increase in muscle, and thus an increased ability to adapt to everyday stress.

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

measurements of total **cholesterol** (TC, complete count of all cholesterol in the blood), high-density lipoprotein cholesterol (HDL-C, the "good" cholesterol), low-density lipoprotein cholesterol (LDL-C, the "bad" cholesterol), and **triglycerides** (TRG, storage form of energy), which reduce the risk of plaque buildup in the coronary arteries, a sign of CAD.

Exercise Prescription

Adequate physical activity is dependent on having a well-rounded program that encompasses all aspects of improving health and preventing disease. A well-rounded program includes cardiovascular fitness, muscular strength and endurance, flexibility, posture, and maintenance of body composition.

The most effective way to participate in a well-rounded program is by following a simple mnemonic device called FITT (Frequency, Intensity, Time, Type). The FITT principle includes how many times a week one should exercise (frequency), how intense the workout should be (intensity), how long the workout is (time), and what modality to use (type of exercise). Modality is dependent primarily on what an individual prefers. This exercise prescription in based on an individual's fitness level when entering the exercise program, and ultimately upon the goals of the individual. For ex-

ample, an untrained individual who wants to lose weight and likes to walk would be placed on a program of treadmill or outdoor walking (type), for thirty minutes a day (time), three to five times per week (frequency), and of light to moderate intensity (intensity).

A good example of an exercise program would include three stages. The first stage is a warm-up, where one should complete light calisthenics to activate and warm the muscles, immediately followed by stretching, which helps to maintain flexibility. The second stage is the conditioning stage, which consists of cardiovascular work to enhance the function of the heart and lungs and a resistance-training regimen to strengthen and tone major muscle groups, such as the quadriceps, hamstrings, chest, biceps, triceps, back, and abdominals. The final stage consists of a cool down, or reduction in heart rate to resting levels, as well as stretching again, since the greatest modification in flexibility comes from post-exercise stretching.

Maintenance of physical activity is important to maintain a healthy lifestyle. In addition, it is important to follow an exercise regime that will start slow and gradually increase as fitness level and exercise tolerance increases. The key is to complete at least thirty minutes of activity most days of the week in the form of activities that one enjoys, such as walking, jogging, swimming, aerobic dance, biking, skateboarding, or participating in a sport. This will enable an individual to reach the goals of *Healthy People 2010*, which include improving the quality of life through fitness with the adoption and maintenance of regular exercise and physical activity programs. SEE ALSO SPORTS NUTRITION.

Robert J. Moffatt
Sara A. Chelland

Bibliography

American College of Sports Medicine (2000). *ACSM's Guidelines for Exercise Testing and Prescription*, 6th edition. Philadelphia: Lippincott, Williams & Wilkins.

Corbin, Charles B.; Lindsey, Ruth; and Welk, Greg (2000). *Concepts of Physical Fitness and Wellness: A Comprehensive Lifestyle Approach*, 3rd edition. Boston: McGraw-Hill.

McArdle, William D.; Katch, Frank I.; and Katch, Victor L. (2001). *Essentials of Exercise Physiology*. Philadelphia: Lea & Faber.

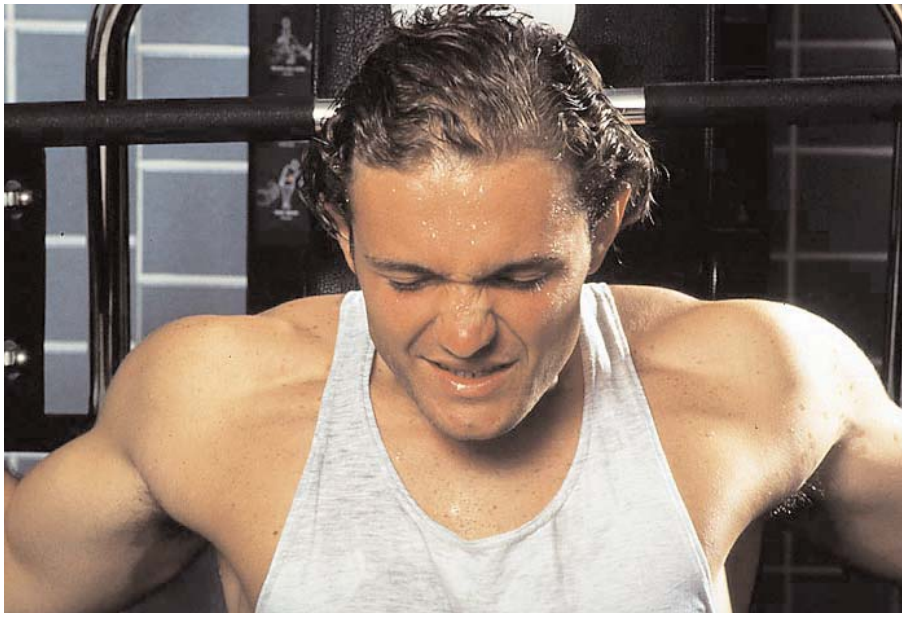
Robbins, Gwen; Powers, Debbie; and Burgess, Sharon (2002). *A Wellness Way of Life*, 5th edition. Boston: McGraw-Hill.

United States Department of Health and Human Services (1996). *Physical Activity and Health: A Report of the Surgeon General*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

Wallace, Janet P. (2001). "Health Benefits of Exercise and Fitness." In *Foundations of Exercise Science*, ed. Gary Kamen. Philadelphia: Lippincott, Williams & Wilkins.

Exercise Addiction

Individuals with an exercise addiction are characterized by their compulsive exercise behaviors, an overinvolvement in exercise, and the presence of an activity disorder—meaning they exercise at a duration, intensity, and frequency beyond that required for sport. A rigid schedule of intense exercise is maintained, accompanied by strong feelings of guilt when this schedule is violated. These individuals resist the temptation to lapse into nonexercise, and if they do lapse, the amount of exercise they partake in increases after



Exercise addicts may be driven to work out despite exhaustion or injury. Intense exercise addiction can lead to permanent physical damage, as the body is not allowed to recuperate between workouts. *[Photo Researchers, Inc. Reproduced by permission.]*

the lapse. Exercise addicts will skip school or work to exercise, forgo social events to exercise, exercise even when they are ill or tired, and keep detailed journals of their workouts. In addition, exercise addiction can lead to disordered eating behaviors.

Physical signs of exercise addiction include **fatigue**, soreness and stiffness, and hormonal changes, including decreased **testosterone** in males and increased production of cortisol, a **hormone** produced in response to **stress** that can cause the breakdown of bone, leading to an increased risk of stress fractures and **osteoporosis**. Exercise addiction can also lead to **muscle wasting**. Behavioral signs include increased **anxiety** and discomfort with rest or relaxation, and an inability to stop exercising. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; SPORTS NUTRITION.

Leslie Bonci

fatigue: tiredness

testosterone: male sex hormone

hormone: molecules produced by one set of cells that influence the function of another set of cells

stress: heightened state of nervousness or unease

osteoporosis: weakening of the bone structure

muscle wasting: loss of muscle bulk

anxiety: nervousness

Expanded Food Nutrition and Education Program

The Expanded Food Nutrition and Education Program (EFNEP), established in 1968, is funded by the United States Department of Agriculture. By providing grants to local communities, the program assists U.S. counties in developing programs to improve home and family life. EFNEP's purpose is to help economically and socially disadvantaged families improve their food practices and their **diet**. This may include advice on planning meals; selecting, purchasing, and preparing foods; and solving housekeeping problems (especially those involving storage and sanitation) that may interfere with proper food and nutrition management. EFNEP trains homemakers living in the community to be education and training facilitators, thereby advancing women and improving neighborhood networks.

Susan Himburg

diet: the total daily food intake, or the types of foods eaten

Bibliography

Owen, Anita Y.; Splett, Patricia L.; and Owen, George M. (1999). *Nutrition in the Community: The Art of Delivering Services*, 4th edition. Boston: McGraw-Hill.

Internet Resource

United States Department of Agriculture. "Expanded Food and Nutrition Education Program." Available from <http://www.reeusda.gov>

Fad Diets

Americans are obsessed with dieting. They willingly try the latest **diet** appearing in popular magazines, discussed on talk shows, and displayed on the shelves of their local bookstore. Many fad diets defy logic, basic biochemistry, and even appetite appeal. They are popular because they promise quick results, are relatively easy to implement, and claim remarkable improvements in how their followers will look or feel. Unfortunately, the one thing most fad diets have in common is that they seldom promote sound weight loss. More important, they only work short-term. As many as 95 percent of people who lose weight gain it back within five years. It is not surprising that nearly 25 percent of Americans are confused when it comes to information about dieting.

diet: the total daily food intake, or the types of foods eaten

Despite the popularity of dieting, the **prevalence** of **overweight** and **obesity** has increased steadily since the 1970s. In 1980, 25 percent of adults in the United States were overweight. By 1991, this figure had risen to 33 percent, and by 2001, over 66 percent of the adult population were classified as overweight or **obese**. Each year, Americans spend more than $30 billion fighting fat—often for gimmicks that do not work. Most people who are trying to lose weight are not using the recommended combination of reducing caloric intake and increasing physical activity. Fad diets provide

prevalence: describing the number of cases in a population at any one time

overweight: weight above the accepted norm based on height, sex, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

obese: above accepted standards of weight for sex, height, and age

COMMON FAD DIETS: SUMMARY OF INFORMATION

Diet	Philosophy	Foods to Eat	Foods to Avoid	Practicality	Lose and Maintain Weight?
Dr. Atkins' New Diet Revolution	Eating too many carbohydrates (CHO) causes obesity and other health problems; elimination of CHO solves problems.	Meat, fish, poultry, eggs, cheese, low-CHO vegetables, butter, oil; no alcohol.	Carbohydrates, specifically bread, pasta, milk, most fruits and vegetables	Limited food choices.	Yes, but initial weight loss is mostly water. Difficult to maintain long-term due to food restrictions.
The Zone	Eating the right combination of foods leads to metabolic state at which body functions at peak level, and results in weight loss and increased energy.	Most foods, so long as they are consumed in the exact proportion (40/30/30) at each meal.	Carbohydrates, specifically bread, pasta, some fruits, and saturated fats	Difficult to calculate portions and follow.	Yes, because of lower caloric intake. Could result in weight maintenance if followed long-term. However, diet rigid and difficult to maintain long-term.
Protein Power	Eating CHO releases insulin that contributes to obesity and other health problems.	Meat, fish, poultry, eggs, cheese, low-CHO vegetables, butter, oil, salad dressings, alcohol in moderation.	Carbohydrates	Rigid rules. Not practical long-term.	Yes, via caloric restriction. Could result in weight maintenance if followed long-term. However, diet rigid and difficult to maintain long-term.
Sugar Busters!	Sugar is toxic, leads to insulin resistance, which then makes you overweight.	Protein and fat. Low-glycemic-index foods. Alcohol in moderation.	Potatoes, white rice, corn, carrots, beets, white bread, all refined white flour products	Eliminates many carbohydrates; discourages eating fruit with meals.	Yes, via caloric restriction. Difficult to maintain long-term due to food restrictions.

Dr. Robert Atkins, 1931–2003. Atkins's books promote a low-carbohydrate diet that is proven to cause weight loss, but which may cause dangerous side effects and malnutrition. *[AP/Wide World Photos. Reproduced by permission.]*

advice counter to that provided by science-based governmental and non-governmental organizations. Is it any wonder that such diets fail to achieve long-term results, so needed by the majority of Americans?

Fad diets take many forms. Over the years, they have promoted consumption of specific foods (e.g., the Cabbage Soup Diet, the Drinking Man's Diet, the Grapefruit Diet), specific combinations of foods (e.g., the Zone) and specific times that foods must be eaten (e.g., the Rotation Diet). Some popular diets recommend elimination of certain foods (e.g., **carbohydrates** in the Atkins Diet, Protein Power, the Carbohydrate Addicts Diet, Life without Bread, and Sugar Busters!). Others recommend eating based on a person's blood type (e.g., Eat Right for Your Type), or eating like a caveman (e.g., Neanderthin). Celebrities promote diets (e.g., Suzanne Somers' Get Skinny on Fabulous Food), and fad diets have taken the name of well-known places associated with wealth, fame, and thinness (e.g., the Beverly Hills Diet, the South Beach Diet). If any one of these fad diets worked, the problem of obesity would likely have been solved long ago.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

Some fad diets have been popular for many years (e.g., Atkins' Diet Revolution). Books appear as "new, revised" editions and continue to sell

Letter on Corpulence

The excerpt below is from the first low-carbohydrate diet to come to public attention, in William Banting's *Letter on Corpulence* of 1864. After many fruitless attempts to lose weight, Banting, an English casket maker, began the diet on the advice of Dr. William Harvey and lost 45 pounds. Harvey advised Banting to abstain from bread, butter, milk, sugar, beer, and potatoes because they contain "starch and saccharine matter, tending to create fat." The first three editions of the *Letter* sold 63,000 copies in the United Kingdom alone.

- For breakfast, at 9.0 A.M., I take five to six ounces of either beef mutton, kidneys, broiled fish, bacon, or cold meat of any kind except pork or veal; a large cup of tea or coffee (without milk or sugar), a little biscuit, or one ounce of dry toast; making together six ounces solid, nine liquid.
- For dinner, at 2.0 P.M., Five or six ounces of any fish except salmon, herrings, or eels, any meat except pork or veal, any vegetable except potato, parsnip, beetroot, turnip, or carrot, one ounce of dry toast, fruit out of a pudding not sweetened; any kind of poultry or game, and two or three glasses of good claret, sherry, or Madeira—Champagne, port, and beer forbidden; making together ten to twelve ounces solid, and ten liquid.
- For tea, at 6.0 P.M., Two or three ounces of cooked fruit, a rusk or two, and a cup of tea without milk or sugar; making two to four ounces solid, nine liquid.
- For supper, at 9.0 P.M. Three or four ounces of meat or fish, similar to dinner, with a glass or two of claret or sherry and water; making four ounces solid and seven liquid.
- For nightcap, if required, A tumbler of grog—(gin, whisky, or brandy, without sugar)—or a glass or two of claret or sherry.

—Paula Kepos

millions of copies. Unfortunately, there is nothing new or revised about the diets; they simply appeal to a new generation of overweight, frustrated dieters. The underlying reason why diets (including fad diets) work is that they result in decreased caloric intake. When **energy** intake is less than energy expenditure, people lose weight. Fad diets that lead to decreased caloric intake, whether by eliminating carbohydrates, eating cabbage soup all day, or adding grapefruit to every meal, will result in weight loss. If a person followed such a diet long-term, he or she would keep the weight off. Of course, no one wants to live on cabbage soup forever, or eliminate carbohydrates forever, so people break the "diet" and gain back the weight they lost—and often even more. The accompanying table provides information about some common fad diets.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

The American Heart Association provides some tips that can be used to recognize a fad diet. First, does the diet contain magic or miracle foods or proprietary ingredients? There are no "super foods" or "magic ingredients" that can undo the long-term effects of overeating and lack of activity. Next, beware of fad diets that claim rapid weight loss (e.g., "lose 10 pounds this weekend!"). Though quite appealing, weight loss occurring this quickly is due to loss of fluid, not fat. Studies show that gradual weight loss increases a person's success at keeping it off permanently. Sound weight loss plans aim for losing no more than one to two pounds per week.

Another sign of a fad diet is losing weight without exercise. Studies consistently show that the single most important variable that predicts long-term success at weight loss and maintenance (not gaining back the weight that was lost) is physical activity. Simple activities like walking or riding a bike (to and from school, for example) should be incorporated into one's

life. Also, beware of the promotion of bizarre quantities of foods or the elimination of other types of foods (e.g., cabbage soup for breakfast, lunch, and dinner; avoiding dairy foods; and eliminating carbohydrates). Forbidding certain foods or entire food groups, in addition to being unhealthy, may increase the likelihood that one will cheat, **binge**, or just give up on the diet. Finally a rigid menu or rigid schedule of eating is a good sign that one should avoid the diet. Limiting food choices and adhering to specific eating times is a daunting task. Rather, one should look for a plan that can be followed not for a week or a month, but for an entire lifetime.

binge: uncontrolled indulgence

Knowledgeable practitioners do not recommend fad diets because such diets do not work long-term. Even though they might work in the short run, there is little value in losing weight if one is only going to regain it after the diet ends. With repeated dieting, weight loss becomes more difficult and results in frustration, feelings of failure, and loss of self-esteem.

From a nutritional standpoint, many fad diets lack important **nutrients**. For example, high-fat, low-carbohydrate diets (such as the Atkins Diet) are low in vitamins E, A, thiamin, B_6, **folate**, **calcium**, magnesium, **iron**, **zinc**, potassium, and dietary **fiber**, and they also require supplementation. In addition, they are high in **saturated fat** and **cholesterol**. On the other hand, when individuals are allowed to choose foods from all food groups, their diet is likely to be nutritionally adequate and healthful long-term.

nutrient: dietary substance necessary for health

folate: one of the B vitamins, also called folic acid

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

fiber: indigestible plant material that aids digestion by providing bulk

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

legumes: beans, peas, and related plants

chronic: over a long period

In conclusion, fad diets do not result in long-term weight loss, are nutritionally inadequate, and should be avoided. The optimal diet for weight loss is one that reduces overall caloric intake and promotes physical activity. It is a diet high in vegetables, fruits, complex carbohydrates (grains and **legumes**), and low-fat dairy products. It is associated with fullness and satiety and reduces the risk of **chronic** disease. It is also convenient and inexpensive to follow. SEE ALSO WEIGHT LOSS DIETS; WEIGHT MANAGEMENT.

Marjorie R. Freedman

Bibliography

Freedman, M. R.; King, J.; and Kennedy, E. (2001). *Popular Diets: A Scientific Review. Obesity Research* 9 (Suppl. 1):1S-40S.

Thomas, P. R., ed. (1995). *Weighing the Options.* Washington, DC: National Academy Press.

Internet Resouces

American Heart Association. <http://www.americanheart.gov>

National Center for Chronic Disease Prevention and Health Promotion. "Healthy Eating Tips" and "Obesity and Overwight." Available from <http://www.cdc.gov>

National Heart, Lung, and Blood Institute. <http:www.nhlbi.nih.gov>

Shape Up America. <http://www.shapeupamerica.org>

Failure to Thrive

Failure to thrive is a term used to describe infants and young children who are not growing or are losing weight due to **malnutrition**, neglect, abuse, or medical conditions. In failure to thrive, the child may have a low body

failure to thrive: lack of normal developmental progress or maintenance of health

malnutrition: chronic lack of sufficient nutrients to maintain health

weight (below the third percentile for the child's age), a low height for age, or a small head circumference. A child with failure to thrive is not eating or being offered enough **calories** to meet his or her nutritional needs. Besides impaired growth, other symptoms include tiredness, sleeplessness, irritability, lethargy, resistance to eating, vomiting, and problems with elimination. The child may be suffering from an illness, medical condition, or recurring infections; taking medications; or come from a poor, distressed, or socially isolated family. To attain normal growth levels, a child with this condition requires from 1.5 to 2 times the normal amount of calories. SEE ALSO INFANT NUTRITION.

calorie: unit of food energy

Heidi J. Silver

Bibliography

Bithoney, W. G.; Dubowitz, H.; and Egan, H. (1992). "Failure to Thrive/Growth Deficiency." *Pediatrics in Review* 13:453–460.

Schwartz, D. (2000). "Failure to Thrive: An Old Nemesis in the New Millennium." *Pediatrics in Review* 21:257–264.

Internet Resource

American Academy of Pediatrics. "Failure To Thrive." <http://www.medem.com>

Famine

Famine is the culmination of a long process, typically covering two or more crop seasons, in which increasing numbers of people lose their access to food. Although early detection seems highly possible, the origins of famine are unclear, and early response is therefore rare. Famine is distinct from generalized **chronic** hunger, **malnutrition**, or undernourishment. It is a more dramatic and exceptional event that triggers institutional responses.

chronic: over a long period

malnutrition: chronic lack of sufficient nutrients to maintain health

Famine has been defined as the regional failure of food production or distribution systems leading to sharply increased mortality due to starvation and associated disease. Excessive mortality—deaths that would not have occurred otherwise—are a core feature of famine. Other important determinants of famine are regional issues, shifting market demand for different foods, and changes in the food aggregate supply. Famine also leads to extensive social disintegration, hoarding of food, smuggling, black-market food sales, and crime. Many people in distress sell their only assets such as their jewelry, animals, or land. Families often divide in search of work or succor—wives may even be cast adrift and children sold. Out-migration also increases as people abandon their lands, homes, and communities in desperation.

Famine is generally accompanied by a recession in the entire rural economy, affecting production and exchange, employment, and the income of farm and nonfarm households alike. Landless laborers, artisans, and traders are among those most vulnerable to famine because of shrinking demand for their labor, goods, and services. Fishermen and those who raise livestock are also vulnerable because they rely on the exchange of meat and marine products to obtain the cheaper grain **calories** they require. Amartya Sen, a Nobel Prize–winning economist, has argued that famine is more than just severe food shortage. His economic theory of famine is based on evidence

calorie: unit of food energy

When inadequate food supply in a region causes excessive mortality, the region is in a state of famine. Economic, political, and social forces contribute to the situation. *[AP/Wide World Photos. Reproduced by permission.]*

that even with relatively small changes in the food supply, famine has been caused by other economic factors. Each person has an economic "entitlement," a range of different goods that can be acquired with an individual's resources, according to Sen. People starve when their entitlement is not enough to procure the food required to survive. How much the food is available to people depends on income distribution and the ability to provide services that others are willing to pay for. However, this does not mean that the supply of food is irrelevant in the cause of famine. A scarcity of food will usually increase the competition among people to acquire it, and thereby increase its price. For those already close to the margin of hunger and poverty, this may drive them to the point of starvation.

The twentieth century saw four major famines: the great Bengal famine in colonial India under British rule in 1943–1944, in which more than three million people died; the famine in several provinces of Ethiopia between 1972 and 1974; the drought and famine in the Sahel region of Africa between 1968 and 1973; and the famine in Bangladesh in 1974 (the same region as the 1943–1944 famine, but now under a different government). It has been argued that the only way certain parts of the world can become less prone to famine is through economic development. SEE ALSO Disaster Relief Organizations; Emergency Nutrition Network; Food Aid for Development; Food and Agriculture Organization; Food Insecurity; Hunger; Malnutrition; United Nations Children's Fund (UNICEF).

Nilesh Chatterjee

Bibliography

Field, John O. (1993). *The Challenge of Famine: Recent Experience, Lessons Learned.* West Hartford, CT: Kumarian Press.

Sen, Amartya (1981). *Poverty and Famines: An Essay on Entitlement and Deprivation.* New York: Oxford University Press.

Young, E. M. (1997). *World Hunger.* London: Routledge.

Fast Foods

Fast foods are relatively inexpensive foods that are prepared and served quickly. The **fast-food** industry had its beginnings around the mid-twentieth century, and it grew tremendously during the last three decades of the twentieth century. Growth of the fast-food industry is projected to be even greater outside the United States during the twenty-first century.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

The most common type of U.S. fast-food restaurant specializes in a meal consisting of a hamburger, French fries, and a beverage. Examples include McDonald's, Burger King, and Wendy's. Some, such as Kentucky Fried Chicken, specialize in chicken; some, such as Subway, provide sandwiches; and others, such as Taco Bell, provide **Americanized** ethnic foods. Outside of the United States, these fast-food eateries serve some of the standard American dishes, such as hamburgers, but they may also serve regionally popular items. There are also fast-food restaurants in other countries that specialize in providing ethnic foods, such as soups in Japan or crepes in France.

Americanized: having adopted more American habits or characteristics

Nutritional Issues

Many fast foods are fried (which facilitates quick preparation), high in **fat** and sodium, and low in **fiber**, **vitamins**, and some **minerals**. The "added value" option, whereby customers can order larger sizes for a minimal additional charge, adds to the total **calorie** and fat intake. Many of these eateries now offer salads, low-calorie or fat-free dressings, low-fat ice cream, and plain, broiled chicken sandwiches or other foods low in fat and/or calories. Menu options will probably continue to increase in response to health concerns and changing demographics. SEE ALSO CONVENIENCE FOODS; DIETARY TRENDS, AMERICAN; DIETARY TRENDS, INTERNATIONAL.

Judith C. Rodriguez

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fiber: indigestible plant material that aids digestion by providing bulk

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calorie: unit of food energy

Extra-large portions of fast food may seem like a bargain, but such items add excessive empty calories to the diet. A "supersized combo meal" may provide a person's entire daily recommended intake of calories, but will probably include very few essential nutrients. *[Photograph by Steve Prezant. Corbis. Reproduced by permission.]*

Bibliography

Price, Charlene (1996). "The U.S. Foodservice Industry Looks Abroad." *Food Review* 19(2):13–17.

Schlosser, Eric (2001). *Fast Food Nation: The Darker Side of the All-American Meal.* New York: Houghton Mifflin.

Fasting

The term *fasting* refers to voluntarily or involuntarily going without food. A person may fast voluntarily because of an **eating disorder**, as a dietary practice related to religious **proscriptions**, or for health reasons, such as weight loss or internal cleansing. There are, however, no nutritional benefits to fasting.

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

proscription: prohibitions, rules against

During a full fast a person abstains from all foods except water or other liquids. A person may also engage in a partial fast, during which particular foods are avoided. Extended fasts lasting longer than a few days can be dangerous because intake is not supporting growth and maintenance. Fasting also promotes the development of **ketones**, which can be harmful to body organs if they accumulate in the body. Ketones are acidic compounds produced from the incomplete breakdown of fats when there is insufficient **carbohydrate** intake, and they can disturb the body's acid-base balance. SEE ALSO DIETING; RELIGION AND DIETARY PRACTICES.

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

Judith C. Rodriguez

Bibliography

Anderson, J., and Deskins, B. (1995). *The Nutrition Bible.* New York: William Morrow.

Fat Substitutes

Since the late 1980s, fat-free and reduced-fat foods have become widely available. While not all new products survive the competitive marketplace, thousands of new reduced-fat and fat-free products have been introduced each year since 1990.

In part, these new reduced-fat food products are the result of consumer demand. But they are also a response to public health concerns and initiatives. In 1990, Healthy People 2000 asked food manufacturers to double the availability of reduced-fat food products by the year 2000, a goal that was easily met.

Dietary Fat: A Good Thing in Moderation

Despite fat's bad reputation, it is a very important **nutrient**. Dietary fat plays many critical roles in the body, such as providing **essential fatty acids**, fat-soluble **vitamins**, and **energy**. It also serves structural functions in **hormones** and in cells.

nutrient: dietary substance necessary for health

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

hormone: molecules produced by one set of cells that influence the function of another set of cells

Fat is also a key factor in how foods taste. Fat absorbs the essence of spices and flavors and allows people to experience their full aroma. Not only does fat carry flavor, it also determines whether a cookie crunches or a muf-

Fat substitutes come in several varieties, including carbohydrate-based substitutes and protein-based substitutes. A more recent innovation is the fat-based substitute called olestra, which is an indigestible molecule that cannot be absorbed by the body. *[Octane Photographic. Reproduced by permission.]*

fin crumbles. In other words, fat is one of the main reasons people enjoy food.

Since the 1970s, **nutrition** scientists have researched the effects of **diet** on **chronic** diseases. Eating a diet lower in fat, **saturated fat**, and **cholesterol** appears to help prevent or delay the development of some serious illnesses, such as certain cancers and **heart disease**.

Most government health agencies and professional health organizations encourage people five years old and older to eat a diet with less than 30 percent of total **calories** from fat, and less than 10 percent of that from saturated fat.

Consumers are concerned about nutrition, and they want to moderate the fat in their diet but there are challenges to overcome. Nutrition, price, convenience, and product safety are important, but taste is the key driver behind food selection for most people. And many consumers still think that less fat means less taste. Fat substitutes were developed to help meet consumers' expectations about taste while providing fewer calories from fat.

nutrition: the maintenance of health through proper eating, or the study of same

diet: the total daily food intake, or the types of foods eaten

chronic: over a long period

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

calorie: unit of food energy

What Are Fat Substitutes?

Substitutes, or fat replacers, provide the sensory and functional qualities normally provided by fat. For example, fat provides moistness in baked goods, texture in ice cream, and crispiness in potato chips. Because fat has so many diverse functions in foods, it is virtually impossible to replace it with a single compound or process. The ingredients used in place of fat depend on how a food product will be eaten or prepared. For instance, not all fat-substitute ingredients are stable when heated, so the type of fat substitute used in a fat-free salad dressing may not work well in a muffin mix.

Many fat substitutes are simply old ingredients used in new ways. For example, the Food and Drug Administration (FDA) approved polydextrose for use as a moisture-binding agent in the early 1980s, but more recently it

COMMON FAT SUBSTITUTES

Carbohydrate-based	Protein-based	Fat-based
Cellulose	Microparticulated protein	Caprenin
Dextrins	Modified whey protein concentrate	Salatrim
Fiber		Emulsifiers (mono- and diglycerides)
Gums		Sucrose polyester (olestra)
Inulin		
Maltodextrins		
Oatrim		
Polydextrose		
Polyols		
Starch/modified food starch		
Z-Trim		

carrageenan: a thickener derived from red seaweed

guar gum: a thickener made from a tropical bean

has been used as a fat substitute. **Carrageenan** has been used since the early 1960s as an emulsifier, stabilizer, and thickener, but is now commonly used to replace fat in foods, as is **guar gum**, which has been used as a thickener for nearly a hundred years.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

molecule: combination of atoms that form stable particles

Some fat substitutes are newer to the food supply, though they are made from familiar ingredients. For example, microparticulated **protein** is made from milk, egg, or whey protein. Other fat substitutes are new ingredients made from combinations of basic **molecules**.

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

In some cases, the FDA has approved fat-reduction ingredients as **food additives**. To be approved, food additives are tested extensively to assess their safety and level of use among different population groups. Examples of fat substitutes approved as food additives include carrageenan, olestra, and polydextrose.

In other instances, fat-reduction ingredients are "generally recognized as safe" (GRAS). GRAS ingredients are made from common food components and are considered by experts to be safe. For example, many spices and flavoring agents, such as sugar and salt, are GRAS ingredients. Examples of GRAS fat substitutes include guar gum and maltodextrin.

Categories of Fat Substitutes

Fat-substitute ingredients fall into three categories: carbohydrate-based, protein-based, and fat-based. Carbohydrate-based fat substitutes are the most common. They are very versatile and found in many types of food products. Carbohydrate-based fat substitutes provide between zero and four calories per gram. When used to replace fat, they may significantly lower the calorie content of a food. Most carbohydrate-based fat substitutes are GRAS substances. Some of these ingredients are only partially digestible. However, when consumed at expected levels, most carbohydrate-based fat substitutes have no digestive effects. Guar gum is an example of a carbohydrate-based fat substitute.

Protein-based fat substitutes are not as numerous as carbohydrate-based ingredients, but they have many applications and can be used in many products, including cheese, yogurt, sour cream, ice cream, mayonnaise, and salad dressing. Protein-based fat substitutes cannot be used for deep-frying. Whey protein concentrate is a protein-based fat substitute.

THE EFFECTS OF FAT SUBSTITUTES ON A TYPICAL AMERICAN MEAL

Regular lunch	Calories	Fat (g)	Lunch with fat substitutes	Calories	Fat (g)
2 slices bread	130	2	2 slices bread	130	2
1 oz. cheese	105	9	1 oz. reduced-fat cheese	75	4
2 oz. bologna	180	17	2 oz. fat-free bologna	40	0
1 tbsp. mayonnaise	100	11	1 tbsp. low-fat mayonnaise	25	1
banana	105	0	banana	105	0
2 cookies	140	6	2 reduced-fat cookies	120	3
Total:	**760**	**45**	**Total:**	**495**	**10**

The last category of fat substitutes includes those that are fat-based. Because they are made from fat, they often come closest to providing fat's taste and cooking properties. Most Americans have heard of olestra, which is a fat-based fat substitute made from sucrose (table sugar) and **fatty acids** from vegetable oils. However, unlike sugar and vegetable oils, the body does not absorb olestra because the human digestive **enzymes** cannot break down such a large molecule. Olestra has the potential to inhibit **absorption** of some fat-soluble nutrients in the digestive tract, and, to offset any possible effects, products made with olestra have appropriate amounts of vitamins A, D, E, and K added.

fatty acids: molecules rich in carbon and hydrogen; a component of fats

enzyme: protein responsible for carrying out reactions in a cell

absorption: uptake by the digestive tract

Ensuring Safety

Most fat substitutes are not new to the food supply. Ingredients that are new, or used in new ways, must meet the FDA's strict criteria to be either classified as GRAS or approved as food additives. Whether they are GRAS or food additives, those ingredients approved for use in foods are considered safe for people of all ages.

Can Fat Substitutes Help to Reduce Dietary Fat?

Several studies have shown that using reduced-fat versions of food products can significantly reduce the amount of fat that people eat. For some people, eating less fat may lead to eating fewer calories and, eventually, to weight loss. As illustrated in the table above, by using reduced-fat foods, a typical lunch can be trimmed of one-third of its calories and three-fourths of its fat.

A common misconception about reduced-fat foods is that they also are low in calories. For many products, however, this is not the case. Most reduced-fat foods have had other ingredients added to replace the texture or flavor provided by fat, so that while the calories may be slightly lower in a fat-reduced product, the difference between it and a full-fat product may not be significant. With fat-modified products, as with all foods, portion size and calories still count.

Fat-modified foods can fit into a healthy eating plan. According to the American Dietetic Association, they offer a safe, feasible, and effective means to maintain the palatability of diets that are controlled in fat or calories. But they are only one of the many tools that can be used to achieve nutrition goals. Foods with fat substitutes should be consumed as part of an overall

healthful eating plan, such as that outlined in the Dietary Guidelines for Americans. SEE ALSO ARTIFICIAL SWEETENERS; DIETARY GUIDELINES FOR AMERICANS; FATS.

Susan T. Borra

Bibliography

Diamond, L. (1997). "The Dietary Guidelines Alliance: Reaching Consumers with Meaningful Health Messages." *Journal of the American Dietetic Association* 97(3):247.

Hahn, N. I. (1997). "Replacing Fat with Food Technology." *Journal of the American Dietetic Association* 3:15–16.

Heimbach, James T.; Van Der Riet, Brooke E.; and Egan, S. Kathleen. "Impact of the Use of Reduced-Fat Foods on Nutrient Adequacy" (1997). *Annals of the New York Academy of Sciences: Nutritional Implications of Macronutrient Substitutes* 819:108–114.

Kurtzweil, Paula (1996). "Taking the Fat Out of Food." *FDA Consumer* 30(6).

Morgan, Rebecca; Sigman-Grant, Madeleine; Taylor, Dennis S.; Moriarty, Kristen; Fishell, Valerie; and Kris-Etherton, Penny (1997). "Impact of Macronutrient Substitutes on the Composition of the Diet and U.S. Food Supply." *Annals of the New York Academy of Sciences: Nutritional Implications of Macronutrient Substitutes* 819:70–95.

Internet Resources

American Dietetic Association (1998). "Position of the American Dietetic Association: Fat Replacers." Available from <http://www.eatright.com>

U.S. Department of Health and Human Services (1999). *Healthy People 2000.* Available from <http://www.health.gov/healthypeople>

U.S. Department of Health and Human Services, and U.S. Department of Agriculture (2000). *Nutrition and Your Health: Dietary Guidelines for Americans*, 5th ed. Available from <http://www.health.gov/dietaryguidelines>

Fats

atoms: fundamental particles of matter

Lipids are organic substances consisting mostly of carbons and hydrogen **atoms**. They are hydrophobic, which means that they have little or no affinity to water. All lipids are soluble (or dissolvable) in nonpolar solvents, such as ether, alcohol, and gasoline. There are three families of lipids: (1) fats, (2) phospholipids, and (3) steroids.

Fatty acids and glycerol make up the larger molecule of fats. A fatty acid consists of a long carbon skeleton of 16 or 18 carbon atoms, though some are even longer. The carbonyl group, which is a carbon atom double-bonded to an oxygen atom and single-bonded to an oxygen attached to a hydrogen (OH-C=O), is the acidic group of the fatty acids. The acidic property is determined by the ability of the hydrogen to dissociate, or break away, from the oxygen atom. The carbonyl group is followed by a long chain of carbon atoms bonded to hydrogen, which is referred to as the hydrocarbon "tail." The long hydrocarbon tail gives fatty acids their hydrophobic, or "water-fearing" property. Fats cannot be dissolved in water because fats are nonpolar (an equal distribution of electrons) and water is polar (an unequal distribution of electrons). The polarity of water is unable to form bonds and break down the nonpolar fatty acid molecule.

There are different types of fatty acids, which vary in length and the number of bonds. Saturated fatty acids have single bonds between the car-

bon atoms that make up the tail. The carbon atoms are "full" or saturated, and therefore cannot take up any more hydrogen. Most animal fat, such as butter, milk, cheese, and coconut oil, are saturated. Unsaturated fatty acids have one or more double bonds between carbon atoms. A double bond is the sharing of four electrons between atoms, while a single bond is the sharing of two electrons. The double bond has the ability to lend its extra two electrons to another atom, thereby forming another bond. Monounsaturated fatty acids contain only one double bond, such that each of the carbon atoms of the double bond can bond with a hydrogen atom. An example of monounsaturated fatty acids is oleic acid, which is found in olive oil. **Polyunsaturated** fatty acids contain two or more double bonds, such that four or more carbon atoms can bond with hydrogen atoms. Most vegetable fats are polyunsaturated fatty acids. The double bonds change the structure of the fatty acid, in that there is a slight bend where the double bond is located.

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

Foods high in saturated fatty acids include whole milk, cream, cheese, egg yolk, fatty meats (e.g., beef, lamb, pork, ham), coconut oil, regular margarine, and chocolate. Foods high in polyunsaturated fatty acids include vegetable oils (e.g., safflower, corn, cottonseed, soybean, sesame, sunflower), salad dressing made from vegetable oils, and fish such as salmon, tuna, and herring.

Triglycerides are the basic unit of fat and are composed of three ("tri-") fatty acids individually bonded to each of the three carbons of glycerol. Fatty acids rarely exist in a free form in nature because they are highly reactive, and therefore make bonds spontaneously.

Fat Function, Metabolism, and Storage

Fats and lipids play critical roles in the overall functioning of the body, such as in digestion and **energy** metabolism. Usually, 95 percent of the fat in food is digested and absorbed into adipose, or fatty, tissue. Fats are the body's energy provider and energy reserve, which helps the body maintain a constant temperature. Fats and lipids are also involved in the production and regulation of steroid **hormones**, which are hydrophobic (or "water-fearing") **molecules** made from **cholesterol** in the smooth endoplasmic reticulum, a compartment within a cell in which lipids, hormones, and **proteins** are made. Steroid hormones are essential in regulating sexuality, reproduction, and development of the human sex organs, as well as in regulating the water balance in the body. Steroid hormones can also freely flow in and out of cells, and they modify the transcription process, which is the first step in protein synthesis, where segments of the cell's **DNA**, or the **genetic** code, is copied.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

hormone: molecules produced by one set of cells that influence the function of another set of cells

molecule: combination of atoms that form stable particles

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

genetic: inherited or related to the genes

Fats and lipids also have important structural roles in maintaining nerve impulse transmission, memory storage, and tissue structure. Lipids are the major component of cell membranes. The three most common lipids in the membranes of eukaryots, or nucleus-containing cells, are phospholipids, glycolipids, and cholesterol. A phospholipid has two parts: (1) the hydrophilic ("water-loving") head, which consists of choline, phosphate, and glycerol, and (2) the hydrophobic ("water-fearing") fatty acid tail, which consists of carbon and hydrogen. The hydrophilic head is the part of the phospholipids that is in contact with water, since it shares similar chemical properties with

water molecules. The hydrophobic tail of the phospholipids faces inward, and therefore is able to avoid any contact with water. In this particular arrangement, the phospholipids arrange themselves in a bilayer (double layer) alignment in **aqueous** solution.

aqueous: water-based

intestines: the two long tubes that carry out the bulk of the processes of digestion

enzyme: protein responsible for carrying out reactions in a cell

bile: substance produced in the liver which suspends fats for absorption

Fats are metabolized primarily in the small **intestines** because the **enzymes** of the stomach cannot break down fat molecules due to their hydrophobicity. In the small intestines, fat molecules stimulate the release of cholecystokinin (CCK), a small-intestine hormone, into the bloodstream. The CCK in the blood triggers the pancreas to release digestive enzymes that can break down lipids. The gallbladder is also stimulated to secrete **bile** into the small intestines. Bile acids coat the fat molecules, which results in the formation of small fat globules, which are called *micelles.* The coating prevents the small fat globules from fusing together to form larger fat molecules, and therefore the small fat globules are more easily absorbed. The pancreatic enzymes can also break down triglycerides into monoglycerides and fatty acids. Once this occurs, the broken-down fat molecules are able to diffuse into the intestinal cells, in which they are converted back to triglycerides, and finally into chylomicrons.

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

Chylomicrons, which are composed of fat and protein, are macromolecules that travel through the bloodstream into the lymphatic capillaries called *lacteals.* The **lymphatic system** is a special system of vessels that carries a clear fluid called *lymph*, in which lost fluid and proteins are returned to the blood. The lacteals absorb the fat molecules and transport them from the digestive tract to the circulatory system, dumping chylomicrons in the bloodstream. The adipose and liver tissues, which release enzymes called lipoprotein lipase, break down chylomicrons into monoglycerides and fatty acids. These molecules diffuse into the adipose and liver cells, where they are converted back to triglycerides and stored as the body's supply of energy.

Fat Nutrition

The energy value of fats is 9 kcal/gram (kilocalories per gram), which supplies the body with important sources of calories. Calories are units of energy. The breaking of bonds within fat molecules releases energy that the body uses. A kilocalorie is the unit used to measure the energy in foods. It is the equivalent of "calories" listed on Nutrition Facts labels on food packaging.

Some of the foods known to contain large amounts of fat include the obvious examples, such as butter on toast, fried foods, and hamburgers. But many of the foods that people consume on a daily basis have hidden sources of fat that may not be obvious to the person eating them. These foods include cookies and cakes, cheese, ice cream, potato chips, and hot dogs. One way to avoid foods that contain high amounts of fat is to look at the Nutrition Facts label located on the packages of most foods, where the total fat content of the food is listed.

Actual intake of fat can vary from 10 percent to 40 percent of the calories consumed daily, depending on personal or cultural regimens. Limiting one's daily fat intake to less than 30 percent of total calorie intake and increasing consumption of polyunsaturated fatty acids have been shown to be beneficial in maintaining a healthful **diet**.

diet: the total daily food intake, or the types of foods eaten

New food-labeling regulations scheduled to take effect in 2006 require manufacturers to list trans fat content on their products' Nutrition Facts panel. According to the U.S. Food and Drug Administration, consumption of foods high in cholesterol, saturated fat, or trans fat should be avoided. *[Photograph by Akira Ono. AP/Wide World Photos. Reproduced by permission.]*

Effects of Excess Dietary-Fat Intake

The recommended intake of fats in the American diet is to limit fats to below 30 percent of the total daily caloric intake. One-third of fats should come from saturated fats, with the other two-thirds split evenly between monounsaturated and polyunsaturated fat. It is estimated that in the average American diet (as of 2002), fats make up 42 percent of calories, with **saturated fat** making up between a third and a half of that amount.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

The effects of this excess intake of dietary fat has some well-established implications for the health of **overweight** Americans. For instance, the consumption of excess amounts of saturated fats has been recognized as the most important dietary factor to increase levels of cholesterol. A high cholesterol level is detrimental to health and leads to a condition known as *atherosclerosis*. Atherosclerosis is the build-up of cholesterol on the walls of **arteries**, which may eventually result in the blocking of blood flow. When this occurs in the arteries of the heart, it is called *coronary artery disease*. When this process occurs in the heart, a myocardial infarction, or **heart attack**, may occur.

overweight: weight above the accepted norm based on height, sex, and age

artery: blood vessel that carry blood away from the heart toward the body tissues

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

Besides the cholesterol implications due to high fat intake, **obesity** is a factor in the causation of disease. Being overweight or **obese** is highly associated with increasing the risk of **type II diabetes**, gallbladder disease, **cardiovascular** disease, **hypertension**, and **osteoarthritis**.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

obese: above accepted standards of weight for sex, height, and age

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

cardiovascular: related to the heart and circulatory system

hypertension: high blood pressure

osteoarthritis: inflammation of the joints

Fat-Replacement Strategies

The purpose of fat-replacement strategies is to reduce the percentage of fat in various foods, without taking away the appealing taste of the food. There are three broad categories of fat-replacement strategies: (1) adding water, starch derivatives, and gums to foods, (2) using protein-derived fat replacements, and (3) using engineered fats.

The addition of water to foods lowers the quantity of fat per serving in the selected food item. When starch derivatives are added to food, they bind

Americans get an average of 14 to 21 percent of their calories from saturated fats, in fatty meats, fried foods, and dairy products such as ice cream. The recommended daily intake of saturated fat is 10 percent of total calories consumed. *[Photograph by Georgio Borgia. AP/Wide World Photos. Reproduced by permission.]*

to the water in the food, thus providing a thicker product that simulates the taste and texture of fat in the mouth. Examples of specific starch derivatives include **cellulose**, Z-trim, maltrin, stellar, and oatrim. The problem with starch derivatives, however, is their limitations as a fat replacement in foods that require frying.

cellulose: carbohydrate made by plants; indigestible by humans

Protein-derived fat replacements are made from egg and milk proteins, which are made into a microscopic globule of protein. They give the sensation of fat in the mouth, although they contain no fatty acids. One such product is Simplesse, which is used mostly in frozen desserts. Because its chemical structure is easily destroyed by cooking or frying, its use is limited in most other foods.

The third fat-replacement strategy includes the use of engineered fats, which are made by putting together various food substances. One popular engineered fat is olestra, which is made by adding fatty acids to regular table sugar molecules (sucrose). This process results in a product that can neither be broken down in the digestive tract nor absorbed. It therefore cannot provide energy, in terms of **carbohydrates** or fatty acids, to the body. Olestra

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

is the first engineered fat to be used in fried foods. It does have its drawbacks, however. Olestra can cause abdominal cramping, loose stools, and it can bind beneficial substances that are normally absorbed, such as the fat-soluble **vitamins** (vitamins A, D, E, and K) and **carotenoids**.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

carotenoid: plant-derived molecules used as pigments

In addition to fat-replacement strategies, there are low-fat or fat-free versions of many foods on the market. Some products made to be low-fat or fat-free include milk, yogurt, some cheeses, and deli meats. As a general rule, products that claim to have reduced amounts of fat should conform to the following stipulations: (1) a product labeled "reduced-fat" must have at least 25 percent less fat than the normal product, (2) a "low-fat" product can have no more than three grams of fat per serving, and (3) a "fat-free" product most have less than 0.5 grams of fat per serving. But one does not always need to look for foods made to contain less fat than normal, as there are plenty of natural foods that contain very little fat, or no fat at all, including most fruits and vegetables. Other foods that fit into the category of low-fat or nonfat foods include egg whites, tuna in water, skinless chicken, and pasta.

Foods that are low in fat are important for a healthful diet. While fats are essential components for bodily function, excess consumption of fats can lead to health problems such as obesity and **heart disease**. A healthful diet therefore consists of balanced proportions of proteins, fats, and carbohydrates. SEE ALSO FAT SUBSTITUTES; LIPID PROFILE; OMEGA-3 AND OMEGA-6 FATTY ACIDS.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Jeffrey Radecki
Susan Kim

Bibliography

Campbell, Neil A., et al. (2000). *Biology*, 4th edition. San Francisco: Benjamin/Cummings.

Must, A., et al. (1999). "The Disease Burden Associated with Overweight and Obesity." *Journal of the American Medical Association* 282: 1523.

Robinson, Corinne H.; Weigley, Emma S.; and Mueller, Donna H. (1993). *Basic Nutrition and Diet Therapy*, 7th edition. New York: Macmillan.

Wardlaw, Gordon M., and Kessel, Margaret (2002). *Perspectives in Nutrition*, 5th edition. Boston: McGraw-Hill.

Female Athlete Triad

The female athlete triad is a common nutritional disorder among female athletes caused by the drive of girls and women to be unrealistically thin in an attempt to improve performance. The disorder is most common in sports judged by build (e.g., gymnastics, diving, figure skating), sports with a weight classification (e.g., light-weight crew), and endurance sports (e.g., distance running). It is characterized by three interrelated conditions: (1) disordered eating, such as bingeing, purging, or severe **calorie** restriction; (2) amenorrhea, or the absence of normal menstrual periods; and (3) osteoporosis, a condition marked by reduced bone density.

calorie: unit of food energy

Physical signs of the female athlete triad include: amenorrhea for more than three months, irregular or slow pulse, skipped heartbeats, fainting, loss of greater than 10 percent of ideal body weight, and recurrent stress

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

anxiety: nervousness

fractures. The condition is also marked by **depression**, **anxiety**, low self-esteem, excessive exercise, and a preoccupation with food and weight management.

Treatment for those with the female athlete triad is multidisciplinary and includes medical care, counseling and nutritional services, and an adjustment in exercise. Some athletes require hospitalization if there are coexisting medical problems, and counseling is done on an individual basis and in support groups. SEE ALSO EATING DISORDERS; EATING DISTURBANCES; OSTEOPOROSIS; SPORTS NUTRITION.

Leslie Bonci

Bibliography

Otis, Carol, and Goldingay, Roger (2000). *The Athletic Woman's Survival Guide.* Champaign, IL: Human Kinetics.

Fetal Alcohol Syndrome

Fetal alcohol syndrome (FAS) is a birth defect caused by a mother's alcohol intake during pregnancy. The symptoms of FAS are mental retardation, poor growth, facial defects, and behavioral problems. It is one of the leading causes of mental retardation in children. The effects are lifelong. Fetal alcohol effects (FAE) is a less severe set of the same symptoms. FAS is found in infants of all races and ethnic groups. Since it is not known how much

The Centers for Disease Control estimate that up to three children of every 2,000 are born with fetal alcohol syndrome. The condition causes physical and mental disabilities, but it is 100 percent preventable. *[Photograph by David H. Wells. Corbis. Reproduced by permission.]*

alcohol a pregnant woman must drink to cause the syndrome, it is recommended that women not drink alcohol at all during pregnancy. SEE ALSO ALCOHOL AND HEALTH; PREGNANCY.

Sheah Rarback

Internet Resource

National Organization on Fetal Alcohol Syndrome. <http://www.nofas.org>

Fiber

Fiber, which is found in all plant-based foods, is composed of a group of compounds that makes up the framework of plants. Although fiber cannot be digested, it is an essential **nutrient** for good health. The health benefits of a **diet** rich in fiber include lower **cholesterol** and a reduced risk of **heart disease** and certain cancers. Also referred to as roughage, fiber is made up of many compounds, mostly **carbohydrates**. It can be found in a variety of foods, including wheat, potatoes, and certain fruits and vegetables. Although the recommended amount of fiber is 20 to 35 grams a day, the average American consumes only 12 to 15 grams on a daily basis. Asians, on average, consume three times as much fiber as Americans do.

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Types of Fiber

Complex carbohydrates, which are a major source of **energy** for the body, are comprised of two main classes: starch, which is digestible, and fiber, which is generally not digestible. There are also two kinds of fiber: insoluble and soluble. Insoluble fiber, found in wheat bran and some fruits and vegetables, cannot be dissolved in water. This type of fiber is made up of cellulose and hemicellulose, substances that offer rigidity to plant material (e.g., the peels and skins of fruits and vegetables, wood, stems, and the outer coverings of nuts, seeds, and grains). Insoluble fiber acts as a natural laxative, giving stool the bulk necessary to move quickly through the **gastrointestinal** tract. In addition to preventing **constipation** and **hemorrhoids**, insoluble fiber may also reduce the risk of colon **cancer** by speeding the passage of food through the digestive tract.

gastrointestinal: related to the stomach and intestines

constipation: difficulty passing feces

hemorrhoids: swollen blood vessels in the rectum

cancer: uncontrolled cell growth

Soluble fiber, found in beans, oats, and some fruits and vegetables, is fiber that can be dissolved in water. This type of fiber is made up of pectins, gums, and mucilages. Marie Boyle notes that, because it reduces the level of cholesterol in the blood, soluble fiber can reduce the risks of heart and **artery** disease and **atherosclerosis**. When consumed in large amounts, soluble fiber also slows **glucose absorption** from the small intestine, which can be helpful in treating **diabetes**. Finally, a diet high in fiber may also promote weight control and reduce the risk of developing **obesity**.

artery: blood vessel that carry blood away from the heart toward the body tissues

atherosclerosis: build-up of deposits within the blood vessels

glucose: a simple sugar; the most commonly used fuel in cells

absorption: uptake by the digestive tract

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

How Much Fiber Is Necessary?

According to the American Dietetic Association, the daily goal for fiber intake is between 20 and 35 grams. However, the average intake in the United States is only 12 to 15 grams. In contrast, people in China consume as much as 77 grams of fiber per day. Children also need fiber, although in different

FIBER CONTENT OF VARIOUS FOODS

Food	Amount	Fiber (g)
Whole-wheat bread	1 slice	1.6
Rye bread	1 slice	1.0
White bread	1 slice	0.6
Brown rice (cooked)	½ cup	2.4
White rice (cooked)	½ cup	0.1
Spaghetti (cooked)	½ cup	0.8
Kidney beans (cooked)	½ cup	5.8
Lima beans (cooked)	½ cup	4.9
Potato (baked)	Medium	3.8
Corn	½ cup	3.9
Spinach	½ cup	2.0
Lettuce	½ cup	0.3
Strawberries	¾ cup	2.0
Banana	Medium	2.0
Apple (with skin)	Medium	2.6
Orange	Small	1.2

SOURCE: Adapted from Edlin et al., 2002.

amounts than adults. For children up to age 18, the recommended daily dose (in grams) is determined by adding five to a child's age. For example, a seven-year-old child would need 12 grams of fiber a day.

The recommended daily amount of fiber can be consumed by eating a diet high in fiber-rich fruits, vegetables, and whole grains. There are several ways to ensure one consumes enough fiber. First, it is important to read food labels. Although they do not distinguish between the two types of fiber, the labels of almost all foods will provide the amount of dietary fiber in each serving. Raw or slightly cooked vegetables will also provide an excellent source of fiber. However, overcooking vegetables may reduce the fiber content. Whole-grain cereals, whole-wheat bread, fresh or dried fruit, beans, rice, and salad are all good sources of fiber. The table presents the fiber content of various foods.

Problem with High-Fiber Diets

Including fiber in one's daily diet has definite benefits. However, although very uncommon, fiber has the potential to cause harm if taken in excess of 60 or 70 grams daily. "Since fiber carries water out of the body, taking too much can cause **dehydration** and intestinal discomfort or gas," (Boyle, p. 84). Large amounts of fiber require a high fluid intake. Therefore, as one increases fiber in the diet, water intake must also be increased. If one does not consume enough fluid, then one's stool could become very hard, resulting in difficult and painful elimination.

dehydration: loss of water

Fiber speeds the movement of foods through the digestive system. Since **iron** is mainly absorbed early during digestion, high amounts of fiber may limit the opportunity for the absorption of iron, **calcium**, and other nutrients. Finally, large amounts of fiber can also cause deficiencies of nutrients and energy by causing one to feel full before enough nutrients have been consumed. Children and elderly persons are especially vulnerable to these concerns, since they eat smaller portion sizes.

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

In conclusion, fiber is an important element of the diet and provides several health benefits. Eating balanced meals containing whole grain and

fresh fruits and vegetables will ensure meeting the proper recommended allowances. SEE ALSO CANCER; CARBOHYDRATES; HEART DISEASE; NUTRIENTS.

Elissa M. Howard-Barr

Bibliography

Boyle, Marie, A. (2001). *Personal Nutrition*, 4th edition. Belmont, CA: Wadsworth/ Thomson Learning.

Edlin, Gordon; Golanty, Eric; and McCormick Brown, Kelli, eds. (2002). *Health and Wellness*, 7th edition. Sudbury, MA: Jones and Bartlett.

Wardlaw, Gordon M. (2000). *Contemporary Nutrition, Issues and Insights*, 4th edition. Boston: McGraw Hill.

Internet Resources

American Dietetic Association. "Health Implications of Dietary Fiber—Position of ADA." Available from <http://www.eatright.com>

Food and Drug Administration. "Why Is Fiber Important to Your Diet?"Available from <http://www.cfsan.fda.gov>

Nutrition Newsletter (1997). "China Project Monograph Named China's Best Scientific Publication." Available from <http://www.nutrition.cornell.edu/news>

Food Aid for Development and the World Food Programme

Food aid has been a key to global agricultural development and trade policy since the end of World War II. Food aid creates agricultural development and income growth in poor nations, and thus creates future markets for donor countries, according to Christopher Barrett. However, food aid may be inflationary because it increases demand and costs for nonfood items in the recipient countries.

The World Food Programme (WFP), the food-assistance agency of the United Nations, was established in 1963 to fight global hunger. WFP has many partners, including the Food Aid for Development (FAD) Office of the World Health Organization. The goal of this combined effort is to ensure that everyone has access to nutritious foods at all times.

Since its inception, WFP has invested $27.8 billion and more than 43 million metric tons of food to combat hunger, promote economic and social development, and provide relief assistance in emergencies to eighty-three countries. In 2000, WFP fed 83 million people. WFP has three main programs:

- *Food-for-Life.* Eighty percent of WFP resources are used by this program for emergency relief activities for refugees and displaced individuals.
- *Food-for-Growth.* Projects in this program aim to prevent nutritional problems among pregnant and breastfeeding women, infants, school children, and the elderly. Literacy and **nutrition** classes are also offered.
- *Food-for-Work.* Chronically hungry individuals are paid with food through the Food-for-Work program. Workers assist with projects to improve local infrastructure, such as building roads and ports, re-

nutrition: the maintenance of health through proper eating, or the study of same

The Food-for-Work program offers food to hungry people in exchange for work they do to improve vital infrastructure. Here, Somalis gather around water tanks, which were built to stabilize the water supply for drinking and irrigation in the drought-afflicted country. *[© Kevin Fleming/Corbis. Reproduced by permission.]*

pairing dykes, terracing hillsides, replanting forests, and repairing irrigation systems. SEE ALSO FAMINE; FOOD INSECURITY; UNITED NATIONS CHILDREN'S FUND (UNICEF).

Delores C. S. James

Bibliography

Barrett, Christopher B. (1998). "Food Aid: Is It Development Assistance, Trade Promotion, Both, or Neither?" *American Journal of Agricultural Economics* 80(3):566–582.

Internet Resources

World Health Organization. "Food Aid for Development." Available from <http://www.who.int>

World Food Programme. "Fighting the Global War on Hunger from the Frontline." Available from <http://www.wfp.org>

Food and Agricultural Organization

nutrition: the maintenance of health through proper eating, or the study of same

The Food and Agricultural Organization (FAO) is one of the largest specialized agencies of the United Nations. Founded in 1945, it is responsible for raising levels of **nutrition** and standards of living, increasing agricultural productivity, and improving rural living conditions throughout the world. The FAO is an international organization that has 183 member countries, plus one member organization, the European Community. The FAO Conference, which meets every two years, is the governing body of the FAO.

The FAO is comprised of eight departments: Administration and Finance, Agriculture, Economic and Social, Fisheries, Forestry, General Affairs and Information, Sustainable Development, and Technical Cooperation. Funding for the FAO's work falls into two categories: the Regular Program, which covers internal operations, and the Field Program, which implements pro-

jects that are usually undertaken in cooperation with national governments and other agencies.

Special programs and activities of the FAO include: (1) the World Food Summit, which strives to reduce worldwide hunger; (2) the Special Program for Food Security, a program for advancing food technologies; (3) Tele-Food, an annual campaign to help poor families produce more food; (4) the Technical Cooperation Program, which promotes the sharing of technical expertise between countries; and (5) EMPRES (Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases) which strives to eradicate pests and diseases. SEE ALSO FAMINE; FOOD AID FOR DEVELOPMENT; FOOD INSECURITY; UNITED NATIONS CHILDREN'S FUND (UNICEF).

Karen Bryla

Internet Resource

Food and Agricultural Organization of the United Nations. <http://www.fao.org>

Food Guide Pyramid

The Food Guide Pyramid is a graphic representation of *A Pattern for Daily Food Choices*, a food guide that was developed by the U.S. Department of Agriculture (USDA) in the 1980s. Food guides are tools designed to help people select healthful diets. The USDA has been developing food guides since 1916, and recommendations have changed over the years due to emerging knowledge about **nutrient** needs and the relationships between **diet** and health, changing economic conditions (such as the Great Depression in the 1930s), and changing lifestyles.

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

nutrition: the maintenance of health through proper eating, or the study of same

A Pattern for Daily Food Choices replaced the *Basic Four* food guide which was the centerpiece of **nutrition** education in the United States for over twenty years. The new food guide was not widely used in nutrition education until the USDA released The Food Guide Pyramid in 1992. Since that time, nutrition educators, dietitians, and teachers have used the Pyramid and accompanying educational materials to teach people how to select foods to build healthful diets. The Pyramid is also a familiar feature on food labels, where it is used by food manufacturers to show where foods fit into the food groups that make up the Pyramid.

Design and Recommendations of The Food Guide Pyramid

USDA nutritionists spent many years designing, testing, and refining the Food Guide Pyramid. The goal was to have an easy-to-use graphic that would help people select a diet that promoted nutritional health and decreased the risk of disease. They designed the Pyramid to be flexible enough to be used by most healthy Americans over the age of two. However, they also recognized that people with substantially different eating habits, such as vegetarians, may need a different food guidance system.

The Pyramid includes five major food groups, each of which provides nutrients needed for good health. By making healthful choices within these food groups, like selecting low-fat and high-fiber foods, people can promote

good health and reduce their risk of disease. The placement of foods within the Pyramid shows that foods of plant origin should supply most of the servings of food in the daily diet.

The Breads, Cereals, Rice, and Pasta Group forms the base of the Pyramid, with the largest number of servings recommended (six to eleven servings recommended daily). The next layer up includes the Fruit Group (two to four servings) and the Vegetable Group (three to five servings). At the third level are the Milk, Yogurt, and Cheese Group (two to three servings) and the Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts Group (two to three servings). At the tip of the Pyramid are Fats, Oils, and Sweets. These foods and food ingredients should be used "sparingly" to avoid excess **calories** and/or fat. It is not necessary to completely avoid foods such as salad dressing, butter, margarine, candy, soft drinks, and sweet desserts, but they should be consumed infrequently.

calorie: unit of food energy

The Pyramid includes symbols that represent the fats and added sugars found in foods. These are most concentrated at the tip of the Pyramid, but are also found in foods from the five major food groups. This reveals that some foods within the five food groups are high in fat and/or sugar. People can limit their fat and sugar intake, as suggested by the Dietary Guidelines for Americans, by selecting foods low in fat and added sugars most of the time.

Uses of the Food Guide Pyramid

Individuals can use the Pyramid educational materials to plan a diet that contains all needed nutrients and is moderate in fat and **saturated fat**. This is important in the United States, where the major causes of death, such as **heart disease**, are related to diets high in fat, especially saturated fat. **Obesity** is also a major health concern in the United States. Although physical activity is a critical component of weight management, food intake also plays a role in **energy** balance. The Food Guide Pyramid educational materials provide serving sizes and a recommended number of servings for people of different ages and activity levels. This guide can help people learn to eat reasonable amounts of food in a country where large portion sizes are the norm.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

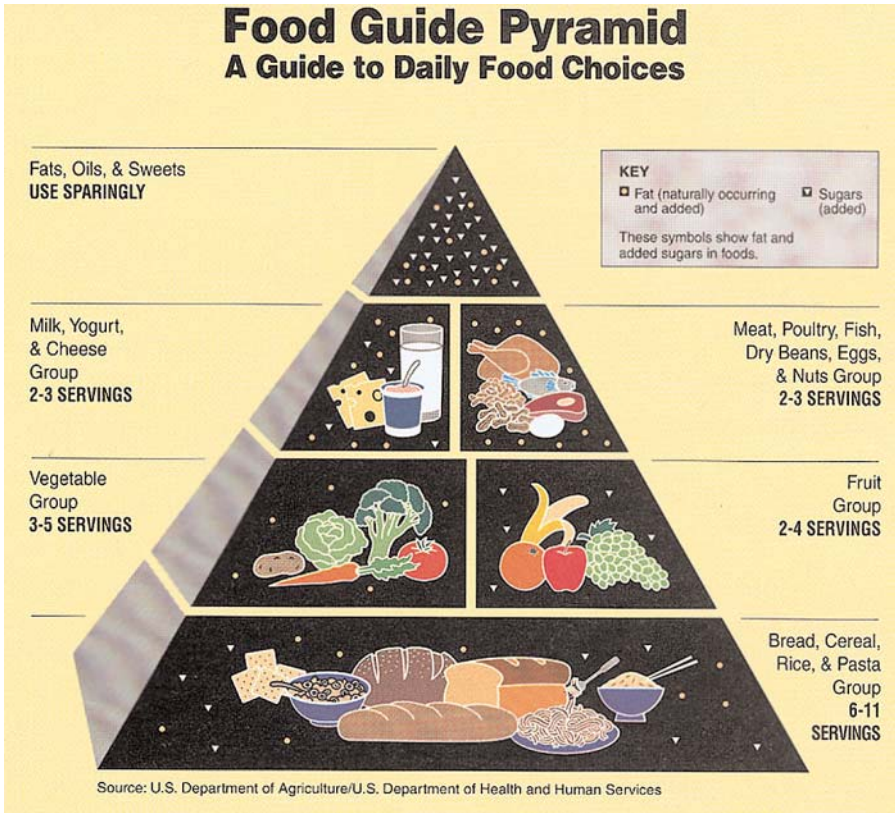
obesity: the condition of being overweight, according to established norms based on sex, age, and height

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Development of Alternative Pyramids

Some nutrition and health professionals disagree with the dietary recommendations of the USDA's Food Guide Pyramid. Critics of the Pyramid have expressed various concerns. Some believe that the food guide does not go far enough in emphasizing plant-food consumption, and that there is an overemphasis on foods of animal origin. Another concern is the inclusion of foods that are high in fats and/or sugars within the basic five food groups, which may lead people to maintain high fat and calorie intake. Others have indicated that the Pyramid is not appropriate for use with various ethnic and cultural groups, although this fact was recognized by the nutritionists who developed the Pyramid.

One alternative pyramid is the Traditional Healthy Mediterranean Diet Pyramid, developed by the Oldways Preservation and Exchange Trust in cooperation with Harvard School of Public Health and the World Health



The Food Guide Pyramid, last updated in 1992, could be revised for release in 2005. Proposed changes would include more recent nutritional recommendations and may be tailored to specific ages and activity levels to help reverse the nation's trend toward obesity. *[EPD Photos. The Gale Group.]*

Organization. This Pyramid has an increased emphasis on foods of plant origin and limits red meat consumption to a monthly serving. It recommends daily olive oil consumption, wine "in moderation,"and daily consumption of six glasses of water. The Mediterranean Pyramid is based on a diet that has long been associated with reduced risk for heart disease, though some Americans might find it difficult adapting to such a different eating plan.

Pyramids targeting specific ethnic groups have been developed by a variety of organizations. They include Latin American, Puerto Rican, Asian, Vietnamese, soul food, and vegetarian pyramids, among others. As information emerged about the nutritional needs of older people, the need for a food guide targeted to this growing population became clear. In 1999, nutritionists at Tufts University developed a prototype of a pyramid targeted to persons seventy years of age and older. Several other pyramids for older adults have been developed at other universities since that time. To meet the needs of children, the USDA released the Food Pyramid Guide for Young Children in 1999.

The USDA Food Guide Pyramid reflects a food guide that was designed to meet the nutritional needs, and to promote long-term health, of Americans over the age of two. It supports the goals of the Dietary Guidelines for Americans, which are designed to promote healthy lifestyles and to reduce health risks. The messages of the Food Guide Pyramid are most effective when accompanied by nutrition education to help people make healthful choices from the five food groups. SEE ALSO DIETARY ASSESSMENT; DIETARY GUIDELINES; HEALTHY EATING INDEX.

Linda Benjamin Bobroff

Bibliography

Insel, Paul; Turner, R. Elaine; and Ross, Don (2001). *Nutrition.* Sudbury, MA: Jones and Bartlett.

Welsh, Susan; Davis, Carole; and Shaw, Anne (1992). "A Brief History of Food Guides in the United States." *Nutrition Today* 27:6–11.

Internet Resources

Food and Nutrition Information Center. *Food Guide Pyramid.* Available from <http://www.nal.usda.gov/fnic>

Oldways Preservation and Exchange Trust. "Oldways Healthy Diet Pyramids." Available from <http://www.oldwayspt.org>

U.S. Department of Agriculture, Human Nutrition Information Service. *The Food Guide Pyramid.* Home and Garden Bulletin Number 252. Available from <http://www.cnpp.usda.gov>

Food Insecurity

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

chronic: over a long period

Millions of people worldwide suffer from hunger and **undernutrition**. A major factor contributing to this international problem is *food insecurity*. This condition exists when people lack sustainable physical or economic access to enough safe, nutritious, and socially acceptable food for a healthy and productive life. Food insecurity may be **chronic**, seasonal, or temporary, and it may occur at the household, regional, or national level.

The United Nations estimates there are 840 million undernourished people in the world. The majority of undernourished people (799 million) reside in developing countries, most of which are on the continents of Africa and Asia. This figure also includes 11 million people located in developed countries and 30 million people located in countries in transition (e.g., the former Soviet Union). The U.S. Department of Agriculture estimates that nearly 11 percent of U.S. households are food insecure, with approximately one-third of these households experiencing moderate to severe hunger.

In developing countries, the root causes of food insecurity include: poverty, war and civil conflict, corruption, national policies that do not promote equal access to food for all, environmental degradation, barriers to trade, insufficient agricultural development, population growth, low levels of education, social and gender inequality, poor health status, cultural insensitivity, and natural disasters. In the United States, the primary cause of food insecurity is poverty. Low levels of education, poor health status, and certain disabilities also increase the risk of food insecurity for individuals and households in the United States.

Globally, certain groups of people are more vulnerable to food insecurity than others. Vulnerable groups include: victims of conflict (e.g., refugees and internally displaced people); migrant workers; marginal populations (e.g., school dropouts, unemployed people, homeless people, and orphans); dependent populations (e.g., elderly people, children under five, and disabled and ill people); women of reproductive age; ethnic minorities; and low literacy households.

For food security to exist at the national, regional, and local levels, food must be available, accessible, and properly utilized. Availability of food means

Food insecurity affects millions of people around the world, including these children in Thailand. The situation in that country and a handful of others has improved slightly, but progress is slow. *[© Bettmann/ Corbis. Reproduced by permission.]*

that enough safe and nutritious food is either domestically produced or imported from the international market. However, food availability does not ensure food accessibility. Government policies must also contribute to equal distribution of food within nations, regions, and communities. In addition, for food to be accessible, individuals and families must be able to afford the food prices on the market. Finally, food must be properly utilized. Proper utilization depends on proper food storage to guard against spoilage, appropriate handling to avoid disease transmission, and proper preparation to ensure nutritiously balanced meals.

Individuals need adequate amounts of a variety of quality, safe foods to be healthy and well-nourished. Undernutrition results from an insufficient intake or an improper balance of **protein**, **energy**, and micronutrients. Nutritional consequences of insufficient food or undernutrition include protein energy **malnutrition**, **anemia**, vitamin A deficiency, iodine deficiency, and **iron** deficiency.

Food insecurity and malnutrition result in catastrophic amounts of human suffering. The World Health Organization estimates that approximately 60 percent of all childhood deaths in the developing world are associated with chronic hunger and malnutrition. In developing countries, persistent malnutrition leaves children weak, vulnerable, and less able to fight such common childhood illnesses as diarrhea, **acute** respiratory infections, **malaria**,

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

malnutrition: chronic lack of sufficient nutrients to maintain health

anemia: low level of red blood cells in the blood

iron: nutrient needed for red blood cell formation

acute: rapid-onset and short-lived

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

and measles. Even children who are mildly to moderately malnourished are at greater risk of dying from these common diseases. Malnourished children in the United States suffer from poorer health status, compromised immune systems, and higher rates of illnesses such as colds, headaches, and **fatigue**.

fatigue: tiredness

Adolescents and adults also suffer adverse consequences of food insecurity and malnutrition. Malnutrition can lead to decreased energy levels, delayed maturation, growth failure, impaired cognitive ability, diminished capacity to learn, decreased ability to resist infections and illnesses, shortened life expectancy, increased maternal mortality, and low birth weight.

Food insecurity may also result in severe social, **psychological**, and behavioral consequences. Food-insecure individuals may manifest feelings of alienation, powerlessness, **stress**, and **anxiety**, and they may experience reduced productivity, reduced work and school performance, and reduced income earnings. Household dynamics may become disrupted because of a preoccupation with obtaining food, which may lead to anger, pessimism, and irritability. Adverse consequences for children include: higher levels of aggressive or destructive behavior, hyperactivity, anxiety, difficulty with social interactions (e.g., more withdrawn or socially disruptive), increased passivity, poorer overall school performance, increased school absences, and a greater need for mental health care services (e.g., for **depression** or suicidal behaviors).

psychological: related to thoughts, feelings, and personal experiences

stress: heightened state of nervousness or unease

anxiety: nervousness

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

To understand the magnitude of food insecurity, hunger, and malnutrition, one must consider both the continued rapid growth in world population and the number of individuals below the poverty line. In 1999 the world population reached 6 billion. The United Nations estimates the world population will exceed 8 billion by 2025. In terms of poverty, the World Bank estimates that nearly 1.2 billion people live on less than one dollar a day, which is the internationally recognized standard for measuring poverty. Another 2.8 billion live on less than two dollars a day.

In addition to these progress-slowing conditions, the number of undernourished people is actually growing in most developing regions. A few large countries have made significant gains, making the global picture appear more promising than it really is. China, Indonesia, Vietnam, Thailand, Nigeria, Ghana, and Peru have all made important gains in reducing food insecurity and hunger. However, in nearly fifty other countries, the number of undernourished people increased by almost 100 million between 1993 and 2003. The absolute numbers continue to rise as a result of rapid population growth, even though the proportion of undernourished people in most developing countries is actually decreasing.

Worldwide commitment to improve global food insecurity was demonstrated at the 1996 World Food Summit, where 186 countries pledged to reduce the number of hungry, food-insecure people in the world by 50 percent (to 400 million) by the year 2015. Progress toward this goal has been slow, with a decrease of only 2.5 million people a year since 1992. At the current pace, the goal will be reached more than one hundred years late. Despite slow progress, some innovative programs have been implemented around the globe to combat food insecurity and undernutrition. Examples of innovative program include: community gardens, farmers markets, community-supported sustainable agricultural programs, food for work exchange

programs, farm to school initiatives, credit to poor households, income transfer schemes, and agricultural diversification programs.

Food insecurity remains a significant international problem, with developing regions of the world enduring most of the burden. Food insecurity results in considerable health, social, psychological, and behavioral consequences and is undeniably linked to poverty. Despite international commitment, the number of food insecure individuals remains unacceptably high. SEE ALSO FAMINE; FOOD AID FOR DEVELOPMENT AND THE WORLD FOOD PROGRAMME; FOOD AND AGRICULTURAL ORGANIZATION; FOOD SAFETY; HUNGER; MALNUTRITION; UNITED NATIONS CHILDREN'S FUND (UNICEF).

Lori Keeling Buhi

Internet Resources

Bellamy, Carol (1998). *The State of the World's Children 1998: Focus on Nutrition*. United Nations Children's Fund. Available from <http://www.unicef.org>

Brandeis University (2002). "The Consequences of Hunger and Food Insecurity for Children, Evidence from Recent Scientific Studies." Center on Hunger and Poverty, Heller School for Social Policy and Management. Available from <http://www.centeronhunger.org>

Food and Agriculture Organization of the United Nations (2002). *The State of Food Security in the World*, 4th edition. Available from <http://www.fao.org>

Nord, Mark; Andrews, Margaret; and Carlson, Steve (2002). *Household Food Security in the United States, 2001*. Food Assistance and Nutrition Research Report No. 29. Economic Research Service, U.S. Department of Agriculture. Available from <http://www.ers.usda.gov>

United Nations Food and Agriculture Organization. "Rome Declaration on World Food Security." Proceedings from the World Food Summit, November 13–17, 1996. Rome, Italy. Available from <http://www.fao.org>

U.S. Department of Agriculture (1999). *U.S. Action Plan on Food Security, Solutions to Hunger*. U.S. Department of Agriculture. Available from <http://www.fas.usda.gov>

World Bank Group. "Income Poverty: The Latest Global Numbers." Updated August 2, 2002. Available from <http://www.worldbank.org>

World Health Organization. "Nutrition Research: Pursuing Sustainable Solutions." Updated September 16, 2002. Available from <http://www.who.int/en>

Food Labels

The quality and safety of foods are a worldwide concern and have been a societal issue since the beginning of civilization. In the United States, very complex laws and regulations have been developed to address food safety concerns. These laws and regulations are designed not only to insure that food is safe to eat, but also to insure that the product label provides information consumers need to make educated food-purchasing decisions.

Overview of Food Labeling

Food labels on products sold in the United States must have the product name (product identity statement); the manufacturer's name and address; the net contents in terms of weight, measure, or count; a list of ingredients; and, in most cases, a Nutrition Facts statement. To insure consistent presentation of information so consumers can easily compare food products, each component of the label is defined by regulations in terms of placement, terminology, and type size. Regulation of food labeling falls

primarily under the jurisdiction of two federal agencies: the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA). Both the FDA and the USDA publish regulations governing food labeling in the *Federal Register* (FR), which is published daily. Each year, all federal regulations are updated and compiled in the *Code of Federal Regulations* (CFR); FDA labeling regulations appear in Title 21 and USDA regulations in Title 9 of the CFR.

nutrient: dietary substance necessary for health

The regulations define two categories of claims: **nutrient** content claims and health claims. Nutrient content claims are statements about the level of a nutrient in a food. Health claims, on the other hand, link the nutrient profile of a food to a health or disease condition. Food products made by very small businesses and foods with insignificant amounts of nutrients may be exempt from labeling regulations.

Product Identity Statement

Food labeling regulations require food products to be labeled prominently with a product identity statement to ensure consumers obtain important information about both the type and form of food contained in the package. The product identity statement should be a standard name or a common or usual name that is familiar to consumers. If it is marketed in various forms (e.g., whole, sliced, diced), the form of the food needs to be included. If it is an imitation food, the statement must include the word "imitation." Any information that is important to describe the food product must be included as part of Product Identity statement.

Net Quantity of Contents

The purpose of the "net quantity of contents" statement is to inform the consumer of the amount of product contained in the package. Regulations require specific wording, type size, and placement. Federal and state agencies monitor food products to ensure products contain the amount of the food stated on the food label.

Ingredient List

A list of the ingredients must be included on all foods that have more than one ingredient. Ingredients must be listed in descending order of predominance and in defined terminology. Ingredients that are present in amounts of less than 2 percent of the product do not necessarily need to appear in order of predominance.

Nutrition Labeling

FDA's voluntary nutrition labeling program was initiated in 1976. Under this program, unless the product bore a nutrition claim or nutrients were added to the product, food manufacturers had the option of providing nutrition information on their products. On November 8, 1990, President George Bush signed into law the Nutrition Labeling and Education Act of 1990 (NLEA), requiring nutrition labeling for most foods (except meat and poultry) and outlining the appropriate use of nutrient content and health claims. Regulations implementing NLEA became effective January 6, 1993. Since then, the Food and Drug Administration (FDA) has issued over forty

NUTRIENTS AND DAILY VALUES USED FOR LABELING

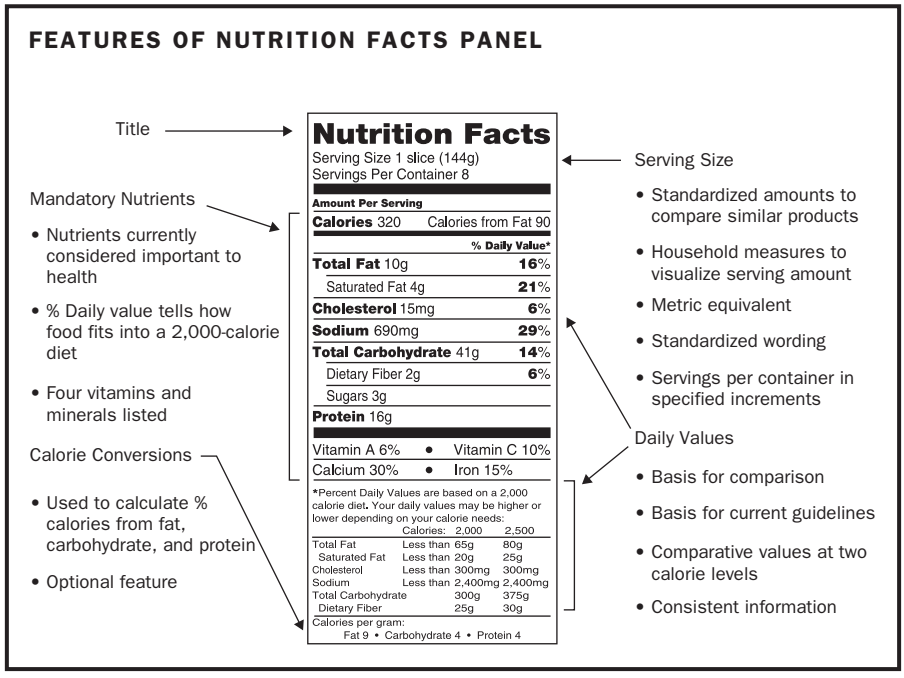
Nutrient	Daily Value
Calories*	—
Calories from fat	—
Calories from Saturated Fat	—
Total Fat*	65g
Saturated Fat	20g
Stearic Acid (USDA only)	—
Polyunsaturated Fat	—
Monounsaturated Fat	—
Cholesterol	300mg
Sodium*	2,400mg
Potassium	3,500mg
Total Carbohydrate*	300mg
Dietary Fiber	25g
Soluble Fiber	—
Insoluble Fiber	—
Sugars	—
Sugar Alcohol	—
Other Carbohydrate	—
Protein*	59g**
Vitamin A	5,000 IU
Beta-carotene	—
Vitamin C	60mg
Calcium	1,000mg
Iron	18mg
Vitamin D	400 IU
Vitamin E	30 IU
Thiamin	1.5mg
Riboflavin	1.7m
Niacin	20mg
Vitamin B_6	2.0mg
Folate	400mg
Vitamin B_{12}	6.0mg
Biotin	0.3mg
Pantothenic Acid	10mg
Phosphorus	1,000mg
Iodine	150mg
Magnesium	400mg
Zinc	15mg
Copper	2.0mg

Mandatory Nutrients are in **bold**
*Core nutrients
**%DV is not required for protein. If included, special rules apply.

major regulations for NLEA and many more minor regulations to revise existing regulations. As a result of these regulations, nutrition labeling is now virtually universal on packaged foods, the nutrition label format is easy to recognize, nutrient reference values have been standardized, nutrient claims have been defined, and disease-specific claims are now authorized.

Nutrition Facts Statement. In order to ensure consistency of information, both FDA and USDA regulations are very explicit about the layout of the Nutrition Facts panel. The type of information that may be included, as well as the format and order, is detailed in the CFR.

Required Nutrients. Manufacturers are required to provide information on fourteen nutrients, but they may omit some of these if they are present at insignificant levels. Food manufacturers determine the nutrient content either by laboratory analyses on the product as packaged, or by calculation using standardized nutrient databases. Of the fourteen nutrients, five are considered core nutrients and must always be included on the Nutrition Facts panel, even if they are present at insignificant levels. In addition to mandatory nutrients, other nutrients may be required in some circumstances, or manufacturers may include them on a voluntary basis. The nonmandatory



nutrients are defined by the regulations. All nutrients must appear in a specified order.

Percent Daily Value. In addition to declaring the gram or milligram amounts for macronutrients (such as **fat**, **cholesterol**, sodium, **carbohydrates**, and **protein**), the "Percent Daily Value" is also declared (with the exception of sugars and protein). All **vitamins** and **minerals** are presented as percentages of the Daily Value (based on a daily intake of 2,000 **calories**). Declaring nutrients as a percentage of the Daily Values provides a standard that is easy to use by individuals who are not familiar with the wide range of levels of different nutrients. For example, a food with 100 IU (international units) of Vitamin A may appear to contain a significant amount of this nutrient, but it is actually only 2 percent of the Daily Value (5,000 IU) for Vitamin A. Alternatively, a food with 6 grams of **saturated fat** may be thought of as low in Saturated Fat, when it actually contains 30 percent of the Daily Value (20 grams).

fat: type of food molecule rich in carbon and hydrogen, with high energy content

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

calorie: unit of food energy

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

Serving Size. A serving size is the amount of food upon which the nutrient content is based. In order to ensure consistent serving sizes between similar products, NLEA defines serving size as the amount of food customarily eaten at one time. The serving size included on the Nutrition Facts panel may vary slightly between similar products, but it is based on the Reference Amounts Customarily Consumed Per Eating Occasion (RACC), as established by the FDA. The serving size is the household measure (e.g., cups, tablespoon, piece, slice, fraction, or container) closest to the RACC, followed by the metric equivalent. For a package of crackers where each cracker weighs 7 grams and the RACC is 15 grams, the serving size would read "2 crackers (14g)."

As a result of NLEA and other United States food labeling laws, health-conscious consumers are afforded a world of information on food labels. Food-labeling regulations provide the consistent standards consumers need

to make food choices in an ever-changing food industry. SEE ALSO DAILY REFERENCE VALUES; DIETARY GUIDELINES; FUNCTIONAL FOODS; HEALTH CLAIMS; NUTRIENTS; REGULATORY AGENCIES.

Karen Hare

Food Safety

One of the many luxuries Americans enjoy is access to the safest and most abundant food supply in the world. This stems from many advances and improvements in food safety, sanitation, and crop production that reduce the chance of food-safety problems, including food-borne illness, pesticide contamination, or infectious disease. There are many reasons why food safety has become an issue. First, medical advances have made it possible for people to live longer, creating an aging population more susceptible to disease. Second, labor in the food industry is more diverse and less skilled. Learning barriers, personnel turnover, and limited food-preparation skills create challenges in training. Third, the U.S. food supply has expanded globally, and many types of food come from areas where food safety standards are less stringent than those in the United States. Other concerns for food safety stem from terrorist threats, food irradiation, and genetically modified foods.

Concerns exist about the use of radioactivity in food irradiation, the presence of possible subsequent toxicity, and the development of more virulent **bacteria**. These concerns, however, are unfounded and the benefits outweigh the risks. Evidence from over four decades of research in the United States shows the benefits to include a decrease in food-borne **pathogens**, an increase in the shelf life of some fruits and vegetables, and less fumigant use for controlling insect pests.

bacteria: single-celled organisms without nuclei, some of which are infectious

pathogen: organism that causes disease

Control and Oversight

The Food and Drug Administration (FDA) ensures that injury, such as disease or illness, will not result from substances in food by closely monitoring the food supply. This differs from monitoring for food hazards (the responsibility of the food handler), where harm is possible under normal conditions. Potential food hazards could include improper storage conditions and serving food at unsafe temperatures. The food handler is directly involved in controlling these potential hazards during receiving, storage, preparation, cooking, and service.

The primary agencies that monitor the safety of the U.S. food supply are the FDA, the U.S. Department of Agriculture (USDA), the Environmental Protection Agency, and the U.S. Fish and Wildlife Service. When monitoring the food supply, the FDA focuses first on microbial food-borne illness, followed by natural **toxins** in food, and residues in food, including environmental contaminants, pesticides, and animal drugs. Nutritional composition and intentional **food additives** are monitored more closely as artificial food products enter the market. The FDA *Food Code*, which is published every two years, provides guidance for restaurants, grocery stores, and institutions such as nursing homes on how to prevent food-borne illness. Managers and supervisors of these institutions are now required to be certified

toxins: poison

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

in food safety and sanitation. Local, state, and federal regulators use the *Food Code* as a model to develop their own food safety rules.

Food-Borne Illness

Each year, millions of people become ill from food-borne illness, the most common food safety-issue, although many cases are not reported. Food-borne illness is caused when toxic levels of pathogens or bacteria are present in food. Microbial food-borne illness, commonly called **food poisoning**, is monitored closely because the cases of food poisoning far outweigh any other type of food contamination. In the case of an infection from a pathogen such as *Salmonella*, contamination and food-borne illness results when a pathogen in a food product multiplies and infects the human body after ingestion. These **microorganisms** can multiply in food during agricultural production, transportation, preparation, and storage, or within the digestive tract after a person eats the contaminated food. Factors that contribute to food toxicity include the amount of the initial contamination, the time held in unsafe conditions, and the use of processes to inactivate or remove toxins and pathogens. The Centers for Disease Control and Prevention (CDC) reports that most food-borne illness outbreaks occur from improper handling of food in the retail area of the food industry (e.g., schools, restaurants). Equally important is safe food-handling by consumers who purchase food and consume it at home, since most cases of food poisoning are a result of improper handling or cooking after purchase.

food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

microorganisms: bacteria and protists; single-celled organisms

For many victims, food-borne illness results only in discomfort or lost time from the job. Those at higher risk—pre-school-age children, older adults in health care facilities, and those with impaired immune systems—food-borne illness is more serious and may be life threatening. Symptoms of food-borne illness vary, but can include **nausea**, vomiting, abdominal cramps, headache, and in some cases difficulty speaking and swallowing. Some instances could result in **paralysis** or death. Fever **fatigue** and jaundice occur after several days in **hepatitis** cases.

nausea: unpleasant sensation in the gut that precedes vomiting

paralysis: inability to move

fatigue: tiredness

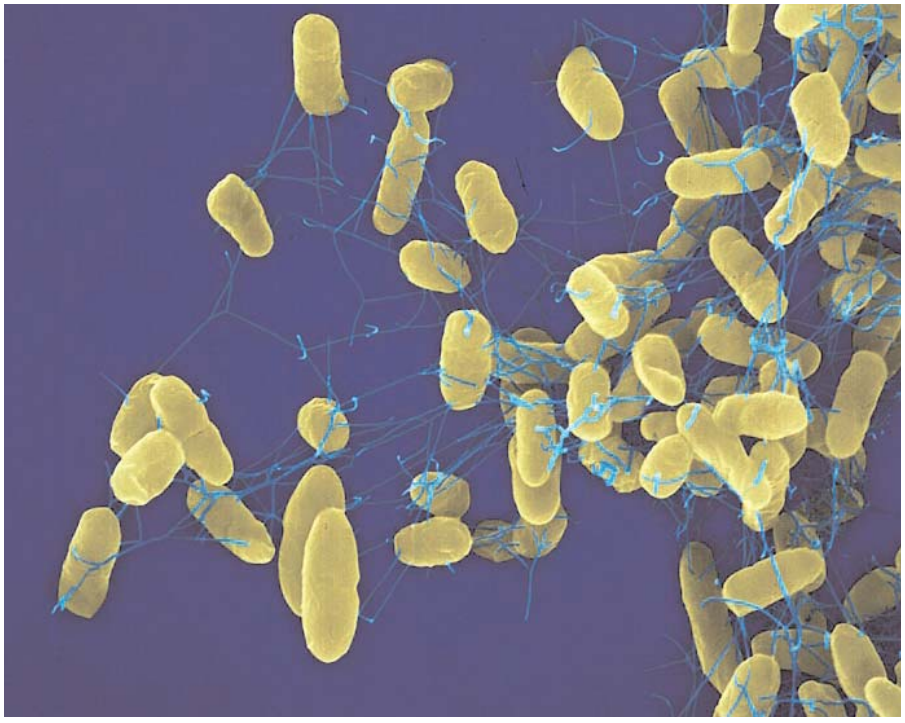
hepatitis: liver inflammation

To protect consumers from food-borne disease, efforts must focus on each point in the farm-to-table chain to better predict and prevent food-borne hazards, and to monitor and rapidly react to outbreaks of food-borne diseases. A food-service establishment should have an effective food-safety program to prevent hazards before they occur. For example, the Hazard Analysis Critical Control Point (HACCP) program is a proactive program initiated by the FDA to ensure food safety for the astronauts in the space program. The process starts by reviewing a food service's standard operating procedures to be sure that food hazards are controlled during receiving, storage, preparation, service, and cooling of foods for later use. An examination of sanitation, as well as food handlers' personal **hygiene** and work practices are important as well.

hygiene: cleanliness

Pesticides and Biotechnology

The use of pesticides to control damage of food crops and enhance production has created a controversy related to potential hazards to consumers. While pesticides can be part of a safe food-protection program, they can be hazardous when handled or used inappropriately. High doses of pesticides applied to laboratory animals cause birth defects, sterility, tumors, organ



Salmonella enteritidis bacteria annually infect between two and four million people in the United States. Most outbreaks of food-borne illness are due to improper food handling or storage. *[USDA/Science Source/Photo Researchers, Inc. Reproduced by permission.]*

damage, and central **nervous system** impairment. As with **antibiotics**, the targeted insects become resistant and can survive exposure, emerging with increased vigor to again attack the crop. The same effects arise from herbicides and fungicides used on crops. New labeling laws introduced by the FDA in October 2002 have caused some organic producers to drop the term *organic* from their label, finding the requirements too restrictive.

nervous system: the brain, spinal cord, and nerves that extend throughout the body

antibiotic: substance that kills or prevents the growth of microorganisms

Genetically modified foods have been a cause of concern in many parts of the world since their introduction, particularly in Europe. Campaigns have been launched by many groups opposing the practice of genetically altering **enzymes**, **amino acids**, and **genes** in foods for the purposes of increasing crop yields, nutritional quality, and profits while decreasing food waste. Whether it is about changing the degree of saturation in oils or adding amino acids to corn to make it a more complete **protein** source, food technologists are working hard to change the chemical make-up of food.

enzyme: protein responsible for carrying out reactions in a cell

amino acid: building block of proteins, necessary dietary nutrient

gene: DNA sequence that codes for proteins, and thus controls inheritance

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Organic farming groups and others will likely continue to fight against the use of pesticides and **genetic** modification in food production for years. When trying to feed the world, one must weigh the risks and benefits of both when establishing food-safety regulations.

genetic: inherited or related to the genes

Bioterrorism

With the advent of **vaccines** and antibiotics, many people in developed countries had become complacent about **infectious diseases**. However, the increase in acts of worldwide terrorism has caused food security to become a major concern for the food industry and for public health officials. Deliberate biological or chemical contamination of food or water remains the easiest method for widespread terrorism, according to the CDC, and since everyone eats, all are open to an attack. Bioterrorism and the emergence of strains of diseases that have become resistant to antibiotic therapy (such as

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

FOOD SAFETY REGULATIONS AND LAWS

1897	Tea Importation Act—Customs inspection for purity
1890	First U.S. Legislation on Meat Inspection
1906	Certified Color Regulations—listed 7 artificial colors found suitable for foods
1907	Federal Meat Inspection Act—arose out of unsanitary conditions in meatpacking plants, use of poisonous preservatives and dyes in food, and cure-all claims for worthless and dangerous medicines
1923	Filled Milk Act
1938	Federal Food, Drug, and Cosmetic Act
1939	First Food Standards for canned tomatoes, tomato puree, tomato paste for consistency
1944	Public Health Service Act—covered a broad spectrum of health concerns including regulation of biological products and control of communicable disease
1954	Pesticide Amendment Act—followed recall of cranberries found with pesticide that can cause cancer
1954	Radiological Examination of Food—brought on by reports that tuna suspected of being radioactive were being imported from Japan following atomic blasts in the Pacific
1957	Poultry Products Inspection
1958	Food Additives Amendment—required manufactures of new additives to establish safety
1960	Color Additive Amendments—similar to food additives, identified safe colors
1966	Fair Packaging and Labeling Act—required honest labels
1967	Wholesome Meat Act—state (intrastate) inspections to match the federal inspection guidelines and closed loopholes in the 1906 act which required only interstate inspection
1968	Wholesome Poultry Products—included interstate and intrastate inspection guidelines for poultry
1970	Egg Products Inspection Act
1980	Swine Health Protection Act
1990	Sanitary Food Transportation Act

tuberculosis and some food-borne infections) constitute growing threats to health and life around the globe. An attack through plant or animal disease would have significant economic impact.

Current systems that detect food-borne illness outbreaks and link them to their source need to be enhanced for defense against food bioterrorism. However, the potential for an undetected contamination in industrialized countries is relatively low. Once food has been processed and readied for distribution, quick identification of any contamination and isolation from distribution is required. Imported food products may be more likely to be contaminated with a pathogen by terrorist groups. Another concern is deliberate infection of crops and herds.

Citizens must rely on government security and public health measures such as emergency preparedness, secure food and disinfected water supplies, and good medical care to reduce the likelihood of contamination. In response to an increased risk of terrorism, the Alliance for Food Security has partnered with the FDA and the National Food Processors Association to provide domestic food and water security. In addition, the FDA has published a guide that outlines strategies to minimize contamination, providing guidance in seven areas of food service, from management to operations.

History and Purpose of Food Safety Regulations

The U.S. Public Health Service Commissioned Corp (PHS) is a uniformed service of the United States comprised of health professionals and led by the Office of the Surgeon General. The origins of the agency can be traced to a 1798 act that was passed to provide care for sick and injured merchant seamen. Formalized in 1889, it oversaw quarantines and medical examinations of immigrants. The agency commissioned officers to control the spread of contagious diseases such as **smallpox** and yellow fever through the 1900s.

smallpox: deadly viral disease

It also conducted biomedical research, provided health care to deprived groups, and supplied medical assistance to victims of natural disasters.

The PHS began its food-protection activities in the early 1900s with studies on the role of milk in the spread of disease. Model food codes and other regulations soon evolved to ensure food quality and safety. These include sanitary practices at processing plants, safety standards for ingredients, and labeling laws to assist state and local governments in initiating and maintaining effective programs for the prevention of food-borne illness. SEE ALSO ADDITIVES AND PRESERVATIVES; BIOTECHNOLOGY; GENETICALLY MODIFIED FOODS; IRRADIATION; ORGANISMS, FOOD-BORNE; PESTICIDES; REGULATORY AGENCIES.

Marilyn K. Dahl

Bibliography

Jackson, R. (1997). *Nutrition and Food Services for Integrated Health Care.* Gaithersburg, MD: Aspen.

National Restaurant Association Foundation (2002). *ServSafe Essentials*, 2nd edition. Chicago: Author.

Sizer, Francis, and Whitney, Eleanor (2003). *Nutrition Concepts and Controversies*, 9th edition. Belmont, CA: Wadsworth/Thomson.

Internet Resources

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. *FDA Food Code.* Available from <http://www.dfsan.fda.gov>

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. "Retail Food Stores and Food Service Establishments: Food Security Preventative Measures Guidance." Available from <http://www.dfsan.fda.gov>

Fortification

Fortification is the addition of **nutrients** to foods to enhance their nutritional value. **Enrichment**, on the other hand, is the addition of nutrients to foods to restore nutrients lost during processing. Examples of fortification include the addition of **folate** and **iron** to grain products, **calcium** to juices, iodine to salt, and iron to infant formulas.

Decisions to fortify foods are often population-based to address geographical inadequacies, such as lack of iodine in the soil, or to increase the intake of key nutrients, such as calcium, vitamin A, and **vitamin D**. Challenges involved in fortification include identifying suitable foods to deliver the nutrients, selecting appropriate forms of the nutrients, designing appropriate processing techniques, and implementing systems to monitor the **efficacy** of the fortification. SEE ALSO ADDITIVES AND PRESERVATIVES; FUNCTIONAL FOODS.

M. Elizabeth Kunkel
Barbara H. D. Luccia

fortification: addition of vitamins and minerals to improve the nutritional content of a food

nutrient: dietary substance necessary for health

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

folate: one of the B vitamins, also called folic acid

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

efficacy: effectiveness

French Paradox

The term *French paradox* refers to the observation that although the French eat similar amounts of high-fat foods, exercise less, and smoke more than

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diet: the total daily food intake, or the types of foods eaten

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

incidence: number of new cases reported each year

Americans, they appear to have a markedly lower mortality rate from **heart disease**. Medical experts generally agree that a low-fat **diet**, exercise, and not smoking minimize the risk of heart attacks, which makes this paradox difficult to understand. Studies suggest that one of the reasons the French have a lower rate of heart disease may be their regular consumption of red wine.

The specific mechanism by which the French paradox operates has not yet been identified. Some research suggests that **antioxidants** called flavonoids, natural chemical compounds found in red wine, may confer important health benefits to the heart and blood vessels. Red grapes are one of the richest sources of flavonoids, which may make red wine more heart-healthy than white wine, beer, or other spirits. Other research suggests that pigments in red wine called polyphenols are responsible for explaining the French paradox. Polyphenols, found in red grape skins, are believed to act as antioxidants, control **blood pressure**, and reduce blood clots. Some research indicates that red grape juice is markedly less potent than wine in conferring health benefits. Researchers suggest that something in the wine-making process changes the polyphenols' properties.

Not all scientists believe in the French paradox. Some believe that it is a health myth caused by errors in health-data reporting on the **incidence** of heart disease in France. Also, some scientists argue that there is no scientific consensus over the protective effect of any alcoholic beverage on heart disease.

Dr. Serge Renaud, a scientist from Bordeaux University in France, coined the term *French paradox* after completing his 1992 landmark report that indicated France's low incidence of heart disease might be caused by wine consumption. SEE ALSO GREEKS AND MIDDLE EASTERNERS, DIET OF; HEART DISEASE; NORTHERN EUROPEANS, DIET OF.

Karen Bryla

Bibliography

Hackman, Robert M. (1998, September). "Flavonoids and the French Paradox." *USA Today*, v. 127, no. 2640, 58–59.

Internet Resources

MSNBC News. "Study May Explain French Paradox." Available from <http://www.msnbc.com/news>

Functional Foods

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

nutrition: the maintenance of health through proper eating, or the study of same

fiber: indigestible plant material that aids digestion by providing bulk

calcium: mineral essential for bones and teeth

Functional foods are foods that provide health benefits beyond basic **nutrition** due to certain physiologically active components, which may or may not have been manipulated or modified to enhance their bioactivity. These foods may help prevent disease, reduce the risk of developing disease, or enhance health. Consumer interest in functional foods increased during the late twentieth century as people's interest in achieving and maintaining good health increased. Health-conscious consumers have become aware of the health benefits associated with specific foods and are incorporating elements such as **fiber**, **calcium**, and soy into their diets. Rapid advances in food science and technology, an aging population, the rapid rise in health care costs,

By feeding their hens a modified diet, some farms have increased the amount of omega-3 in the eggs they sell. These eggs are considered to be functional food because their higher omega-3 content can improve the health of consumers whose diets are deficient in that fatty acid. *[Photograph by Eric Risberg. AP/Wide World Photos. Reproduced by permission.]*

and changing government marketing and labeling regulations have also had an impact on the functional foods market.

There is a difference between the Western and Eastern perspective on functional foods. In the West, functional foods are considered revolutionary and represent a rapidly growing segment of the food industry. Food and pharmaceutical companies alike are competing to bring functional foods into the mass market. On the other hand, functional foods have been a part of Eastern cultures for centuries. Foods were used for medicinal purposes in traditional Chinese medicine as early as 1000 B.C.E. From ancient times, the Chinese have used foods for both preventive and therapeutic health effects, a view that is now being increasingly recognized around the world.

Clearly, most foods are functional in some way. What makes a "functional food," however, is its potential ability to positively affect health. Functional foods range from fruits, vegetables, and whole grains, which are naturally high in **phytochemicals**, to products in which a specific ingredient is added, removed, increased, or decreased. Examples of functional foods include soy, oats, flaxseed, grape juice, broccoli and other cruciferous vegetables, phytosterol/stanol-enriched margarine, eggs enhanced with omega-3 **fatty acids**, foods **fortified** with **herbal** preparations, and **psyllium**.

phytochemical: chemical produced by plants

fatty acids: molecules rich in carbon and hydrogen; a component of fats

fortified: altered by addition of vitamins or minerals

herbal: related to plants

psyllium: bulk-forming laxative derived from the Plantago psyllium seeds

Regulations Related to Functional Foods

Functional foods are regulated by the United States Food and Drug Administration (FDA) under the authority of two laws. The Federal Food, Drug, and Cosmetic Act (FD&C) of 1938 provides for the regulation of all foods and **food additives**. The Dietary Supplement Health and Education Act (DSHEA) of 1994 amended the FD&C Act to cover dietary supplements and ingredients of dietary supplements. Functional foods may be categorized as whole foods, enriched foods, fortified foods, or enhanced foods. Labeling claims that are used on functional foods are of two types: (1) Structure and function claims, which describe effects on normal functioning of the body, but not claims that the food can treat, diagnose, prevent, or cure a disease

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

cardiovascular: related to the heart and circulatory system

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

(claims such as "promotes regularity," "helps maintain **cardiovascular** health," and "supports the **immune system**" fit into this category); and (2) Disease-risk reduction claims, which imply a relationship between dietary components and a disease or health condition.

Structure and function claims do not require preapproval by the FDA, and they require much less stringent scientific consensus than disease-risk reduction claims. Under the FD&C Act, structure and function claims cannot be false or misleading. However, the law does not define the nature or extent of evidence necessary to support these claims. To complicate matters, the evidence available to support structure and function claims varies widely

TYPES OF FUNCTIONAL FOODS

Functional food	Potential health benefit	Labeling claim
Whole foods		
Oats	Reduces cholesterol and constipation, reduces risk of heart disease	May reduce the risk of heart disease
Soy	Reduces cholesterol, reduces risk of osteoporosis, certain cancers, and heart disease	May reduce the risk of heart disease
Fruits and vegetables	Reduces risk of certain cancers and heart disease; reduces hypertension	May reduce the risk of some cancers; May reduce the risk of heart disease
Fish	Reduces cholesterol and triglycerides	None
Garlic	Reduces risk of heart disease and certain cancers, reduces cholesterol	None
Grapes/grape juice	Reduces risk of heart disease	Structure/function claim
Flaxseed	Reduces risk of heart disease and certain cancers; reduces triglycerides; increases blood-glucose control	None
Nuts	Reduces risk of heart disease	None
Enriched foods		
Grains	Reduces risk of certain cancers, heart disease, and nutrient deficiencies	May reduce the risk of some cancers; May reduce the risk of heart disease
Fortified foods		
Juices with calcium	Reduces risk of osteoporosis, reduces hypertension	Helps maintain healthy bones and may reduce risk of osteoporosis
Grains with folic acid	Reduces risk of heart disease and neural tube birth defects	May reduce risk of brain and spinal cord birth defects
Infant formulas with iron	Reduces risk of iron deficiency	None
Grains with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol and constipation; increases blood-glucose control	May reduce the risk of some cancers; May reduce the risk of heart disease
Milk with vitamin D	Reduces risk of osteomalacia and osteoporosis	Helps maintain healthy bones and may reduce risk of osteoporosis
Juices with added fiber	Reduces risk of certain cancers and heart disease; reduces cholesterol, hypertension, and constipation	May reduce risk of some cancers
Enhanced foods		
Dairy products with probiotics	Reduces risk of colon cancer and candidal vaginitis; controls inflammation; treatment of respiratory allergies, diarrheal disorders, and eczema	Structure/function claim
Beverages and salad dressings with antioxidants	May support overall health	Structure/function claim
Foods and beverages containing herbal preparations	Varies with ingredients	Structure/function claim
Sports bars	Varies with ingredients	Structure/function claim
Spreads with stanol esters	Reduces cholesterol	Structure/function claim
Foods containing sugar alcohols in place of sugar	Reduces risk of tooth decay	May reduce risk of tooth decay
Eggs with omega-3 fatty acids	Reduces risk of heart disease	Structure/function claim

because some ingredients have been studied extensively, some have not been studied very much, and some ingredients are backed by mixed results.

Disease-risk reduction claims, typically called *health claims*, do require FDA approval before they can be used on products and must reflect scientific consensus. For example, the health claim for soy **protein** and its relation to cardiovascular disease reads: "Diets low in **saturated fat** and **cholesterol** that include 25 grams of soy protein a day may reduce the risk of **heart disease**. One serving of (name of food) provides ____ grams of soy protein." This claim may appear only on soy products that provide at least 6.25 grams of soy protein per serving. Other FDA-approved health claims include those related to fruits and vegetables and a reduced risk of **cancer**; saturated fat and an increased risk of heart disease; sodium and increased risk for **hypertension**, and folic acid–fortified foods and reduced risk of **neural** tube defects.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

cancer: uncontrolled cell growth

hypertension: high blood pressure

neural: related to the nervous system

Many developed functional foods seem to have benefits for human health. For example, calcium-fortified orange juice provides approximately the same amount of calcium as milk. With more than half of all children under the age of five and nearly 85 percent of females age twelve to nineteen not meeting the Dietary Reference Intake (DRI) for calcium, calcium-fortified orange juice may contribute significantly to calcium intake. On the other hand, a positive impact on health is more difficult to establish for other developed functional foods. These include prepared foods spiked with herbal preparations, which may contain little of the herbal ingredients listed on the label, or insufficient quantities of these ingredients to produce the claimed effect. Additionally, some herbal ingredients can be harmful, such as kava, which has been associated with liver damage, and belladonna, which is toxic.

The Future

The future of functional foods will undoubtedly involve a continuation of the labeling and safety debates. As consumers become more health conscious, the demand and market value for health-promoting foods and food components is expected to grow. Before the full market potential can be realized, however, consumers need to be assured of the safety and **efficacy** of functional foods. Future research will focus on mechanisms by which food components such as phytochemicals positively affect health, and whether these components work independently or synergistically. According to the American Dietetic Association, dietetics professionals will be increasingly called upon to develop preventive meal plans, to recommend changes in food intake, to enhance phytochemical and functional food intake, and to evaluate the appropriateness of functional foods and dietary supplements to meet preventive (and therapeutic) intake levels for both healthy persons and those diagnosed with disease. SEE ALSO ANTIOXIDANTS; PHYTOCHEMICALS.

efficacy: effectiveness

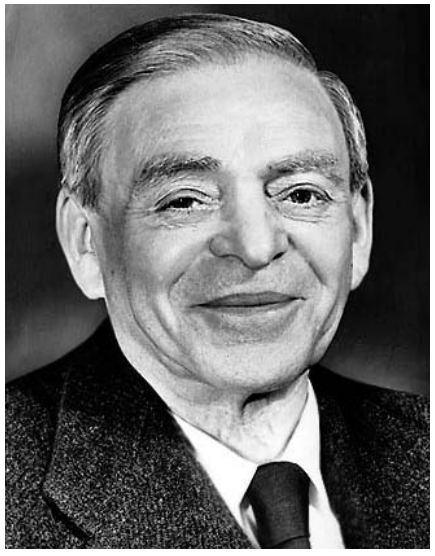
M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

American Dietetic Association (1999). "Functional Foods—Position of the ADA." *Journal of the American Dietetic Association* 99:1278–1285. Also available from <http://www.eatright.org>

Mazza, G., ed. (1998). *Functional Foods: Biochemical and Processing Aspects.* Lancaster, PA: Technomic Publishing.

Wildman, Robert E. C., ed. (2001). *Handbook of Nutraceuticals and Functional Foods.* Boca Raton, FL: CRC Press.



Dr. Casimir Funk, who discovered that substances in food could prevent or cure certain diseases. He called those substances "vitamines." *[AP/Wide World Photos. Reproduced by permission.]*

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

niacin: one of the B vitamins, required for energy production in the cell

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

amine: compound containing nitrogen linked to hydrogen

hormone: molecules produced by one set of cells that influence the function of another set of cells

pituitary gland: gland at the base of the brain that regulates multiple body processes

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

drugs: substances whose administration causes a significant change in the body's function

Funk, Casimir

American biochemist
1884–1967

Casimir Funk was born in Warsaw, Poland. The son of a dermatologist, Funk earned a doctorate degree at the University of Bern, Switzerland, at the young age of twenty. He then worked at the Pasteur Institute in Paris, the Wiesbaden Municipal Hospital in Germany, the University of Berlin, and the Lister Institute in London.

Funk emigrated to the United States in 1915 and held several industrial and university positions in New York. He became a naturalized U.S. citizen in 1920. With funding provided by the Rockefeller Foundation, Funk returned to Warsaw in 1923 to serve as the director of the Biochemistry Department of the State Institute of Hygiene. Funk moved to Paris in 1927 and became a consultant to a pharmaceutical company and founded Casa Biochemica, a privately funded research institution.

At the outbreak of World War II in 1939, Funk returned to the United States to work as a consultant for the United States Vitamin Corporation. He became the president of the Funk Foundation for Medical Research in 1940.

Funk's work with what are now called **vitamins** began when he recognized that certain food factors were needed to prevent nutritional-deficiency diseases, such as beriberi (vitamin B_1 deficiency), **scurvy** (vitamin C deficiency), pellagra (**niacin** deficiency), and **rickets** (**vitamin D** deficiency). He suggested that these unidentified substances were all in a class of organic compounds called **amines**, which are vital to life, so he named them vitamines (vital amines). Although they turned out not to be amines, Funk's proposal (and the coining of the term *vitamine*) has been called a stroke of genius. He later confirmed the existence of vitamins B_1, B_2, C, and D, and he stated that they were necessary for normal health and the prevention of deficiency diseases.

In his work to find the specific factor that prevented beriberi, Funk eventually isolated nicotinic acid (niacin, or vitamin B_1) from rice. Although it did not cure beriberi, scientists later discovered that it cured pellagra. Funk also worked with the B-vitamin thiamine, determining its molecular structure and developing a method for synthesizing it.

In his later research, Funk studied animal **hormones** and contributed to the knowledge about hormones of the **pituitary** and sex glands, emphasizing the importance of balance between hormones and vitamins. Funk also investigated the biochemistry of **cancer**, **diabetes**, and **ulcers**. He improved manufacturing methods for many commercial **drugs** and developed several new commercial products in his laboratories. He died in Albany, New York, on November 20, 1967. SEE ALSO BERIBERI; PELLAGRA; VITAMINS, FAT SOLUBLE; VITAMINS, WATER-SOLUBLE.

Karen Bryla

Bibliography

Abbott, David (1984). *The Biographical Dictionary of Scientists: Chemists.* New York: P. Bedrick.

Jukes, T. H. (1989). "Historical Perspectives: The Prevention and Conquest of Scurvy, Beri-Beri, and Pellagra." *Preventive Medicine* 18:877–883.

Koppman, Lionel (1986). *Guess Who's Jewish in American History*. New York: Steimatzky.

Internet Resource

"Casimir Funk." Available from <http://www.encyclopedia.com>

Generally Recognized as Safe (GRAS)

In 1959, the U.S. Food and Drug Administration (FDA) established a list of seven hundred food substances that were exempt from the then new requirement that manufacturers test **food additives** before putting them on the market. The Generally Recognized as Safe, or GRAS, list acknowledged that many additives had existing scientific evidence of long and safe use in food. Among the additives on the list are sugar, salt, spices, and **vitamins**. Manufacturers can petition for GRAS status for new additives if the substances meet the criteria cited above. GRAS list additives are continually reevaluated based on current scientific evidence. SEE ALSO ARTIFICIAL SWEETENERS; BIOTECHNOLOGY; FOOD SAFETY; FUNCTIONAL FOODS.

Susan T. Borra

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

Genetically Modified Foods

Genetic modification employs recombinant **deoxyribonucleic acid** (rDNA) technology to alter the **genes** of **microorganisms**, plants, and animals. Genetic modification is also called biotechnology, gene splicing, recombinant DNA technology, or genetic engineering. Contemporary genetic modification was developed in the 1970s and essentially transfers genetic material from one organism to another. The modification of organisms has existed for centuries in the form of plant-breeding techniques (such as cross-fertilization) used to produce desired traits. With genetic modification, however, isolated genes are inserted into plants for a desired trait with a much quicker result than occurs when cross-breeding plants, which can take years. These isolated genes do not have to come from similar species in order to be functional; theoretically, genes can be transferred among all microorganisms, plants, and animals.

genetic: inherited or related to the genes

deoxyribonucleic acid: DNA, the molecule that makes up genes

gene: DNA sequence that codes for proteins, and thus controls inheritance

microorganisms: bacteria and protists; single-celled organisms

Examples of Genetically Modified Foods

Crops may be modified to increase resistance to pests and disease, increase adaptability to environmental conditions, improve flavor or nutritional profile, delay ripening, or increase shelf life. Many common crops are genetically modified, such as corn, canola, flax, potatoes, tomatoes, squash, and soybeans. Corn and potatoes may be modified with a gene to produce an **endotoxin** that protects them against the corn-borer pest and the potato beetle, respectively. A soybean can be genetically modified with a gene from a bacterium to make it herbicide resistant. By inserting two genes from daffodil and one gene from a bacterium, rice can be enriched with beta-carotene.

endotoxin: toxic substance produced and stored within the plant tissue

In the early 1990s, genetically modified tomatoes (Flavr Savr by Calgene, Inc.) were deemed safe by the U.S., Canadian, and British governments and introduced into the market. These tomatoes were bred to stay firm after

harvest so they could remain on the vine longer and ripen to full flavor. However, the tomatoes were so delicate that they were difficult to transport without damage, and the product was pulled from the market in 1997.

Recombinant bovine growth hormone (rBGH), also known as recombinant bovine somatotropin (rBST), is another example of a product that has not been very successful. Recombinant BGH (Posilac by Monsanto Company) is a genetically engineered version of a growth hormone that increases milk output in dairy cows by as much as 10 to 30 percent. In 1999 the United Nations Food Safety Agency unanimously declared the use of rBGH unsafe after confirming reports of excess levels of the naturally occurring insulin-like growth factor one (IGF-1), including its highly potent variants, in rBGH milk and concluding that these posed major risks of **cancer**. Health Canada also banned the use of rBGH in milk production in 1999, but the hormone is still permitted in the U.S. milk supply.

cancer: uncontrolled cell growth

Safety of Genetically Modified Foods

Biotechnology has moved at such a rapid pace that the safety of genetically modified foods has become a concern. At this time, there are no long-term, large-scale tests to prove their safety—or lack thereof. Unforeseen consequences may arise from widespread genetic modification of the food supply, including:

allergic reaction: immune system reaction against a substance that is otherwise harmless

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

- ***Allergic reaction***. If a gene producing a **protein** that causes an allergic reaction is engineered into corn, for example, an individual who is allergic to that protein may experience an allergic reaction to the corn. Despite the fact that food-regulating agencies require companies to report whether altered food contains any suspect proteins, unknown allergens could potentially slip through the system.

toxins: poisons

- *Increased toxicity*. Genetic modification may enhance natural plant **toxins** in unexpected ways. When a gene is switched on, besides having the desired effect, it may also stimulate the production of natural toxins.

antibiotic: substance that kills or prevents the growth of microorganisms

- *Resistance to* ***antibiotics***. As part of the genetic modification of organisms, marker genes are used to determine if the desired gene has been successfully embedded. Marker genes typically provide resistance to antibiotics. Even though marker genes are genetically scrambled before use to reduce the potential for this danger, their use could contribute to the growing problem of antibiotic resistance.
- *Herbicide-resistant weeds*. Once modified crops are planted, genes may travel via airborne, waterborne, or animal-borne seeds and pollen to weedy relatives, creating "superweeds" that are able to resist herbicides.
- *Harm to other organisms*. Nontargeted species may inadvertently be harmed by a genetically modified plant producing endotoxins intended for a specific pest. For example, nearly all insect-resistant plants contain a gene from the bacterium *Baciullus thuringiensis* (Bt), which results in the production of a natural endotoxin that is toxic to all insects. The Bt endotoxin is widely used by organic and conventional farmers because it is a relatively harmless, natural pesticide. However, genetically modified plants such as Bt corn, cotton, potatoes, rice, and tomatoes constantly produce the Bt endotoxin, and thus speed up the spread of Bt resistance among pests that feed on these

A protest of genetically modified foods in front of the regional headquarters of the United Nations in Thailand. Critics of genetically modified foods cite concern over the possibility that modified foods might have unexpected and dangerous properties. *[© AFP/Corbis. Reproduced by permission.]*

plants. They may also reduce insect diversity and population numbers among harmless and beneficial insects.

- *Pesticide-resistant insects and the demise of safe pesticides.* Most of the common genetically modified crops contain a gene that produces a protein which is toxic to a specific pest. However, exposing pests to toxins may stimulate resistance by the pests and render the pesticides useless.

Typically, when a new crop is created, whether by traditional methods or genetic modification, breeders conduct field testing for several seasons to make sure only desirable changes occur. Appearance, growth characteristics, and taste of the food are checked, and analytical tests to determine changes in **nutrients** and safety are performed. According to the U.S. Department

nutrient: dietary substance necessary for health

of Agriculture, there is no evidence that any genetically modified foods now on the market pose any human health concerns or are in any way less safe than crops produced through traditional breeding. In 2002, however, the European Union updated and strengthened existing regulations and labeling laws for genetically modified foods in the European markets.

The Food and Agriculture Organization (FAO) of the United Nations recognizes that genetic engineering has the potential to help increase productivity in agriculture, forestry, and fisheries. However, the FAO urges caution to reduce the risks associated with transferring toxins from one organism to another, of creating new toxins, or of transferring allergenic compounds from one organism to another. The FAO acknowledges potential risks to the environment, including outcrossing (crossing unrelated organisms), which could lead to the evolution of more aggressive weeds, pests with increased resistance to diseases, or environmental stresses that upset the ecosystem balance.

Labeling of Genetically Modified Foods

According to the Institute of Food Technologists, genetically modified foods should not be labeled because "labels are likely to mislead consumers by implying a warning. . . . Moreover, labeling rDNA-engineered foods would not be economically prudent." In the European Union, concern about the safety of genetically modified organisms, fanned by years of political activism, has resulted in regulations that keep many genetically modified foods out of the European market. These regulations include requirements for tracing the genetic origin of each food ingredient, and for labeling the resulting products accordingly. Fueled by consumer protest and demand, lawmakers in China and Canada have recently begun discussing stricter labeling laws as well.

Conclusion

Genetic modification of foods is an area of biotechnology that is developing very rapidly, with many potential applications for improving the quantity and quality of the food supply. As with any new food technology, however, the safety of the products derived from this technology must be carefully assessed. Consumer concerns will likely continue to fuel the debate. SEE ALSO BIOTECHNOLOGY; FOOD SAFETY; FUNCTIONAL FOODS; PESTICIDES.

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Institute of Food Technologists (2000). "Genetically Modified Organisms: A Backgrounder." *Food Technology* 54:42–45.

International Food Information Council (2000). *Food Biotechnology: A Communications Guide to Improving Understanding.* Washington, DC: Author.

Internet Resources

Food and Agriculture Organization of the United Nations (2000). "FAO Statement on Biotechnology." Available from <http://www.fao.org/biotech>

United States Department of Agriculture (2002). "Agricultural Biotechnology." Available from <http://www.usda.gov/agencies>

World Health Organization (2002). "Foods Derived from Modern Biotechnology." Available from <http://www.who.int>

The Acceptance of Genetically Modified Foods

In the United States, only limited objections have been raised to genetically modified foods, which can be more nutritious, disease-resistant, flavorful, or cheaper than natural foods. In Europe, by contrast, consumers and governments have focused on the potential dangers of genetic modification, which include unforeseen resistance to antibiotics and herbicides, the spread of dangerous allergens, and damage to livestock, public health, and the environment. Health disasters such as the mad cow outbreak have left many European consumers with a distrust of corporations and regulatory bodies and a determination to understand where their food comes from. While some genetically modified crops are allowed in Europe, the European Union has instituted strict regulatory requirements for labeling and traceability and has effectively placed a moratorium on approving new crops. These regulations have caused friction with the U.S. government by limiting the import of U.S. agricultural products, many of which are genetically modified and none of which are required to carry labeling. The American Farm Bureau Federation estimates that U.S. corn producers alone would be able to export $300 billion more corn if the ban were lifted.

—Paula Kepos

Glisson, Francis

English scholar, physician, and scientist
1597–1677

Francis Glisson was born in Rampisham, England, and attended Cambridge University, with which he had a long relationship. During his life he acted as a dean, senior fellow, and professor at the university. He also had a private medical practice.

The Royal College of Physicians of London admitted Glisson as a candidate in 1634, the same year he received his medical degree from Cambridge. Within the Royal College he played the roles of fellow, councilor, and president. He also belonged to the "Invisible College," a small group of professionals who met weekly in 1645 to promote investigation into natural and experimental philosophy. Later it became the Royal Society. Around that same time, a group of fellows of the Royal College began to exchange notes on **rickets**, intending to publish a book on the topic. Glisson was assigned to investigate the basic nature of rickets. His investigation skills proved to be strong, and he impressed his coworkers so much that they gave him the responsibility of drafting the entire book, with the assistance of seven contributors.

Tractatus de rachitid, sive morbo puerili (A Treatise of the Rickets), was published in 1650. It is not clear if any of the anatomical and clinical descriptions of rickets were solely Glisson's work. He claimed responsibility for sole authorship for chapters three through fourteen, where he wrote clearly about the nature of the disease. In March of 1660, Glisson became an early member of the Royal Society. In his second book, *Anatomia hepatis (Anatomy of the Liver)*, Glisson identified and described the outer capsule of connective tissue that surrounds the liver and its blood supply (now called Glisson's Capsule). In his third book, *Tractatus de ventriculo et intestini* (*A Treatise of the Stomach and Intestines*), Glisson coined the term *irritability*, referring to the body's ability to sense an irritant and try to rid itself of it.

Though primarily known for his pioneering work on rickets, Francis Glisson contributed to the body of knowledge in general anatomy and **physiology** of the digestive organs. In the opening paragraph of *A Treatise of the Rickets*, he wrote that infantile rickets was "an entirely new disease, that was never described by any of the ancient or modern writers." He was able to show that infantile **scurvy** was a separate disease from rickets, although the two usually occur together. SEE ALSO NUTRITIONAL DEFICIENCY; RICKETS.

Slande Celeste

Francis Glisson was a major contributor to an early pediatric text titled *A Treatise of the Rickets.* His work accurately described both rickets and infantile scurvy, but did not recognize the dietary causes of the diseases. *[Science Photo Library/Photo Researchers, Inc. Reproduced by permission.]*

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

Internet Resource

Vanderbilt University Medical Center. "Rickets and Vitamin D." Available from <http://www.mc.vanderbilt.edu>

Global Database on National Nutrition Policies and Programmes

Hunger and **malnutrition** occur throughout the world, though the knowledge and resources exist to eliminate them. The challenge lies in changing

malnutrition: chronic lack of sufficient nutrients to maintain health

political will, developing realistic policies, and taking determined actions both nationally and internationally. These are the basic beliefs of the Global Database on National Nutrition Policies and Programmes (GDNNPP). GDNNPP was created by the World Health Organization (WHO) in 1995 to monitor and evaluate the progress of implementation of the 1992 World Declaration and Plan of Action for Nutrition, which states that all people should have access to safe and nutritious food and be free from hunger.

GDNNPP plays a large role in improving nutrition status globally by compiling data from six regions of the world: Africa, the Americas (in conjunction with the Pan-American Health Organization), the Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific. Policies and programs vary from country to country according to population needs.

GDNNPP provides a global review and comparative analysis of national nutrition policies and plans of action. It identifies the priority nutrition issues of various countries, as well as key elements for developing and implementing effective and sustainable nutrition policies and programs. It also evaluates each country's progress in developing, strengthening, and implementing national nutrition policies and programs, and it serves as a guide to creating better national nutrition policies and programs through authoritative standards and guidelines, research, and collaboration. GDNNPP is designed to help enforce the health objectives, strategies, and activities of the WHO, which also provides technical and financial support to participating WHO countries.

Delores C. S. James

Internet Resources

Pan American Health Organization. "Nutrition and Food Protection: Current Health Topics." Available from <http://www.paho.org>

World Health Organization. "Global Database on National Nutrition Policies and Programmes." Available from <http://www.who.int/nut_pol.htm>

Glycemic Index

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

diabetes: inability to regulate level of sugar in the blood

glucose: a simple sugar; the most commonly used fuel in cells

The glycemic index (GI) is a ranking of **carbohydrate** foods individuals with **diabetes** use to manage their disease. This ranking is based on the rate carbohydrates affect blood **glucose** levels relative to glucose or white bread. Generally, the glycemic index is calculated by measuring blood glucose levels following the ingestion of a carbohydrate. This blood glucose value is compared to the blood glucose value acquired following an equal carbohydrate dose of glucose or white bread. Glucose is absorbed into the bloodstream faster than any other carbohydrate, and is thus given the value of 100. Other carbohydrates are given a number relative to glucose. Foods with low GI indices are released into the bloodstream at a slower rate than high GI foods.

absorption: uptake by the digestive tract

A number of factors influence the digestion and **absorption** rate of food, including ripeness, particle size, the nature of the starch, the degree of processing and preparation, the commercial brand, and the characteristics of the diabetic patient, and these factors naturally affect each food's glycemic index position or rank. In addition, differences exist in the glycemic indeces of foods due to the choice of reference food, the timing of blood sampling, or the computational method used to calculate the glycemic index.

GLYCEMIC INDEX OF COMMON FOODS

Food item	GI (Glucose = 100)	GI (Bread = 100)	Serving size (grams or milliliters)
Beverages			
Coca Cola, soft drink (Atlanta, GA, USA)	63	90	250 ml
Apple juice, unsweetened	40	57	250 ml
Orange juice (mean of Canada, Australia, & USA)	52	74	250 ml
Breads			
Bagel, white, frozen (Lender's Bakery, Montreal Canada)	72	103	70 g
Wonder, enriched white bread	73	105	30 g
Healthy Choice Hearty 7 Grain Wheat bread (Con Agra Inc., USA)	55	79	30 g
Dairy Products and Alternatives			
Ice cream, regular flavor, not specified (mean of Canada, Italy, & USA)	61	87	50 g
Milk, full-fat (mean of Italy, Sweden, USA, Australia, and Canada)	27	38	250 g
Milk, skim (Canada)	32	46	250 g
Fruit and Fruit Products			
Apples, raw (mean of Denmark, New Zealand, Canada, USA, and Italy)	38	52	120 g
Banana, raw (mean of Canada, USA, Italy, Denmark, and South Africa)	52	74	120 g
Grapefruit, raw (Canada)	25	36	120 g
Pasta and Noodles			
Macaroni and cheese, boxed (Kraft General Foods Canada, Inc., Don Mills, Canada)	64	92	180 g
Spaghetti, white or type not specified, boiled 10-15 min (mean of Italy, Sweden, and Canada)	44	64	180 g
Ravioli, durum wheat flour, meat-filled, boiled (Australia)	39	56	180 g
Vegetables			
Green peas, frozen, boiled (mean of Canada and India)	48	68	80 g
Carrots, not specified (Canada)	92	131	80 g
Baked potato, without fat (mean of Canada and USA)	85	121	150 g

SOURCE: Adapted from Foster-Powell et al.

The objectives of **diet** management in diabetic patients are to reduce **hyperglycemia**, prevent **hypoglycemic** episodes, and reduce the risk of complications. For people with diabetes, the glycemic index is a useful tool in planning meals to achieve and maintain glycemic control. Foods with a low glycemic index release sugar gradually into the bloodstream, producing minimal fluctuations in blood glucose. High GI foods, however, are absorbed quickly into the bloodstream causing an escalation in blood glucose levels and increasing the possibility of hyperglycemia. The body compensates for the rise in blood sugar levels with an accompanying increase in **insulin**, which within a few hours can cause hypoglycemia. As a result, awareness of the glycemic indices of food assists in preventing large variances in blood glucose levels.

Experts disagree regarding the use of the glycemic index in athletes' diets and in exercise performance. Insufficient evidence exists supporting the benefit of low glycemic meals prior to prolonged exercise. Nonetheless,

diet: the total daily food intake, or the types of foods eaten

hyperglycemia: high level of sugar in the blood

hypoglycemic: related to low level of blood sugar

insulin: hormone released by the pancreas to regulate level of sugar in the blood

a low GI pre-event meal may be beneficial for athletes who respond negatively to carbohydrate-rich foods prior to exercise or who cannot consume carbohydrates during competition. Athletes are advised to consume carbohydrates of moderate to high GI during prolonged exercise to maximize performance, approximately 1 gram per minute of exercise. Following exercise, moderate to high GI foods enhance **glycogen** storage. SEE ALSO CARBOHYDRATES; DIABETES MELLITUS; EXCHANGE SYSTEM.

Julie Lager

glycogen: storage form of sugar

diet: the total daily food intake, or the types of foods eaten

hormone: molecules produced by one set of cells that influence the function of another set of cells

metabolism: the sum total of reactions in a cell or an organism

stillbirth: giving birth to a dead fetus

miscarriage: loss of a pregnancy

cretinism: arrested mental and physical development

fortified: altered by addition of vitamins or minerals

An example of grade III (large and visible) goiter. Most cases of goiter in the developing world are due to an iodine deficiency. Unable to meet the body's hormonal needs, the thyroid becomes enlarged to compensate. *[© Lester V. Bergman/Corbis. Reproduced by permission.]*

Bibliography

Burke, Louise M.; Collier, Gregory R.; and Hargreaves, Mark (1998). "Glycemic Index—A New Tool in Sport Nutrition?" *International Journal of Sport Nutrition* 8:401–415.

Foster-Powell, Kaye; Holt, Susanna H. A.; and Brand-Miller, Janette C. (2002). "International Table of Glycemic Index and Glycemic Load Value." *American Journal of Clinical Nutrition* 76:5–56.

Gretebeck, Randall J.; Gretebeck, Kimberlee A.; and Tittelbach, Thomas J. (2002). "Glycemic Index of Popular Sport Drinks and Energy Foods." *Journal of the American Dietetic Association* 102(3):415–416.

Ludwig, David S. (2002). "The Glycemic Index: Physiological Mechanisms Relating to Obesity, Diabetes, and Cardiovascular Disease." *Journal of the American Medical Association* 287(18):2414–2423.

Willette, Walter; Manson, JoAnn; and Liu, Simin (2002). "Glycemic Index, Glycemic Load, and Risk of Type 2 Diabetes." *American Journal of Clinical Nutrition* 76 (suppl.):274S–281S.

Wolever, Thomas; Jenkins, David J. A.; Jenkins, Alexandra L.; and Josse, Robert G. (1991). "The Glycemic Index: Methodology and Clinical Importance." *American Journal of Clinical Nutrition* 54:846–854.

Internet Resources

National Institute of Diabetes and Digestive and Kidney Diseases. "Diabetes." Available from <http://www.niddk.nih.gov>

National Library of Medicine. "Diabetes." Available from <http://medlineplus.gov>

Goiter

A goiter is a noncancerous enlargement of the thyroid gland in the front of the neck. Many conditions can cause goiter, but the most common is a lack of sufficient iodine in the **diet**, which is usually a result of the soil in which food is grown being iodine-poor—a condition that occurs in many mountainous regions away from the sea. Iodine is required for the production of thyroid **hormones**, which regulate the body's **metabolism**.

About 740 million people have goiters, but the percentage varies greatly by region (eastern Mediterranean: 32%; Africa: 20%: Europe: 15%; Southeast Asia: 12%; western Pacific: 8%; the Americas: 5%). Surveying communities for goiters is one of the best ways of detecting iodine deficiency, which, if not treated, can cause **stillbirths**, **miscarriages**, **cretinism**, mental impairments, deafness, and dwarfism.

Iodine deficiency is the most common preventable cause of brain damage and mental retardation, affecting about 50 million people worldwide. However, these disorders have been tremendously reduced simply by using table salt **fortified** with iodine.

Adults require at least 20 micrograms of iodine daily, but 150 micrograms is recommended. Seafoods are excellent sources, while the iodine content of other foods varies depending on animal feed and soil. Iodism (iodine poisoning) is a rare condition that results in weakness, swollen salivary glands, a metallic taste in the mouth, and a runny nose. SEE ALSO MINERALS.

Donna Staton
Marcus Harding

Bibliography

Food and Nutrition Board (2002). *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc.* Washington, DC: National Academy Press.

UNICEF (1998). *The State of the World's Children 1998*. Oxford: Oxford University Press.

Internet Resource

International Council for the Control of Iodine Deficiency Disorders. "About IDD." Available from <http://www.people.virginia.edu/~jtd/iccidd>

Goldberger, Joseph

American physician
1874–1929

Often considered a significant contributor to the field of **nutrition** science, Joseph Goldberger was born to a Jewish family in Girald, Austria-Hungary. When he was six years old, Goldberger and his family emigrated to the United States, settling on Manhattan's East Side.

Goldberger enrolled in City College in New York at the age of sixteen, determined to study engineering. At the end of his second year, Goldberger decided to switch to medicine after attending a lecture at Bellevue Hospital Medical College. In 1895, he obtained his medical degree from Bellevue and began private practice in a small Pennsylvania city. Bored after two years, Goldberger decided to take a competitive exam to enter the Marine Hospital Service, and he joined its ranks in 1899. The Marine Hospital Service, responsible for caring for sick merchant seamen and for fighting epidemics, was renamed the Public Health Service in 1902.

Goldberger married Mary Farrar in 1906. Because his marriage to a non-Jewish woman was unusual in his day, there were religious-based objections from both families.

During his time at the Public Health Service, Goldberger specialized in **preventive medicine**, **infectious diseases**, and nutrition. He fought tropical fevers, **typhus**, **typhoid**, and other infectious outbreaks throughout the United States and the Caribbean. In 1914, impressed with Goldberger's success, the Surgeon General of the United States appointed him to study the disease pellagra, which was becoming prevalent in the southern United States. Pellagra is characterized by skin rashes, mouth sores, diarrhea, and, if untreated, mental deterioration.

At the time, pellagra was thought to be an infectious disease. However, as Goldberger traveled throughout the South observing those with pellagra, he never contracted the disease. He noticed that poor people were more likely to get pellagra, and that their **diet** was restricted to cornbread, molasses, and

nutrition: the maintenance of health through proper eating, or the study of same

preventive medicine: treatment designed to prevent disease, rather than waiting for it to occur before intervening

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

typhus: bacterial disease transmitted by infected rodents

typhoid: fever-causing bacterial infection due to Salmonella typhi; transmitted by contaminated food or water

diet: the total daily food intake, or the types of foods eaten

Joseph Goldberger. In 1914 the U.S. Surgeon General appointed Goldberger to fight pellagra, a disease that was sickening thousands of poor Southerners. Goldberger correctly theorized that the disease is caused by malnutrition. *[Bettman/Corbis. Reproduced by permission.]*

a little pork fat. Institutions such as prisons, asylums, and orphanages also had higher levels of pellagra, and residents of these institutions also had limited diets. Based on this evidence, Goldberger concluded that pellagra had a dietary cause and was not infectious.

In 1915, Goldberger conducted a study with inmates at a Mississippi prison, who received a pardon in exchange for their participation. Inmates at this prison had a fairly balanced diet, and the volunteers were given the poor Southern diet that Goldberger associated with pellagra. Within months, the volunteers developed pellagra—and the pellagra symptoms disappeared when they were fed meat, fresh vegetables, and milk. Goldberger and his researchers also tried to catch the disease from infected inmates, but they were unsuccessful. This conclusive evidence proved Goldberger's theory that pellagra is caused by dietary factors and cannot be transmitted from one person to another.

Due to political and social circumstances, however, Goldberger had difficulty convincing others of this theory. In 1926, he reported that the lack of one of the **B vitamins** was responsible for pellagra, though he was unable to identify the specific vitamin.

B vitamins: a group of vitamins important in cell energy processes

cancer: uncontrolled cell growth

niacin: one of the B vitamins, required for energy production in the cell

Goldberger died of kidney **cancer** in 1929, at the age of fifty-four. In 1937, Conrad Elvehjem at the University of Wisconsin discovered that nicotinic acid, better known as **niacin** (vitamin B_3), prevented and healed pellagra. SEE ALSO PELLAGRA.

Karen Bryla

Bibliography

Akst, Daniel (2001). "Forgotten Plague." *American Heritage*, December/January, 72–79.

Koppman, Lionel (1986). *Guess Who's Jewish in American History*. New York: Steimatzky.

Internet Resources

National Institutes of Health, Museum of Medical Research. "Dr. Joseph Goldberger and the War on Pellagra." Available from <http://www.nih.gov/od/museum>

Science Odyssey. "People and Discoveries: Pellagra Shown to Be a Dietary Disease." Available from <http://www.pbs.9org/wgbh>

Vanderbilt University Medical Center, Eskind Biomedical Library Historical Collection. "Pellagra." Available from <http://www.mc.vanderbilt.edu>

Graham, Sylvester

American reformer
1794–1851

Sylvester Graham, a Presbyterian minister and reformer, is best known for his creation of the Graham cracker. He also put forth the idea that moderation is beneficial, and that certain foods and behaviors are detrimental to both physical and spiritual health. It is not enough to practice moderation in all things, he claimed, because some things are simply not good, either for spiritual or physical reasons, or both. These theories made Graham a central figure in the health reform movement of the 1800s.

Graham was born on July 5, 1794, in West Suffield, Connecticut. His father, the clergyman John Graham, was seventy-two years of age at the time of his birth. Within two years, his father was dead, and Graham was raised by various relatives.

Graham worked as a farm-hand, clerk, and teacher before preparing for the ministry. He married Sarah Earl in 1826. In 1830 he was made general agent for the Pennsylvania Temperance Society, and he began to study human **physiology**, **diet**, and regimen. He then launched himself on a lecture career that took him up and down the Atlantic Coast.

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

diet: the total daily food intake, or the types of foods eaten

He advocated bread at least twelve hours old, made of the whole of the wheat, and coarsely ground. He also recommended hard mattresses, open bedroom windows, cold shower baths, loose and light clothing, daily exercise, vegetables and fruits, rough (whole-grain) cereals, pure drinking water, and cheerfulness at meals. He taught that temperance included both physical and moral reform.

In 1832, Graham edited Luigi Cornaro's *Discourse on a Sober and Temperate Life*. This discourse was translated into many languages and first published in the United States in 1788, after which it went through at least twelve editions. Cornaro wrote of three social evils: adulation and ceremony, heresy, and intemperance. Intemperance was, to Cornaro, the principal vice, and he wrote that a person should choose "to live in accordance with the simplicity of nature, to be satisfied with very little, to follow the ways of holy self-control and divine reason, and to accustom himself to eat nothing but that which is necessary to sustain life."

In 1837, Sylvester Graham wrote his *Treatise on Bread and Bread Making*, which advocated the use of Graham flour, made from coarsely ground whole-wheat kernels, and instructed wives to bake their own bread. Perhaps as a result of his impact on their business, which was reduced by the making of homemade bread, he was attacked by a mob of bakers. Meanwhile, Graham flour showed up in barrels and Graham boarding houses sprang up to minister to the new demands.

Graham influenced others to take up the cause of health reform. John Harvey Kellogg, while working as an apprentice typesetter, was exposed to a compilation of articles on health, including Graham's *Health, or How to Live*, a series of six pamphlets published by the Seventh-day Adventist Church, and he became intensely interested in Graham's dietetic and sanitary reforms. In his spare moments Kellogg read all of Graham's writings. Ralph Waldo Emerson made reference to Sylvester Graham as the "poet of bran and pumpkins." Graham died in 1851.

Louise E. Schneider

Bibliography

Sabate, Joan (2001). *Vegetarian Nutrition.* Boca Raton, FL: CRC Press.

Schwartz, Richard W. (1970). *John Harvey Kellogg, MD.* Nashville, TN: Southern Publishing Association.

Shryock, Richard H. (1931). "Sylvester Graham and the Popular Health Movement, 1830–1870." *Mississippi Valley Historical Review* XVIII:172–183.

Whorton, James C. (1987). "Traditions of Folk Medicine." *Journal of the Medical Association* 257:1632–1640.

Grazing

The term grazing is used to describe the eating of small, frequent meals, or mini-meals, throughout the day, typically every three to four hours. Grazing does not mean constantly eating snack foods, but rather is a concept of

consuming one's daily food intake, including all necessary **nutrients**, over five or six (or more) small meals, rather than two or three large ones. Frequent eating can be a great way to maintain one's **energy** level. This is also a beneficial eating pattern for individuals with **gastrointestinal** problems such as **indigestion** and **acid reflux**. Without a focus on healthy choices, however, grazing can become an easy way to overeat, and could possibly lead to weight gain. SEE ALSO DIETARY TRENDS, AMERICAN; EATING HABITS.

Susan Mitchell

nutrient: dietary substance necessary for health

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

gastrointestinal: related to the stomach and intestines

indigestion: reduced ability to digest food

acid reflux: splashing of stomach acid into the throat

Internet Resource

American Dietetic Association. <http://www.eatright.org>

Greeks and Middle Easterners, Diet of

The "Mediterranean **diet**" gained much recognition and worldwide interest in the 1990s as a model for healthful eating habits. The diet is based on the traditional dietary patterns of Crete, a Greek island, and other parts of Greece and southern Italy. The diet has become a popular area of study due to observations made in 1960 of low incidences of **chronic** disease and high life-expectancy rates attributed to the populations who consumed a traditional Mediterranean diet. This healthful diet model goes far beyond the use of particular ingredients and recipes. It attains its full meaning in the context of climate, geography, customs, and the way of life of Mediterranean peoples.

diet: the total daily food intake, or the types of foods eaten

chronic: over a long period

The Mediterranean Basin

In efforts to understand the Mediterranean diet, it is necessary to first learn about the many countries that border the Mediterranean Sea. The diet is closely tied geographically to areas of olive oil cultivation in the Mediterranean Basin. It can be defined by diets of the early 1960s in Greece, southern Italy and other Mediterranean regions in which olive oil was the principal source of dietary **fat**. The olive remains the most typical Mediterranean tree because it has adapted to the regional climate of long, very hot, dry summers and mild, damp winters.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

The lands surrounding the Mediterranean Sea contain some of the oldest cultures on Earth. Greece, as well as other countries of Europe, North Africa, and some Middle Eastern nations, played a central role in the expansion of empires and cross-cultural exchanges over the centuries. Over 2,000 years ago trade by means of sea routes allowed Greek, Roman, Phoenician, Carthaginian, Arab, and Oriental products and traditions to intermix, resulting in mutual enrichment and an evolution of what is now incorporated into the Mediterranean diet. However, many different diets exist throughout the Mediterranean region, and there is no such thing as just one Mediterranean diet. Variations of this diet have traditionally existed in the North African countries of Morocco and Tunisia, parts of Turkey, and other Middle Eastern countries such as Lebanon and Syria.

Traditional Eating Habits

Traditional eating habits of Mediterranean countries, and those countries along the basin, include olives, fish, lamb, wheat, rice, chick peas and other

In ancient times, sea trade brought many of the world's cultural and culinary achievements to the nations around the Mediterranean Sea. More recently, the Mediterranean diet—which features low-cholesterol foods such as vegetables and fish, and includes very little meat—has been recognized as one of the world's healthiest. *[Photograph by Annebicque Bernard. Corbis. Reproduced by permission.]*

legumes, pistachios, dates, cheese, and yogurt. Bread typically accompanies each meal.

Traditional food consumption includes the following:

- *Dairy products.* Most dairy products are eaten in fermented forms, such as yogurt and cheese. Whole milk is used in desserts and puddings. Feta cheese, traditionally made of sheep or goat's milk, is the most commonly consumed cheese.
- *Meats.* Lamb is the most widely eaten meat. Pork is eaten only by Christians, not by Muslims or Jews. Many Middle Easterners will not combine dairy products or shellfish with the meal. Kosher beef, kosher poultry, lox (brine-cured cold-smoked salmon, much of which is slightly saltier than other smoked salmon), and sardines are also common foods. Legumes such as black beans, chick peas (garbanzo beans), lentils, navy beans, fava beans, and red beans are used in many dishes.
- *Breads and Cereals.* Some form of wheat or rice accompanies each meal. Pita and matzoh (unleavened bread) are common. Filo dough, which is used to make baklava, is also used in many dishes.
- *Fruits.* Fruits tend to be eaten as dessert or as snacks. Fresh fruit is preferred. Fruits made into jams and compotes (a cooked preparation of fruit in syrup) are eaten if fresh fruit is not available. Lemons and concentrated lemon juice are commonly used for flavoring.

legumes: beans, peas, and related plants

- *Vegetables.* Potatoes and eggplant are the most commonly consumed vegetables. Fruit and vegetables are preferred raw or mixed in a salad. Vegetables are often stuffed with rice or meats. Green and black olives are present in many dishes, and olive oil is most frequently used in food preparation.

Food Preparation and Storage

Grilling, frying, grinding, and stewing are the most common ways of preparing meats in countries bordering the Mediterranean Basin. A whole, roasted lamb or leg of lamb is a special dish prepared for festive gatherings. Spices and seasonings are essential in the preparation of Middle Eastern dishes. Common spices and herbs include dill, garlic, mint, cinnamon, oregano, parsley, leek, and pepper.

Many Middle Eastern nations, such as Turkey, Syria, and Lebanon, have predominantly Muslim populations. Eating *halal* is obligatory for every Muslim. *Halal* is an Arabic word meaning "lawful" or "permitted," and refers to Islamic law regarding the diet. Animals such as cows, sheep, goats, deer, moose, chickens, ducks, and game birds are *halal*, but they must be *zabihah* (slaughtered according to Islamic method) in order to be suitable for consumption. Halal foods are those that are:

- Free from any component or ingredient taken or extracted from an unlawful animal or ingredient that Muslims are prohibited from consuming.
- Processed, manufactured, prepared, or stored with apparatus, equipment and/or machinery that has been cleansed according to Islamic law.
- Free from contamination when prepared or processed with anything considered unclean.

Present-Day Eating Habits

Today, the Mediterranean region is characterized by a high increase in modernization. The traditional diet of the Mediterranean region has been affected by modernization, particularly in the area of agricultural production for trade. The countries of North Africa and the Middle East struggle the most with modernization problems. This has led to an increase in the dependence on costly food imports from outside the region. While the Greek economy remains rooted in agriculture and the government places a strong emphasis on agricultural reforms, Middle Eastern nations face constraints such as high rates of urbanization, leading to the loss of vital agricultural land.

Modernization has created significant changes in food consumption patterns in the countries of the Mediterranean region. The factors affecting the traditional dietary customs of the region are economy, environment, society and culture, disasters (e.g., war, drought), the expansion of food industries, and advertising campaigns promoting certain foods (e.g., soda, candy bars). **Fast-food** restaurant chains are also altering traditional diets. The expansion of fast food has resulted in the population consuming **processed foods** such as sweets and snack foods, which were never a part of their nutritional sustenance.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Halal food products	Food products not halal
Milk (from cows, sheep, camels, and goats)	Pork and pork by-products
Honey	Animals improperly slaughtered or dead before slaughtering
Fish	Animals killed in the name of anyone other than Allah (God)
Plants that are not an intoxicant	Alcohol and intoxicants
Fresh or naturally frozen vegetables	Carnivorous animals, birds of prey, and land animals without external ears
Fresh or dried fruits	Blood and blood by-products
Legumes and nuts such as peanuts, cashew nuts, pistachios, hazelnuts, and walnuts	Foods contaminated with any of the above products
Grains such as wheat, rice, rye, barley, and oats	

SOURCE: Adapted from <http://www.ifanca.org/halal.htm>

Culture

Mediterranean and Middle Eastern culture is centered on a strong patriarchal family. This has lessened in recent years, but family ties are still strong. Customs and family traditions influence **nutrition** greatly.

nutrition: the maintenance of health through proper eating, or the study of same

Food is an integral part of family celebrations, special days of honor, and festivals. In the Middle Eastern nation of Israel, kosher dietary laws concerning the selection, preparation, and eating of food remains influential in Jewish life. The Jewish laws of *kashrut*, or keeping kosher, determines which foods are kosher and which are non-kosher. Many ancient practices and **rituals**, handed down from generation to generation, are observed.

ritual: ceremony or frequently repeated behavior

Many people from Mediterranean and Middle Eastern cultures observe Islam and Eastern Orthodox religions, which influence the kinds of food chosen and how the foods are combined. Fasting from sunrise to sunset is a Muslim religious obligation practiced during the sacred month of Ramadan. Muslims do not eat any form of pork, or any meat that has been slaughtered without mentioning God's name. Muslims cannot drink alcoholic beverages or foods flavored with alcohol—which differs from Greek and other Mediterranean cultures, where wine is a large part of the diet. Middle Easterners also have a high incidence of **lactose intolerance**, and therefore fresh milk is not widely consumed.

lactose intolerance: inability to digest lactose, or milk sugar

Nutrition and Disease

The wide use of olive oil in food preparation throughout the Mediterranean region contributes to a diet high in monounsaturated **fatty acids** and cultures commonly known for lower **blood pressure** among their populations. Recent research has produced scientific proof that a Mediterranean diet (which includes olive oil) is not only generally healthful, but that consuming olive oil can actually help lower harmful low density lipoprotein (LDL) **cholesterol** (often referred to as "bad" cholesterol). Olive oil contains **antioxidants** that discourage **artery** clogging and chronic diseases, including **cancer**.

fatty acids: molecules rich in carbon and hydrogen; a component of fats

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

artery: blood vessel that carries blood away from the heart toward the body tissues

cancer: uncontrolled cell growth

The Mediterranean diet offers a practical and effective strategy that is relatively easy to adopt and more likely to be successful over the long term than most heart-healthy nutrition plans. In April 2001, the American Heart Association (AHA) published a science advisory stating that some components

of the Mediterranean diet may be beneficial when used in conjunction with the association's traditional diets for the prevention and treatment of **cardiovascular** disease.

cardiovascular: related to the heart and circulatory system

In the Mediterranean diet, not all fat is regarded as bad, however. In fact, the focus of the diet is not to limit total fat consumption, but rather to make wise choices about the type of fat in the diet. The Mediterranean diet is low in **saturated fat**, which is found mostly in meat and dairy products, vegetable oils such as coconut and palm oils (tropical oils), and butter. The diet views two types of protective fats, omega-3 fatty acids and monounsaturated fats, as healthful and places no restrictions on their consumption. Omega-3 fatty acids are found in fatty fish (e.g., sardines, salmon, tuna) and in some plant sources (e.g., pistachios, walnuts and other tree nuts, flaxseed, various vegetables). Monounsaturated fat is abundant in olive oil, nuts, and avocados.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

Because the Mediterranean diet emphasizes eating whole, natural foods, it is extremely low in **trans-fatty acids**, which are increasingly recognized as important contributors to **heart disease**. These fats are found in hard margarine and deep-fried and processed snacks and food, including fast food and commercially baked products. They are similar to saturated fats and are known to raise levels of LDL cholesterol. Eating a diet incorporating the traditional foods of the Mediterranean, such as a variety of fruits and vegetables, has been shown to decrease the risk of heart disease. Five important dietary factors may contribute to the cardioprotective effect of this eating pattern. These are the inclusion of fish rich in omega-3 fatty acids, olive oil, nuts, and moderate amounts of alcohol, and the exclusion of trans-fatty acids.

trans-fatty acids: type of fat thought to increase the risk of heart disease

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Conclusion

Many common characteristics exist among the countries along the Mediterranean Basin, but each country has adapted to the geography and developed its own customs. The common core, however, can be seen in the diets of these countries. It is important to remember that the Mediterranean diet emphasizes eating whole, unprocessed foods that are extremely low in harmful LDL cholesterol. Recent studies indicate that the use of natural, monounsaturated oils such as olive oil, a balanced intake of vegetables and fish, and a low intake of red meats provides a natural defense against cardiovascular disease. Although more research is needed, the Mediterranean way of eating is potentially an ideal diet to improve the health of people by warding off illnesses.

Mohammed-Reza Forouzesh

Bibliography

Achterberg, Cheryl L.; McKenzie, J.; and Arosemena, F. (1996). *Multicultural Pyramid Packet*, Vol. 1. University Park, PA: Penn State Nutrition Center, College of Health and Human Development, Pennsylvania State University.

Giugliano, Dario; Sedge, Michael; and Sepe, Joseph (2000). *The Mediterranean Diet: Its Origins and Myths.* Reddick, FL: Idelson-Gnocchi.

Haber, B. (1997). "The Mediterranean Diet: A View from History." *American Journal of Clinical Nutrition* 66:1053S–1057S.

Keys, A. (1980). *Seven Countries: A Multivariate Analysis of Death and Coronary Heart Disease.* Cambridge, MA: Harvard University Press.

Osbourne, C. (1988). *Middle Eastern Food and Drink.* New York: Bookwright Press.

Rimm, E. B., and Ellison, R. C. (1995). "Alcohol in the Mediterranean Diet." *American Journal of Clinical Nutrition* 61:1378S–1382S.

Simopoulos, A. P., and Visoli, F. (2000). "Mediterranean Diets." In *World Review of Nutrition and Dietetics*, Vol. 87. Switzerland: Karger Publishers.

Spiller, G. A., and Bruce, B. (2002). *The Mediterranean Diet: Constituents and Health Promotion.* Boca Raton, FL: CRC Press.

Internet Resources

Curtis, B. M, and O'Keefe, J. H. Jr. (2002). "Understanding the Mediterranean Diet." *Post Graduate Medicine* 112(2). Available from <http:www.postgradmed.com>

"Health Benefits of Olive Oil and the Mediterranean Diet." Available from <http://www.mediterraneandiet.gr>

Islamic Food and Nutrition Council of America. "What Is Halal?" Available from <http://www.ifanca.org/halal.htm>

Islamic Halal Food Monitor of Canada. "A Brief Look at Dietary Laws for Muslims." Available from <http://www.eat-halal.com>

Oldways Preservation and Exchange Trust. "The Mediterranean Diet Pyramid." Available from <http://www.oldwayspt.org>

Nolan, J. E. "Cultural Diversity: Eating in America—Middle Eastern." Available from <http://ohioline.osu.edu>

The Green Revolution

The Green Revolution (GR) refers to the use of high-yield variety (HYV) seeds, which were invented by the crop geneticist Norman Borlaugh. HYVs are normally used as a part of a technological package that also includes biochemical inputs such as water, fertilizers, and pesticides, and often mechanical inputs. The GR, which started in the 1960s, is the last of the four agricultural revolutions in the world. It has been used in more than one hundred poor countries and has made possible a "revolutionary" increase in food production. The origin of the Green Revolution can be traced to the early twentieth century and the Malthusian fear that world food production would eventually fail to feed the growing population. This would result in a "red revolution" by the hungry. The implications of the GR for agrarian change, and especially for smaller farmers and laborers, have been widely debated.

Some scholars argue that since HYVs produce more food per acre, they have land-augmenting effects, and thus benefit smaller landholders. However, GR inputs are expensive, and smaller owners cannot make appropriate investments to increase output and reduce production costs as larger farmers can. So they incur losses and go into debt, which they have to clear up by selling their land. This is the classic mechanism of agrarian change from below. Larger landowners also lease land from smaller ones, who cannot afford to buy the inputs, causing "reverse tenancy" and an increased concentration of operational (as opposed to owned) land. Also, as cultivation with the use of hired labor and HYVs becomes more profitable, erstwhile landlords often evict their tenants, enhancing proletarianization and encouraging agrarian capitalism.

HYVs mature sooner than traditional seed varieties, and thus allow multiple cropping, increasing the demand for labor per acre. This increased food production leads to increased demand for harvesting, threshing, and

post-harvest labor (e.g., for food processing), and creates the possibility for increased wages in GR areas. However, multiple cropping encourages capitalist farmers to resort to mechanization in order to complete farm operations on time, and this can erode employment opportunities.

The GR has also been shown to have increased regional disparity between wealthier, irrigated areas and poorer drier areas, and to have caused **ecological** problems such as water depletion and toxicity.

ecological: related to the environment and human interactions with it

Raju Das

Bibliography

Das, Raju J. (2002). "The Green Revolution and Poverty: A Theoretical and Empirical Examination of the Relation Between Technology and Society." *Geoforum* 33(1):55–72.

Lipton, Michael. (1989). *New Seeds and Poor People.* Baltimore: Johns Hopkins University Press.

Shiva, Vandana (1991). *The Violence of the Green Revolution: Third World Agriculture, Ecology, and Politics.* London: Zed Books.

Growth Charts

Growth charts are used by pediatricians, dietitians, nurses, and parents to assess the growth of infants, children, and adolescents. In the United States, growth charts are created by the Centers for Disease Control and Prevention (CDC) and assess weight, height, and **body mass index** (BMI). Each chart consists of a series of percentile curves that are used to compare the body measurements of children to others their age and gender. For example, a five-year-old girl whose weight falls in the 25th percentile weighs the same as or more than 25 percent of other five-year-old girls—and less than 75 percent of other five-year-old girls.

body mass index: weight in kilograms divided by square of the height in meters times 100; a measure of body fat

Amy N. Marlow

Growth Hormone

Human growth hormone (HGH) stimulates the growth of bones and affects the **metabolism** of **carbohydrate**, **protein**, and **fat**. It is secreted by the **pituitary gland**, which is located in the brain. Whereas HGH is produced in the body, genetic engineering has resulted in the development of recombinant human growth hormone (rHGH), which is used to treat stunted growth in children. Bovine somatotropin (BST) is a naturally occurring protein hormone in cows that increases milk production when administered as a supplement. BST is not biologically active in humans and is broken down into inactive **amino acids** and peptides when consumed. Therefore, milk from cows treated with BST is believed to be as safe and nutritious as milk from untreated cows.

metabolism: the sum total of reactions in a cell or an organism

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fat: type of food molecule rich in carbon and hydrogen, with high energy content

pituitary gland: gland at the base of the brain that regulates multiple body processes

amino acid: building block of proteins, necessary dietary nutrient

Supplemental HGH is used by athletes, particularly body builders and power lifters, to increase muscle mass and decrease body fat. Individuals who are HGH-deficient and take supplemental HGH will see an increase in muscle mass and decreased body fat, whereas those with normal HGH levels will see an increase in lean body mass from an increase in the size of heart,

liver, and kidneys, and from fluid retention, but there will be no increase in muscle mass. Excessive use can cause acromegaly (an increase in the size of the bones of the hand, feet, and jaw), as well as muscle weakness, **arthritis**, impotence, and **diabetes**. Since HGH increases the size of the liver, kidneys, and heart, its use can predispose the individual to **chronic** diseases. HGH is classified as an **anabolic** hormone, and its ability to increase muscle and decrease fat confers an unfair athletic advantage on the user. The use of HGH is thus banned by the International Olympic Committee (IOC), the National Collegiate Athletic Association (NCAA), and many professional sporting organizations. SEE ALSO ERGOGENIC ACIDS; SPORTS NUTRITION.

Leslie Bonci

arthritis: inflammation of the joints

diabetes: inability to regulate level of sugar in the blood

chronic: over a long period

anabolic: promoting building up

Bibliography

Rosenbloom, Christine, ed. (2000). *Sports Nutrition: A Guide for the Professional Working with Active People*, 3rd edition. Chicago: American Dietetic Association.

Williams, M. (1998). *The Ergogenics Edge.* Champaign, IL: Human Kinetics.

Health

H

Health is a measure of quality of life that is difficult to define and measure. In the 1940s, the World Health Organization (WHO) defined health as a "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." At the first International Conference on Health Promotion in Ottawa, Canada (1986), the Ottawa Charter for Health Promotion built on the WHO's concept and further defined health as "a resource for everyday life ... a positive concept emphasizing social and personal resources, as well as physical capabilities." Good health enables one to function independently within a changing environment. SEE ALSO HEALTH COMMUNICATION; HEALTH EDUCATION; HEALTH PROMOTION; HEALTHY PEOPLE 2000 REPORT.

Delores C. S. James

Bibliography

World Health Organization (1948). *Official Records of the World Health Organization, No 2: Proceedings and Final Acts of the International Health Conference Held in New York from 19 June to 22 July 1946.* New York: United Nations, WHO Interim Commission.

Internet Resource

World Health Organization (1986). *Ottawa Charter for Health Promotion.* Available from <http://www.who.int/hpr>

Health Claims

As part of the Nutrition Labeling and Education Act of 1990 (NLEA), the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA) implemented regulations defining what terms may be used to describe the level of a **nutrient** in a food, as well as what claims could be made about the relationship between a nutrient or a food and the risk of a disease or health-related condition. Prior to the implementation of

nutrient: dietary substance necessary for health

these regulations, there were no guidelines for food manufacturers to use when making statements about the nutritional value of a food product. Consequently, consumers had difficulty comparing foods based solely on the nutritional content of the products. The NLEA served to level the playing field for manufacturers of nutritionally focused food products by providing a consistent definition of claims to assist consumers when shopping for food products.

Nutrient Content Claims

calcium: mineral essential for bones and teeth

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

fiber: indigestible plant material that aids digestion by providing bulk

calorie: unit of food energy

Nutrient content claims, such as "high in **calcium**" or "lite," are a form of advertising used to highlight the levels of key nutrients, **cholesterol**, **fiber**, or **calories** in the products being labeled. The claim is usually placed on the front side of the package so it is visible to the shopper wanting to make quick comparisons among food products. As a result of NLEA, the FDA strictly regulates nutrient content claims. The regulations spell out which nutrient content claims are allowed and under what circumstances they can be used. There are eleven core terms: "free," "low," "lean," "extra lean," "high," "good source," "reduced," "less," "light," "fewer," and "more." In addition, there is a multitude of synonyms that may be used for each of these terms.

"Healthy"

fat: type of food molecule rich in carbon and hydrogen, with high energy content

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

iron: nutrient needed for red blood cell formation

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Food labeling regulations allow manufacturers to make a "healthy" claim on the label. Due to the types of foods that are regulated by each agency, however, the FDA's definition of "healthy" is different from the USDA's definition. Under the FDA, "healthy" may be used if the food is low in **fat** and **saturated fat** and has a limited amount of sodium and cholesterol. In addition, single-item foods must provide at least 10 percent of one or more of vitamin A, vitamin C, **iron**, calcium, **protein**, and fiber. Raw, canned, or frozen fruits and vegetables and certain cereal-grain products do not necessarily need to meet this criteria. These foods can be labeled "healthy" if they do not contain ingredients that change the nutritional profile and, in the case of enriched grain products, if they conform to the standards of identity, which call for certain required ingredients (**vitamins**, **minerals**, protein, or fiber). Meal-type products (those large enough to be considered a meal [6 ounces]) must provide 10 percent of the Daily Value of two or three of these ingredients, in addition to meeting the other criteria. The sodium content cannot exceed 360 mg (milligrams) for individual foods and 480 mg for meal-type foods.

Health Claims

Health claims describe a relationship between a food substance and a disease or health-related condition. Due to the nature of such claims and the complexity of the science upon which such claims are made, the FDA carefully regulates health claims. Under the provisions of NLEA, the FDA has approved twelve specific health claims, and also provided a framework for additional specific claims to be approved as nutritional science evolves. Since NLEA, other processes have been established that allow food manufacturers a more efficient process to obtain approval for making a health claim. The Food and Drug Administration Modernization Act (FDAMA) was passed in 1997. Under FDAMA, upon successful submission of a "notification," a health claim may be made for a food based on an authoritative state-

NUTRIENT CONTENT CLAIMS

Claim	Definition	Nutrient
"Free"	No amount of or only trivial amounts.	Fat Saturated Fat Cholesterol Sodium Sugars Calories
"Very Low"	Not an overall definition.	Sodium
"Low"	May be used on foods that can be eaten frequently without exceeding dietary guidelines. Amount varies depending on the nutrient.	Fat Saturated Fat Sodium Cholesterol Calorie
"Lean" and "Extra Lean"	Used to describe fat in meat, poultry, seafood, and game meats.	Fat
"High"	May be used if the food contains 20% or more of the Daily Value per serving.	Vitamins and Minerals Dietary Fiber Protein
"Good Source"	May be used if the food contains 10% to 19% of the Daily Value per serving.	Vitamins and Minerals Dietary Fiber Protein
"Reduced"	Nutritionally altered to contain at least 25% less of a nutrient, or of calories, than the reference food. Reduced claim cannot be made if it is already labeled low.	Fat Saturated Fat Sodium Cholesterol Calorie
"Less"	Contains 25% less of a nutrient, or of calories, than the reference food.	Fat Saturated Fat Sodium Cholesterol Calorie
"Light"	One-third fewer calories, or half the fat, of the reference food. If the food derives 50% or more of calories from fat, the reduction must be 50%.	Calories Fat
"Light in Sodium"	Sodium has been reduced by at least 50%.	Sodium
"More"	Contains at least 10% of the Daily Value of the nutrient present in reference food. "Fortified," "enriched," "added," "extra," and "plus" are all synonyms of "more."	Vitamins and Minerals Dietary Fiber Protein

ment of a scientific body of the U.S. government or the National Academy of Sciences. The passage of this law has provided an opportunity for additional health claims, and for food manufacturers to efficiently communicate to consumers information about the relationship between foods and health.

General requirements for making a health claim. All products carrying a health claim must meet general requirements for levels of nutrients that may be associated with the risk of **chronic** disease. Food products with high levels of total fat, saturated fat, cholesterol, or sodium are not allowed to make a health claim. For individual foods, these levels are 13 grams of fat, 4 grams of saturated fat, 60 mg of cholesterol, and 480 mg of sodium per standardized serving. For meal products, the levels are 26 grams of fat, 8 grams of saturated fat, 120 mg of cholesterol, and 960 mg of sodium per label serving size. The levels for a main dish product are 19.5 grams of fat, 6 grams of saturated fat, 90 mg of cholesterol, and 720 mg of sodium per label serving size.

chronic: over a long period

Types of health claims. Health claims can be made through third-party references (such as the National Cancer Institute), statements, symbols (such as a heart), and vignettes or descriptions. In all cases, the claim must meet

the requirements for authorized health claims. The claim cannot state the degree of risk reduction and can only use "may" or "might" in discussing the food–disease relationship and it must indicate other factors that play a role in the specified disease. The claim must also be presented in relationship to the overall **diet**. For example, it might say: "While many factors affect **heart disease**, diets low in saturated fat and cholesterol may reduce the risk of this disease."

diet: the total daily food intake, or the types of foods eaten

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Nutrition is a dynamic science. FDA and USDA food-labeling regulations are designed to be flexible enough to evolve with the science, yet they also provide the consistency consumers need to make sound food choices in the supermarket. Through NLEA, food manufacturers have an equal opportunity by which to market food products. Additionally, consumers have credible food labels so they make informed food choices based on the nutritional attributes of a food product. SEE ALSO FOOD LABELS; REGULATORY LABELS.

Karen Hare

Health Communication

Health communication is the discipline that studies and develops appropriate communication strategies to inform individuals and communities about ways to enhance health. It is used at all levels of disease prevention and health promotion and can contribute to improving health and delaying disease, disability, and death. Health communication can be used to: (1) improve patient-provider relationships, (2) assist individuals to search for and use reputable health information and services, (3) enable individuals to adhere to provider recommendations, (4) develop and evaluate public health messages and campaigns, (5) assess health images in the media, (6) and distribute information to those at risk. SEE ALSO HEALTH; HEALTH EDUCATION; HEALTH PROMOTION.

Delores C. S. James

Bibliography

U.S. Department of Health and Human Services (2000). *Healthy People 2010, Conference Edition, in Two Volumes.* Washington, DC: U.S. Public Health Service.

Health Education

Health education is the discipline dedicated to designing, implementing, and evaluating health programs and materials that improve the health of individuals, families, and communities. Health education is one of the tools of health promotion. A goal of health education is to provide individuals with the knowledge, skills, and motivation to make healthier **lifestyle** choices. Health education takes place in a variety of settings, such as schools; health care facilities; businesses; nonprofit organizations; and local, state, and federal health agencies. A certified health education specialist (CHES) is a person who has met the standards of competence established by the National Commission for Health Education Credentialing and has successfully passed the CHES examination. SEE ALSO HEALTH; HEALTH COMMUNICATION; HEALTH PROMOTION.

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

Delores C. S. James

Internet Resource

National Commission for Health Education Credentialing. "What Is a Certified Health Education Specialist?" Available from <http://www.nchec.org>

Health Promotion

Achieving optimal health is not the sole responsibility of the individual. Health promotion enables individuals to improve their health and delay disease, disability, and death. Health-promoting activities include healthful eating, adequate physical activity, **stress** management, not smoking, and adequate sleep. On a societal level, health promotion focuses on achieving equity in health among all ethnic and socioeconomic groups. Health disparities can be reduced or eliminated by providing culturally relevant health information, programs, and services; improving access to health care; creating public policy that promotes health; creating healthy environments; and providing other opportunities for making healthy choices. SEE ALSO HEALTH; HEALTH COMMUNICATION; HEALTH EDUCATION.

stress: heightened state of nervousness or unease

Delores C. S. James

Internet Resource

World Health Organization (1986). *Ottawa Charter for Health Promotion.* Available from <http://www.who.int/hpr>

Healthy Eating Index

Nutrition plays a vital role in the prevention of **chronic** diseases such as **coronary heart disease**, **hypertension**, and **diabetes**. The Healthy Eating Index (HEI) is a measure of the overall quality of an individual's **diet**. It was developed by the U.S. Department of Agriculture (USDA) to assess how well American diets comply with the *2000 Dietary Guidelines for Americans* and the *Food Guide Pyramid.*

nutrition: the maintenance of health through proper eating, or the study of same

chronic: over a long period

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

hypertension: high blood pressure

diabetes: inability to regulate level of sugar in the blood

diet: the total daily food intake, or the types of foods eaten

The HEI measures the intake of ten dietary components to provide a single score out of a possible 100 points. A diet with a score greater than 80 is considered "good," one with a score of 51-80 is considered "fair," and one with a score of less than 51 is considered "poor." Each component contributes equally to the overall score.

Components 1–5 assess how well an individual's diet complies with the *Food Guide Pyramid* serving recommendations for the Grain, Vegetable, Fruit, Milk, and Meat Groups. Recommended servings for each food group are calculated based on diets containing 1,600, 2,200, and 2,800 **calories** per day. Components 1–5 have a maximum of 50 points, with 10 coming from each food group. A score of zero is assigned to a group if no items from that category are consumed. Intermediate scores are calculated proportionately to the number of servings consumed.

calorie: unit of food energy

Component 6 assesses total **fat** consumption as a percentage of total caloric intake. Ten points are given if fat intakes are less than or equal to 30 percent of total calories. Zero points are given if the proportion of fat

fat: type of food molecule rich in carbon and hydrogen, with high energy content

By applying the Healthy Eating Index (HEI) to data gathered by various consumer surveys, the USDA is able to assess the quality of Americans' diets. Recent HEI results suggest that Americans need to eat more fruit. *[Royalty-Free/Corbis. Reproduced by permission.]*

to total calories is 45 percent or higher. Intakes between 30 percent and 45 percent are scored proportionately.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

Component 7 assesses **saturated fat** consumption as a percentage of total caloric intake. Ten points are given to saturated fat intakes of 10 percent or less of total calories. Zero points are given if the saturated fat intake is 15 percent or more of total calories. Scores between the two cutoff values are calculated proportionately.

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

Component 8 assesses total **cholesterol** intake. It is recommended that individuals consume no more than 300 milligrams of cholesterol daily. Ten points are given if cholesterol intake is less than or equal to 300 milligrams. Zero points are given when intake reaches 450 milligrams or more. Values between the two cutoff points are scored proportionately.

Component 9 assesses total sodium intake. Individuals should ideally consume no more than 2,400 milligrams of sodium daily. Ten points are given at an intake level of 2,400 milligrams or less. Zero points are given at a level of 4,800 milligrams or more. Scores between the two levels of intake are scored proportionately.

Component 10 assesses variety in the diet. While there is agreement that individuals should eat a variety of foods daily, there is no consensus of how to measure variety. The HEI measures variety by adding together the number of "different" foods eaten in amounts sufficient to contribute at least one-half of a serving in a food group. Ten points are given if at least half a serving of eight or more different types of food items are eaten daily. Zero points are given if at least half a serving of three or fewer different foods were eaten in a day. Intermediate intakes are calculated proportionately.

The USDA periodically applies the HEI to data from the national food consumption surveys. The most recent HEI uses data from the National

Health and Nutrition Examination Survey (NHANES). Previous data were based on the Continuing Survey of Food Intakes by Individuals (CSFII). Current data are based on 24-hour dietary recalls of representative samples. The HEI is computed for Americans two years of age and older. The findings indicated that:

- HEI scores have improved slightly since 1989, but did not change significantly from 1996 to 2000.
- The mean HEI score for 1999-2000 was 63.8.
- Most Americans need to improve their diet, especially in the Fruit Group and Milk Group.
- HEI scores improved with education.
- HEI is only modestly affected by income.
- Non-Hispanic blacks, low-income groups, and those with a high school diploma (or less education) had lower-quality diets.
- Women tend to have higher scores than men.

The HEI is a practical tool for assessing dietary quality, and results from the index can provide insights on how to improve eating patterns. Different strategies need to be developed to reach different segments of the population. The USDA Center for Nutrition and Public Policy has developed an interactive, self-assessment version of the Healthy Eating Index, which can be found on its Web site. SEE ALSO DIETARY GUIDELINES FOR AMERICANS; FOOD GUIDE PYRAMID.

Delores C. S. James

Bibliography

Basiotis, P.; Carlson, A.; Gerrior, S.; Juan, W.; and Lino, M. (2002). *The Healthy Eating Index 1999–2000.* Washington, DC: U.S. Department of Agriculture.

U.S. Department of Health and Human Services (2000). *Healthy People 2010, Conference Edition, in Two Volumes.* Washington, DC: U.S. Public Health Service.

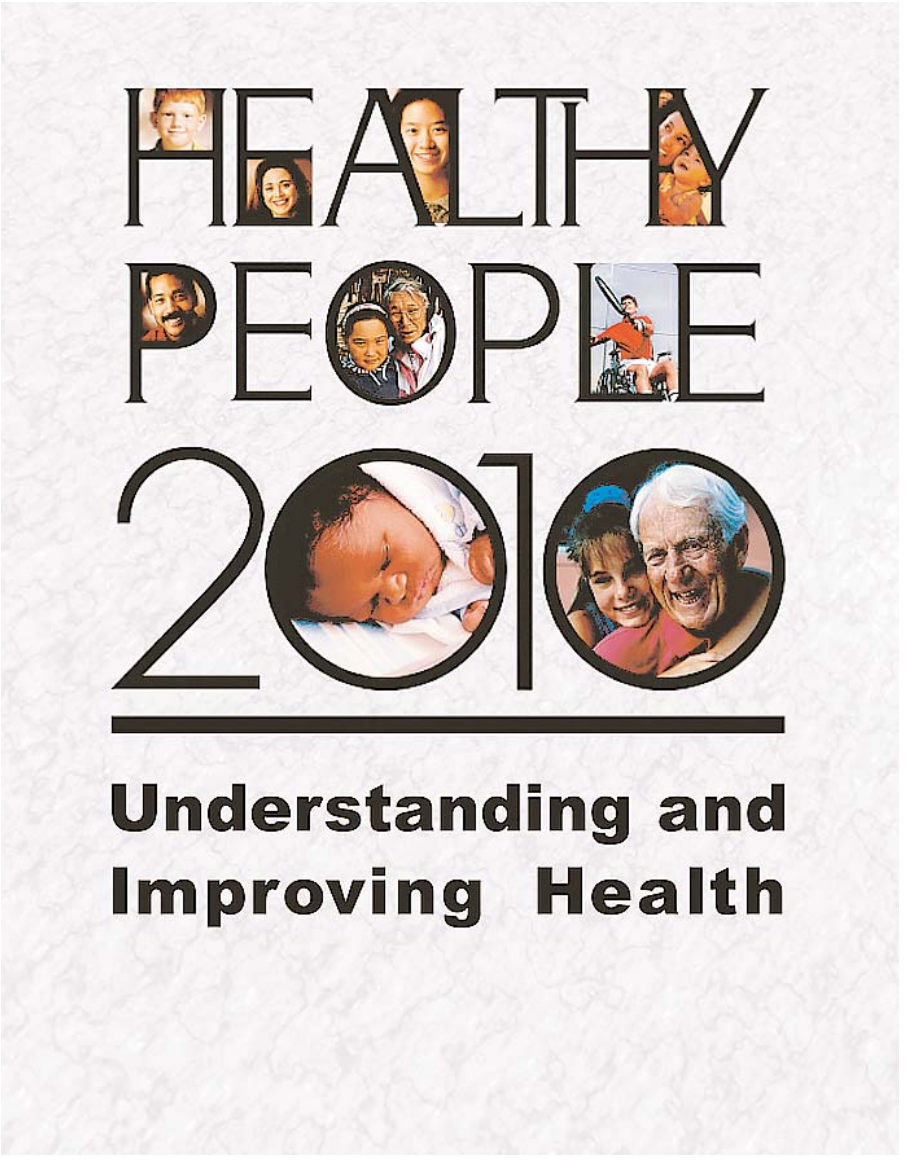
Internet Resources

Center for Nutrition and Public Policy. "The Interactive Healthy Eating Index." Available from <http://147.208.9.133/default.asp>

U.S. Department of Agriculture. "The Healthy Eating Index." Available from <http://www.nalusda.gov/fnic>

Healthy People 2010 Report

In the mid-1970s, the United States government began to focus on national health issues, particularly disease prevention and health promotion. The first document to focus on the nation's health was the *Report of the President's Committee on Health Education* (1973). This was followed by the enactment of the *National Consumer Health Information and Health Promotion Act of 1976*, which created the *Office of Disease Prevention and Health Promotion.* In 1979, this office produced the first Healthy People report, *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*, which focused on reducing mortality rates and increasing independence among older adults.



Healthy People 2010 describes ten leading health indicators (LHIs) that reflect important health concerns for U.S. citizens. The LHIs, which include physical activity, mental health, and substance abuse, among others, are accompanied by a set of objectives designed to improve Americans' health. *[I.Q. Solutions. Reproduced by permission.]*

In 1990, *Healthy People 2000* was published. This report contained twenty-two priority areas and 319 health objectives to be achieved by the year 2000. The overall goals were to increase years of healthy life, reduce health disparities, and improve access to preventive health services. These goals were set partly on the basis of the original 1979 goals, as well as to address the health of high-risk populations, racial and ethnic disparities, and to involve more community organizations in formulating the objectives.

While the nation has achieved many of the *Healthy People 2000* objectives, such as reducing mortality rates, reducing unintentional injuries, and increasing immunization rates, other health issues became more critical between 1990 and 2000. For example, smoking increased among the young-adult population, specifically in girls; HIV infection due to risky sexual behavior continued to be a concern, specifically among African-American women; **obesity** rose 50 percent between 1980 and 2000, and there was an increase in the percentage of people with **diabetes** and mental health disorders. All of these emerging issues prompted the next set of objectives to

obesity: the condition of being overweight, according to established norms based on sex, age, and height

diabetes: inability to regulate level of sugar in the blood

focus more closely on individual **lifestyle** behavior change and community health.

Healthy People 2010, released in January 2000, has twenty-eight focus areas and 467 objectives, with the overall goals of eliminating health disparities and increasing the quality and years of healthy life.

Healthy People 2010 expands on the *Healthy People 2000* objectives, while also addressing emerging issues such as obesity and mental health. For example, obesity has been linked to many other health concerns such as **high blood pressure**, diabetes, **cancer**, and **heart disease**. Therefore, one objective of *Healthy People 2010* is to promote health and reduce **chronic** disease associated with **diet** and weight. This objective will focus on weight status and growth; food and **nutrient** consumption; **iron** deficiency and **anemia**; schools, worksites, and **nutrition** counseling; and food security.

The Healthy People 2010 objectives will be used by state agencies, such as health departments, in planning health promotion and disease prevention programs. Local health agencies will also use the guidelines when planning health programs. For example, schools will use the nutrition objectives in school nutrition programs; private companies will use the physical activity objectives to plan worksite **wellness** programs; and various organizations will join together in planning health fairs.

Through the collaborative effort of all people in the nation using the *Healthy People 2010* guidelines, there can be a significant improvement in the length and quality of life for all. SEE ALSO HEALTH EDUCATION; HEALTH PROMOTION, NATIONAL INSTITUTES OF HEALTH.

Pauline A. Vickery

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

chronic: over a long period

diet: the total daily food intake, or the types of foods eaten

nutrient: dietary substance necessary for health

iron: nutrient needed for red blood cell formation

anemia: low level of red blood cells in the blood

nutrition: the maintenance of health through proper eating, or the study of same

wellness: related to health promotion

Bibliography

Green, L., and Ottoson, J. (1999). *Community and Population Health*, 8th edition. Boston: WCB/McGraw-Hill.

U.S. Department of Health and Human Services (1991). *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services, 2001. *Healthy People 2010*. Washington, DC: U.S. Government Printing Office.

Internet Resources

U.S. Department of Health and Human Services. *Healthy People 2010*. Available from <http://www.health.gov/healthypeople>

U.S. Department of Health and Human Services. "Healthy People 2010: Fact Sheet." Available from <http://www.health.gov/hpcomments>

Heart Disease

The heart, which is about the size of a human fist, is the body's largest, strongest, and most important muscle. The heart continuously pumps blood through the body, helps regulate and prolong health, and controls the flow (circulation) of blood to the lungs, organs, muscles, and tissues in the body.

Heart disease is a leading cause of debilitation and death worldwide in men and women over age sixty-five. In many countries heart disease is viewed as a "second epidemic," replacing **infectious diseases** as the leading cause

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

of death. It is especially devastating in countries that do not have adequate health care. There are many types of diseases and disorders that affect the heart.

Congenital Heart Disease

Congenital cardiac anomaly (CAA), also known as congenital heart disease (CHD), refers to any structural defect of the heart or major vessels that exists from birth. It is the most common cause of infant death, other than problems of prematurity, and death is likely to occur in the first year of life. CAA may result either from **genetic** causes or from external causes such as maternal infection or exposure to other factors that affect embryonic **development**. The general problems associated with CAA include increased cardiac workload, **hypertension**, poor oxygenation of blood, and respiratory infections. There are many types of CAA, including aortic stenosis, atrial septal defect, valvular stenosis, and pulmonary stenosis.

genetic: inherited or related to the genes

development: the process of change by which an organism becomes more complex

hypertension: high blood pressure

Rheumatic Heart Disease

Rheumatic heart disease (RHD) involves damage to the heart and heart vessels caused by rheumatic fever. A susceptible person acquires a streptococcal infection, which may trigger an autoimmune reaction in the heart tissue. Rheumatic fever can cause swelling (inflammation) in the heart, joints, brain, and spinal cord. Rheumatic fever produces **fatigue** (tiredness) and the infection can damage or weaken heart valves. Problems with the heart may be evident early, or it may occur long after the infection. RHD is characterized by heart murmurs, abnormal pulse rate and rhythm, and congestive heart failure. **Acute** RHD requires aggressive treatment to prevent heart failure. **Chronic** RHD requires continuous observation. If poor cardiac function develops, it may be treated with a low-sodium **diet** and **diuretics**. Patients with deformed heart valves should be given prophylactic **antibiotics** before dental and surgical procedures.

fatigue: tiredness

acute: rapid-onset and short-lived

chronic: over a long period

diet: the total daily food intake, or the types of foods eaten

diuretic: substance that depletes the body of water

antibiotic: substance that kills or prevents the growth of microorganisms

Myocardial Infarction (MI)

Myocardial infarction (MI) is the clinical term for a **heart attack**. It is caused by occlusion (blockage) of the coronary **artery** (**atherosclerosis**) or a blood clot (coronary thrombosis), resulting in the partial or total blockage of one of the coronary arteries. When this occurs, the heart muscle (myocardium) does not receive enough **oxygen**. If the MI is mild, the heart muscle may partially repair itself. Permanent damage may occur when a portion of the heart muscle dies (called an infarction).

MI is characterized by crushing chest pains that may radiate to the left arm, neck, or upper abdomen (which may feel like acute **indigestion** or a gallbladder attack). The affected person usually has shortness of breath, ashen color, clammy hands, and faints. Treatment within one hour of the heart attack is important and usually includes chewing aspirin and administering CPR. Many individuals die each year of their first MI.

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

artery: blood vessel that carries blood away from the heart toward the body tissues

atherosclerosis: build-up of deposits within the blood vessels

oxygen: O_2, atmospheric gas required by all animals

indigestion: reduced ability to digest food

Coronary Artery Disease (CAD)

Coronary artery disease (CAD) refers to any one of the conditions that affect the coronary arteries and reduces blood flow and **nutrients** to the heart.

nutrient: dietary substance necessary for health

According to the American Heart Association, heart disease is the most common cause of cardiac arrest, and 95 percent of cardiac arrest patients die before they reach the hospital. That high mortality rate has prompted the placement of portable defibrillators in places such as schools, airplanes, police cars, and in this service plaza along the Pennsylvania Turnpike. *[Photograph by Keith Srakocic. AP/Wide World Photos. Reproduced by permission.]*

It is the leading cause of death worldwide for both men and women. The most common kind of CAD is atherosclerosis, which results in narrowing and hardening of the arteries. Coronary atherosclerosis is at epidemic proportions worldwide.

Traditionally, CAD was seen as a disease of aging and was observed primarily in the elderly. However, atherosclerosis is now occurring more often in younger populations. One out of every three individuals worldwide,

estrogen: hormone that helps control female development and menstruation

menopause: phase in a woman's life during which ovulation and menstruation ends

lipid: fats, waxes, and steroids; important components of cell membranes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

trans-fatty acids: type of fat thought to increase the risk of heart disease

obesity: the condition of being overweight, according to established norms based on sex, age, and height

diabetes: inability to regulate level of sugar in the blood

stress: heightened state of nervousness or unease

calorie: unit of food energy

fiber: indigestible plant material which aids digestion by providing bulk

Chronic stress is a risk factor for heart disease, and acute stress can trigger heart attacks. Regular yoga or other exercise may help prevent both conditions by releasing stress and strengthening the heart muscle. *[AP/Wide World Photos. Reproduced by permission.]*

and one in five in the United States, dies from heart disease each year. In the United States, CAD has declined more rapidly in whites than in blacks. CAD affects women ten years later than men, mostly due to the protective production of **estrogen**. After **menopause**, a woman is two times more susceptible to heart disease than women who have not reached menopause.

Risk factors. Controlled risk factors associated with CAD include hypertension; cigarette smoking; elevated blood **lipids** (e.g. **cholesterol**, **triglyceride**); a high-fat diet (especially saturated fats and **trans-fatty acids**); physical inactivity; **obesity**; **diabetes**; and **stress**. Lifestyle changes can assist in prevention of CAD. Uncontrolled risk factors include a family history of CAD, gender (higher in males), and increasing age.

Tobacco use is one of the leading contributors to heart disease. Smoking increases the risk of heart attacks (and increases the risk of lung diseases) by decreasing oxygen flow to the heart and lungs. Hypertension, which makes the heart work harder than normal, can be caused by poor diet, excessive dietary salt, lack of exercise, smoking, and chronic stress. Adult-onset diabetes mellitus may result from poor dietary habits and lack of exercise over a lifetime. Uncontrolled diabetes can lead to heart failure. Exercise can reduce the risk for CAD by increasing coronary blood flow, and it has shown positive effects on blood flow to the heart (myocardial perfusion). Long-term benefits of exercise include lower incidences of coronary heart failure and increased cardiac function in normal subjects.

Prevention. Health professionals recommend that dietary fat be reduced to 30 percent or less of total **calories**. The diet also should have no more than 10 percent of its calories from saturated fats, no more than 300 milligrams (mg) of cholesterol daily, no more than 2,400 mg of sodium, and at least 3,500 mg of potassium. A plant-based diet consisting primarily of whole grains, fruits, and vegetables is recommended. Eating at least 25 grams of **fiber** and five servings of fruits and vegetables daily may reduce the risk for heart disease.

Individuals who consume alcohol should do so in moderation. Moderation is defined as two drinks for men and one drink for women daily. Alcohol is a very addictive substance, however, and should not be used as a primary means of prevention. Caffeine in moderation has no adverse effect; however, excessive intake may make the heart pump faster. Increased heart rate stresses the heart and may cause long-term damage to blood vessels.

Establishing good exercise and dietary habits early in childhood is important to prevent heart disease. Regular activity and proper **nutrition** decreases **reactivity** to stress and makes the heart stronger and more efficient. At least thirty minutes of moderate exercise daily is recommended to prevent heart disease. Stress management helps to prevent **high blood pressure**, which is a major contributor to heart disease. Techniques such as yoga, deep breathing, and **meditation** may prevent coronary disease by improving resistance to stress. SEE ALSO ARTERIOSCLEROSIS; ATHEROSCLEROSIS; CARDIOVASCULAR DISEASES; EXERCISE.

Teresa Lyles

Bibliography

Goldberg, I. J.; Mosca, L.; Piano, M. R.; and Fisher, E. A. (2001). "Wine and Your Heart: A Science Advisory for Healthcare Professionals from the Nutrition Com-

mittee, Council on Epidemiology and Prevention, and Council on Cardiovascular Nursing of the American Heart Association." *Circulation* 103:472–475.

Insel, P. M., and Roth, W. T. (2004). "Cardiovascular Disease and Cancer." In *Core Concepts in Health*, 9th (brief) edition. New York: McGraw-Hill.

Mosby's Medical, Nursing, and Allied Health Dictionary, 6th edition (2003). St. Louis, MO: American Dietetic Association.

Internet Resources

American Heart Association. "Congenital Heart Defects in Children Fact Sheet." Available from <http://www.americanheart.org>

American Heart Association/American Stroke Association. "Heart Disease and Stroke Statistics—2003 Update." Available from <http://www.americanheart.org>

"Description of Congenital Heart Defects." Available from <http://www.congenitalheartdefects.com/typesofcad.html>

"Heart Attack." Available from <http://www.heartcenteronline.com/myheartdr>

nutrition: the maintenance of health through proper eating, or the study of same

reactivity: characteristic set of reactions undergone due to chemical structure

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

meditation: stillness of thought, practiced to reduce tension and increase inner peace

Hispanics and Latinos, Diet of

The United States Census Bureau defines *Hispanics* as those who indicate their origin to be Mexican, Puerto Rican, Cuban, Central or South American (e.g., Dominican, Nicaraguan, Colombian) or other Hispanic origin. This designation is made independently of racial classification. According to the 2002 U.S. Census, 13.3 percent of the U.S. population (or over 37 million Americans) identified themselves as being of Hispanic origin. This number exceeds the number of non-Hispanic blacks, or African Americans, in the United States, making Hispanics the largest minority subpopulation within the nation. The three major subgroups that make up the Hispanic population are Mexican Americans, Puerto Ricans, and Cubans. By far the largest of these is the Mexican-American population, which represents at least two-thirds of all Hispanics.

Ethnic and racial **diversity** within the U.S. increased dramatically during the latter part of the twentieth century, with much of the large-scale immigration coming from Asia and Latin America. From 1980 to 2000 the Hispanic population within the United States doubled. More than 40 percent of Hispanics were living in the western part of the country at the end of the century. In 2000, New Mexico had a higher proportion of Hispanics in its population than any other state, with 42 percent of its population being of Hispanic origin. The high growth rate among Hispanics is attributable to higher fertility rates than those observed in other ethnic groups, and to increases in immigration, especially in border states such as California and Texas. Compared to the non-Hispanic white population, the Hispanic population in the United States is younger, less educated, economically disadvantaged, and more likely to live in larger households. However, there are significant differences among the Hispanic subpopulations, with those of Mexican origin being relatively less advantaged and those of Cuban origin being relatively more advantaged in terms of education and income.

diversity: the variety of cultural traditions within a larger culture

Characteristics of the Hispanic Diet

The contemporary diet of Hispanics in the United States is heavily influenced by the traditional dietary patterns of their countries of origin, as well

as by the dietary practices of the adopted communities in which they live. As such, there are many regional differences between Hispanic subgroups, both in terms of the composition of the diet and the means of food preparation. Despite the heterogeneous ancestral backgrounds of Hispanic Americans, many Hispanics still retain core elements of the traditional Hispanic diet, including a reliance on grains and beans and the incorporation of fresh fruits and vegetables in the diet. Family life has traditionally occupied a central place in Hispanic culture, and this has influenced dietary behaviors through home preparation of meals and the practice of families eating together.

Information about what Hispanics in the United States eat has been compiled through national surveys conducted by the U.S. Department of Agriculture (USDA). Among the highlights of these data are that Hispanics tend to eat more rice, but less pasta and ready-to-eat cereals, than their non-Hispanic white counterparts. With the exception of tomatoes, Hispanics are also less likely to consume vegetables, although they have a slightly higher consumption of fruits. Compared to non-Hispanic whites, Hispanics are more than twice as likely to drink whole milk, but much less likely to drink low-fat or skim milk. Hispanics are also more likely to eat beef, but less likely to eat processed meats such as hot dogs, sausage, and luncheon meats. Hispanics are more likely to eat eggs and **legumes** than non-Hispanic whites, and less likely to consume fats and oils or sugars and candy.

legumes: beans, peas, and related plants

Analysis of the **macronutrient** content of the diet reveals that Hispanics, especially Mexican Americans, have a lower intake of total fat and a higher intake of dietary **fiber** compared to non-Hispanic white populations, with much of the dietary fiber coming from legumes. In general, Mexican Americans and other Hispanic subgroups are low in many of the same micronutrients as the general population, with intakes of vitamin E, **calcium**, and **zinc** falling below Recommended Daily Allowances.

macronutrient: nutrient needed in large quantities

fiber: indigestible plant material that aids digestion by providing bulk

calcium: mineral essential for bones and teeth

zinc: mineral necessary for many enzyme processes

Acculturation and the Hispanic Diet

Just as Hispanics have altered American cuisine, American culture has also altered the diet of Hispanic Americans. As with many other immigrant groups in the United States, the lifestyle of Hispanic Americans is undergoing a transition away from one based on the traditional values and customs of their ancestry, as they begin to adopt the values and behaviors of their adopted country. With regard to health behaviors, this process of acculturation is typically characterized by a more **sedentary** lifestyle and a change in dietary patterns. The effects of acculturation on the Hispanic diet are illustrated in national dietary survey data that show that Hispanic Americans who continue to use Spanish as a primary language eat somewhat more healthful diets than those who use English as a primary language. These healthier eating behaviors include lower consumption of fat, **saturated fat**, and **cholesterol**. Additional analysis of these survey data reveals that these dietary differences do not appear to be the result of greater nutritional knowledge or greater awareness of food-disease relationships.

sedentary: not active

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

The degradation of diet quality that occurs as Hispanic Americans become acculturated into the mainstream U.S. population occurs in the context of improvements in, rather than degradation of, economic status. For example, first-generation Mexican-American women, despite being of lower

The traditional Hispanic diet includes plenty of grains and legumes. It is somewhat lower in fat and cholesterol than the diets of non-Hispanic whites in the U.S. *[Royalty-Free/Corbis. Reproduced by permission.]*

socioeconomic status than second-generation Mexican American or non-Hispanic white women, tend to have higher intakes of **protein**, **vitamins** A and C, folic acid, and calcium than these other groups. The diets of second-generation Mexican American women more closely resemble those of non-Hispanic white women of similar socioeconomic status.

The process of acculturation and the changing nature of the Hispanic diet has serious implications for the state of Hispanic health. The **prevalence** of type 2 **diabetes** mellitus is two to three times higher in Hispanic Americans than in non-Hispanic whites, with an estimated 10 percent of adults over the age of twenty and 25 to 30 percent of those over the age of fifty affected. The prevalence of the disease is especially high among Mexican Americans. Diabetes, a disease characterized by high levels of **glucose** in the blood, is a major cause of death and disability in the United States. Compared to nondiabetic individuals, those with the disease are also at two to four times higher risk of developing **cardiovascular** disease, the leading cause of death in the country. Accompanying this increased risk of diabetes among Hispanics is a marked increase in the risk of **obesity**.

Much of the increased risk of diabetes experienced by Hispanic Americans is believed to be attributable to the changing lifestyle that accompanies the acculturation process, including the changing quality of the Hispanic diet and the adoption of a more sedentary lifestyle. These trends are occurring across all segments of the Hispanic population, although the extent of the changes are more pronounced in some subgroups (e.g., Mexican Americans in large urban areas) than in others. Although Hispanic Americans generally smoke less than their non-Hispanic white counterparts, the direction of Hispanic health is also threatened by an increasing frequency of cigarette smoking, particularly among younger segments of the population.

socioeconomic status: level of income and social class

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

prevalence: describing the number of cases in a population at any one time

diabetes: inability to regulate level of sugar in the blood

glucose: a simple sugar; the most commonly used fuel in cells

cardiovascular: related to the heart and circulatory system

obesity: the condition of being overweight, according to established norms based on sex, age, and height

PERCENTAGES OF INDIVIDUALS CONSUMING SPECIFIED FOODS, FROM A ONE-DAY DIETARY RECALL

Food item	Mexican Americans	Other Hispanics	Non-Hispanic whites
Cereals and pasta			
Ready-to-eat cereals	26.2	23.9	30.3
Rice	14.7	29.0	6.1
Pasta	3.7	6.6	8.3
Vegetables			
Dark green vegetables	3.2	5.2	9.6
Deep yellow vegetables	9.3	8.6	14.2
Tomatoes	46.2	40.1	39.1
Green beans	3.4	6.3	8.1
Citrus	29.1	29.6	26.1
Other (noncitrus) fruits	43.8	37.7	40.4
Whole milk	37.5	31.3	15.2
Low fat milk	17.6	19.4	30.3
Beef	25.9	25.3	20.5
Processed meats (hot dogs, sausages, luncheon meats)	23.5	24.2	32.7
Eggs	29.8	24.4	16.9
Legumes	30.6	23.5	11.8
Fats and oils (table fats and salad dressings)	36.9	44.0	59.0
Sugars and candy	46.0	49.3	54.7

SOURCE: U.S. Dept. of Agriculture, Agricultural Research Service.

nutrition: the maintenance of health through proper eating, or the study of same

Approaches for improving the health of Hispanics need to be broad-based and to consider the complexities of a variety of lifestyle factors. **Nutrition** education programs aimed at improving the quality of the Hispanic diet are currently based on a combination of preserving some elements of the traditional Hispanic diet—including a reliance on beans, rice, and tortillas—and a change in others—such as reduced consumption of high-fat dairy products and less use of fat in cooking. SEE ALSO CENTRAL AMERICANS AND MEXICANS, DIETS OF; SOUTH AMERICANS, DIET OF.

Braxton D. Mitchell

Bibliography

Aldrich L, and Variyam, J. N. (2000). "Acculturation Erodes the Diet Quality of U.S. Hispanics." *Food Review* 23:51–55.

Flegal, K. M.; Ezzati, T. M.; Harris, M., et al. (1991). "Prevalence of Diabetes in Mexican Americans, Cubans, and Puerto Ricans from the Hispanic Health and Nutrition Examination Survey, 1982–1984." *Diabetes Care* 14(Suppl 3):628–638.

Guendelman, S., Abrams, B. (1995). "Dietary Intake among Mexican-American Women: Generational Differences and a Comparison with White Non-Hispanic Women." *American Journal of Public Health* 85:20–25.

Harris, M. I.; Flegal, K. M.; Cowie, C. C., et al. (1998). "Prevalence of Diabetes, Impaired Fasting Glucose, and Impaired Glucose Tolerance in U.S. Adults: The Third National Health and Nutrition Examination Survey (NHANES), 1988–94." *Diabetes Care* 21:518–524.

Hobbs, F., and Stoops, N. (2000). *Demographic Trends in the 20th Century*. U.S. Census Bureau, Census 2000 Special Reports, Series CENSR-4. Washington, DC: U.S. Government Printing Office.

Romero-Gwynn, E.; Gwynn, D. L.; Grivetti, R., et al. (1993). "Dietary Acculturation among Latinos of Mexican Descent." *Nutrition Today* (July/Aug.):6–11.

U.S. Census Bureau (1999). *The Hispanic Population in the United States: Population Characteristics.* Washington, DC: U.S. Government Printing Office.

Internet Resource

U.S. Department of Agriculture, Agricultural Research Service (1999). "Data Tables: Food and Nutrient Intake by Hispanic Origins and Race, 1994-1996." Available from <http://www.barc.usda.gov/bhnrc>

HIV/AIDS

HIV (human immunodeficiency virus) was identified in 1983 by the French scientist Luc Montagier and his staff at the Pasteur Institute in Paris. Ever since that discovery, scientists have been searching for ways to treat those infected with HIV, and to produce a vaccine to prevent its spread. While new antiviral treatments have been developed, a vaccine has yet to be found. HIV causes AIDS (acquired immunodeficiency syndrome), an unpredictable condition that may progress over many years and is characterized by a slow deterioration of the **immune system**. Once an individual becomes infected (HIV has infected the target cells) it takes a week or more before the virus is spread throughout the body's blood and **lymph system**. The immune system responds by turning out HIV **antibodies** in about six to eighteen weeks. The progression of HIV infection to AIDS may take several years. In the initial period, prolonged (2–4 weeks) flu-like symptoms may appear. This is followed by an **asymptomatic** period (clinical latency) that may last ten or more years. When the immune system becomes further compromised, the patient may experience **opportunistic infections**, caused by the reduced function of the immune system resulting in a plethora of nonspecific and variable signs and symptoms. The condition known as AIDS is marked by severe compromise of the immune system and the presence of one or more opportunistic infections. Some clinical signs and symptoms may include sweating, diarrhea, malaise (feeling tired), anorexia (loss of appetite), weight loss, wasting (loss of muscle tissue), chest pain, swelling of the **lymph nodes**, **fungal** infections, **neurological** disorders, body-fat accumulations, and increased blood fats. In addition to disease-induced signs and symptoms, medications used to treat HIV/AIDS may produce additional signs and symptoms.

Nutrition for HIV/AIDS

In the absence of a cure, it is important to control symptoms, support the immune system, and lower the levels of HIV circulating in the blood. To lower the level of HIV in the blood, patients take a prescribed combination of antiviral **drugs**. The role nutrition plays will vary along the disease continuum (disease progression over many years), with consideration given to the patient's age, gender, behaviors, current medication, drug history, **socioeconomic status**, and associated health concerns.

In all cases, adequate **hydration** (fluid intake) and increased **calorie** and **protein** intake are necessary to fight the infection. Proper nutrition must begin immediately to support **nutritional deficiencies** (including vitamin A and E, the **B vitamins**, magnesium, and **zinc**) that occur early in the disease process. These nutritional deficiencies contribute to decreased immunity and disease progression. Ellen Mazo and Keith Berndtson, in *The Immune Advantage*, suggest that once the patient has been diagnosed with HIV infection, more protein and complex **carbohydrates**, along with moderate amounts of fats, should be consumed. The **diet** should include lean

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

antibody: immune system protein that protects against infection

asymptomatic: without symptoms

opportunistic infections: infections not normally threatening, which gain a foothold in people with weakened immune systems

lymph node: pocket within the lymph system in which white blood cells reside

fungal: of or from fungi

neurological: related to the nervous system

drugs: substances whose administration causes a significant change in the body's function

socioeconomic status: level of income and social class

hydration: degree of water in the body

calorie: unit of food energy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

nutritional deficiency: lack of adequate nutrients in the diet

B vitamins: a group of vitamins important in cell energy processes

zinc: mineral necessary for many enzyme processes

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

diet: the total daily food intake, or the types of foods eaten

The HIV/AIDS Epidemic

Figures from the Joint United Nations Programme on HIV/AIDS and the World Health Organization:

Deaths from AIDS in 2003 (North America): 15,000

Deaths from AIDS in 2003 (worldwide): 3 million

People newly infected with HIV in 2003 (North America): 45,000

People newly infected with HIV in 2003 (worldwide): 5 million

People living with AIDS in 2003 (North America): 1 million

People living with AIDS in 2003 (worldwide): 40 million

—Paula Kepos

meat, fish, beans, seeds and nuts, whole-grain breads and cereals, and fruits and vegetables. Moderate amounts of fat for **energy** and calories can be acquired through foods such as nuts, avocado dip, peanut butter, and seeds.

The diet should include each of the five major food groups (dairy, vegetable, meat, fruit, and bread). The sixth group (fats and sugars) should be used sparingly. Patients with a poor appetite should eat six or more small meals throughout the day, rather than three large ones. In prolonged cases of appetite depression, a physician may prescribe an appetite stimulant (e.g., megesterol acetate). It is important to keep all foods refrigerated, to avoid eating rare meats, to practice proper hand washing, and to use soap and hot water to clean sinks and utensils. Food-borne illnesses pose serious threats for HIV/AIDS patients.

HIV/AIDS Complications

Some symptoms will require additional attention beyond general nutritional recommendations. For example, diarrhea will rapidly reduce the water content of the body, causing severe alterations in the body's **metabolism** and **electrolyte** balance. Electrolytes may be replaced with products such as Pedialyte or Gatorade. Proteins and calories should be increased to prevent weight loss, and dairy products, alcohol, caffeine, and spicy and fatty foods should be avoided.

A second complication is that of weight loss and wasting. According to Derek Macallan, in *Wasting HIV Infection and AIDS*, wasting may be either **acute** (associated with a secondary disease) or **chronic** (associated with **gastrointestinal** disease), and is the result of a variety of processes, including drug use, medications, concurrent disease, and HIV itself. HIV infection causes abnormal protein and fat metabolism. During episodes of acute wasting the patient may require a prescription for **steroids**, to help support tissue maintenance and tissue development, in combination with optimal protein and calories in the diet.

Contributing to weight loss and wasting is malabsorption (the failure of nutritional substances to be absorbed in the **intestines**). Malabsorption occurs in advanced cases of HIV infection when gastrointestinal disease is present. Diseases that can cause malabsorption in HIV/AIDS patients include Kaposi's sarcoma, non-Hodgkin's lymphoma, cytomegalovirus, *Myco-bacterium avium* complex, and cryptosporidiosis. Malabsorption may require an alternative to oral nutrition.

Alternatives to Oral Nutrition

Alternative routes for nutrition must be considered in patients with fungal growth in the oral cavity, inflammation of the gums and oral **mucosa**, open sores, difficulty in swallowing, and other debilitating diseases of the **oral-pharyngeal** region and/or gastrointestinal tract. These alternatives include parenteral (PN) and enteral nutrition. PN replaces essential **nutritional requirements** via **intravenous** (IV) access. The IV may be placed in a peripheral vein or in a large central vein, depending on the medical condition of the patient and the choice of nutrition replacement therapy. The cost for PN is high, and there is a risk of severe infection; therefore it is not recommended except for brief treatment measures during known episodic cases of acute weight loss and in the absence of gastrointestinal (GI) function.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

metabolism: the sum total of reactions in a cell or an organism

electrolyte: salt dissolved in fluid

acute: rapid-onset and short-lived

chronic: over a long period

gastrointestinal: related to the stomach and intestines

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic processes

intestines: the two long tubes that carry out the bulk of the processes of digestion

mucosa: moist exchange surface within the body

oral-pharyngeal: related to mouth and throat

nutritional requirements: the set of substances needed in the diet to maintain health

intravenous: into the veins

This scanning electron micrograph (SEM) shows a T-lymphocyte white blood cell, lumpy from infection. The smaller circles are AIDS viruses budding from the cell's membrane. *[Nibsc/Photo Researchers, Inc. Reproduced by permission.]*

Enteral nutrition (placing a tube into the stomach or intestine) is preferred in those patients who have difficulty in swallowing, disease of the oral-pharyngeal region, and adequate GI function. The medical risks with enternal nutrition are less than for PN, but may include injury to the GI tract and infection in the absence safe food practices.

Ethical Considerations for Care

It is strongly advised that those suspected with or diagnosed with HIV infection seek professional attention from a qualified physician and a registered dietician. For these caregivers, the development of new antiviral drugs, changes in methods of administration of existing drugs, and new information regarding nutrition require diligent and regular review. It is important for health care workers to keep an open dialogue with the patient, so that they stay aware of the patient's health status and treatment measures. Many issues regarding the amount (drugs and nutrition) and length of care for AIDS patients remain controversial and should be negotiated with the patient.

Finally, when traditional medical wisdom fails, some patients may turn to alternative medicine. There are many questionable products on the market that make extraordinary health claims, and caution is required. These products are often overpriced and marketed with misleading claims, and should therefore be considered carefully before use. SEE ALSO FOOD SAFETY; IMMUNE SYSTEM; MALNUTRITION.

Stephen Hohman

Bibliography

Lehman, Robert H. (1997). *Cooking for Life: A Guide to Nutrition and Food Safety for the HIV-Positive Community.* New York: Dell.

Macallan, Derek C. (1999). "Wasting HIV Infection and AIDS." *Journal of Nutrition* 129(1S):238–242.

Mazo, Ellen, and Berndtson, Keith (2002). *The Immune Advantage.* Emmaus, PA: Rodale.

Morrison, Gail, and Hark, Lisa (1999). *Medical Nutrition & Disease*, 2nd edition. Cambridge: MA: Blackwell Science.

"Questionable Mail Order Products" (1999). *Nutrition Forum.* 16(6):46.

Romeyn, Mary (1998). *Nutrition and HIV: A New Model for Treatment*, 2nd edition. San Francisco: Jossey-Bass.

Watson, Ronald R. (2001). *Nutrition and AIDS*, 2nd edition. Boca Raton, FL: CRC Press.

Homelessness

Homelessness is a global problem. According to a 1996 United Nations report, 500 million people worldwide were homeless or residing in low-quality housing and unsanitary conditions in 1995. The number of homeless continues to rise, however, and quantifying this population is difficult. Most homelessness rates are reported by service providers, and countries with the best-developed service systems will therefore report the highest number of homeless, a condition referred to as the service-systems paradox. Various other problems, such as double-counts, overcounts, the problem of mobility, and hidden homelessness also affect estimates.

In the United States, homelessness gained national attention in the early 1980s. While some people thought the growth in the homeless population was a result of the recession that occurred during this period, the problem has not gone away.

It is estimated that two million people per year are homeless in the United States. A report issued by the Urban Institute in 2000 stated that 2.3 million adults and children in the United States are likely to experience homelessness at least once in a year.

A way to get at the root of the problem is to understand the causes of homelessness. Worldwide, homelessness is caused by a breakdown in traditional family support systems, continued urbanization, the effects of structural adjustment programs, civil wars, and natural disasters. A shortage in affordable rental housing and an increase in poverty are thought to be two major factors contributing to the rise of homelessness in the United States. Other potential causes are the lack of affordable health care, domestic violence, mental illness, and addiction disorders. Often, individuals will have several risk factors causing them to "choose between food, shelter, and other

The forced relocation of Native Americans from their ancestral lands has fueled homelessness among that population. Other homeless people have lost their homes to pay for unexpected medical expenses, or because of economic hardship. *[Corbis Corporation. Reproduced by permission.]*

basic needs" (National Coalition for the Homeless, p. 6). Shelter is often the lowest priority, and is often unaffordable, and thus homelessness becomes a problem. Similar risk factors affect both the homeless and those who are experiencing poverty. Because homelessness and poverty are linked, efforts to improve poverty will inevitably decrease homelessness.

Economics of Poverty and Undernutrition

Looking at a nation's poverty data is one way to judge its economic well-being. In the United States in 2001, 32.9 million people were living below the poverty line, which was $9,034 for an individual (for a family of three, the poverty threshold in 2001 was a salary of $14,128, while for a family of four it was $18,104). However, the poverty rate dropped a half percentage point to 11.3 percent between 1999 and 2000.

Around the world, poverty is pervasive: one billion people lived in poverty in 2001. Poverty and hunger are undeniably linked, so that solving the hunger problem by feeding people, without attacking the poverty problem, does not address the root cause of poverty.

In 1999, 31 million households (10.1%) in the United States were on the verge of hunger, while 3 percent of households were hungry. Even more startling, between 750 and 800 million people around the world were hungry in 1996. Of these, 550 million were in Asia, while 170 million were in sub-Saharan Africa. Along with hunger comes undernutrition, which can pose serious health threats.

Consequences of Long-Term Undernutrition among Homeless Children

The Institute of Medicine has estimated the number of homeless children in the United States to be approximately 100,000 each night. Almost half of these children are younger than six years of age. Although this is a growing population, few studies have examined the effect of undernutrition on homeless children. However, recent studies have found that a poor **diet**

diet: the total daily food intake, or the types of foods eaten

in early childhood has implications for long-term health and cognitive development.

Homeless children suffer several medical problems due to undernutrition, including **chronic** and recurring physical ailments, and higher rates of fever, cough, colds, diarrhea, and **obesity**. In addition, a greater **incidence** of infections, **fatigue**, headaches, and **anemia**, as well as impaired cognitive development and visual motor integration, has been documented in homeless children.

Homeless adults also suffer several medical problems due to undernutrition. Common problems include anemia, dental problems, **gastric ulcers**, other **gastrointestinal** complaints, **cardiovascular** disease, **hypertension**, **hypercholesterolemia**, **acute** and chronic **infectious diseases**, **diabetes**, and **malnutrition**.

chronic: over a long period

obesity: the condition of being overweight, according to established norms based on sex, age, and height

incidence: number of new cases reported each year

fatigue: tiredness

anemia: low level of red blood cells in the blood

gastric: related to the stomach

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

gastrointestinal: related to the stomach and intestines

cardiovascular: related to the heart and circulatory system

hypertension: high blood pressure

hypercholesterolemia: high levels of cholesterol in the blood

acute: rapid-onset and short-lived

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

diabetes: inability to regulate level of sugar in the blood

malnutrition: chronic lack of sufficient nutrients to maintain health

nutrient: dietary substance necessary for health

Government Programs to Reduce Hunger and Undernutrition

According to the United States Census Bureau, 5 million adults and 2.7 million children lived in hungry households in 1999. To combat hunger and the undernutrition problem, the United States government funds and administers several food programs, including the Food Stamp Program; the National School Lunch Program; the School Breakfast Program; the Special Supplemental Nutrition Program for Women, Infants and Children; the Child and Adult Care Food Program; the Emergency Food Assistance Program; and the Community Food and Nutrition Program.

The Food Stamp Program provides coupons for low-income families that enable them to buy food. The coupons are dispersed on a monthly basis, with the purpose of reducing hunger and malnutrition.

Through the National School Lunch Program (NSLP), schools can be reimbursed for providing nutritious meals to children. A nutritious school lunch provides children with one-third or more of their Recommended Dietary Allowance (RDA) for **nutrients**.

Similar to the NSLP, the School Breakfast Program offers reimbursements to schools for providing breakfast to students. This breakfast provides one-fourth or more of their RDA for nutrients. In addition, meals and snacks are provided for children at risk for hunger through the Summer Food Service Program for Children. The food is usually provided during educational and recreational activities, and one-third of the children's RDA is provided through this program.

The Special Supplemental Nutrition Program for Women, Infants and Children (WIC) has a mission to improve the diets of women, infants, and children by providing monthly food packages that include certain foods.

Federal funds are provided to public and nonprofit child-care centers, family and group child-care homes, and after-school programs for meals and snacks to the populations they serve through the Child and Adult Care Food Program (CACFP). The programs are required to follow the nutrition standards set by USDA when providing meals.

Through the Emergency Food Assistance Program (TEFAP), food is distributed through emergency food shelters. The food is provided through

surplus commodities purchased by the United States Department of Agriculture (USDA). Low-income families are served as well.

Finally, the Community Food and Nutrition Program (CFNP) is the source of federal funding for programs providing hunger relief and improving nutrition for low-income individuals. The funding is provided on the local, state, and national levels.

Organizations Providing Community-Based Solutions to Homelessness

Several community-based solutions to homelessness have been developed, such as emergency shelters, transitional housing, permanent housing for formerly homeless individuals, voucher distribution for housing, food pantries, soup kitchens and meal distribution programs, mobile food programs, physical and mental health, alcohol and/or drug, HIV/AIDS, and outreach programs, drop-in centers, and migrant housing.

Examples of organizations seeking to provide solutions to hunger and homelessness include the Food Research and Action Center, America's Second Harvest, the Center on Hunger and Poverty, Bread for the World, World Hunger Year, and the Food Industry Crusade Against Hunger. These organizations provide coordination and support to antihunger networks of food banks and food assistance programs, education of the public, and encouragement to policy makers for the expansion and protection of programs aiding the homeless.

Deficits in the Diet

Many homeless people rely on shelters and soup kitchens for their food intake. However, these sites may not provide an adequate diet. "Most shelters rely on private donations, a local food bank, and surplus commodity distributions. Because the nutritional quality and quantity of these resources vary greatly over time, meals may be nutritionally limited, even though the quantity of the food served may be acceptable to the recipient" (Wolgemuth et al., 1992, p. 834). Furthermore, easily stored and prepared foods do not provide the best nutritional value. These items are typically "high in salt, **fat**, preservatives, and empty **calories** (i.e., calories with little or no nutritional value), and low in variety, **fiber**, and **protein**" (Strasser et al., 1991, p. 70).

Due to the food sources of the homeless, deficits in the diet have been documented in numerous studies. The **B vitamins**, vitamin C, **zinc**, **calcium**, thiamine, folic acid, magnesium, and **iron** are all commonly found to be deficient in the homeless. Iron deficiencies are particularly common among the homeless, leading to high rates of anemia. In addition, the food that is likely to be offered at most local shelters and soup kitchens is high in salt, fat, and **cholesterol**, contributing to a high incidence of hypertension among the homeless.

Clearly, the homeless are a widely varied population, and responses to homelessness must also be varied in nature. Several such responses are needed. These include: prevention of homelessness through improving the housing stock; improving outreach through increased soup kitchens, emergency responses, and night shelters; and creating supportive housing to

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

fiber: indigestible plant material that aids digestion by providing bulk

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

B vitamins: a group of vitamins important in cell energy processes

zinc: mineral necessary for many enzyme processes

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

help homeless persons reintegrate into society. Interagency coordination to improve services and the provision of enterprise development and skills training to improve the economic survival of the homeless are also needed. Finally, federal and local governments must be involved in efforts to help the homeless through policy development. This multifaceted approach will ensure a more effective response to homelessness. SEE ALSO FOOD INSECURITY; NUTRITIONAL DEFICIENCY; WIC PROGRAM.

Pauline A. Vickery
Heidi Williams
Nadia Lugo

Bibliography

Carrillo, T. E.; Gilbride, J. A.; and Chan, M. M. (1990). "Soup Kitchen Meals: An Observation and Nutrient Analysis." *Journal of the American Dietetic Association* 90(7):989–991.

Dalaker, J. (2001). *Poverty in the United States: 2000*. Washington, DC: U.S. Census Bureau.

Hwang, S. W. (2001). "Homelessness and Health." *Canadian Medical Association Journal* 164(2):229–233.

Kelly, E. (1998). "Nutrition Among Homeless Children." *Public Health Reports* 113:287.

Luder, E.; Ceysens–Okada, E.; Koren-Roth, A.; and Martinez-Weber, C. (1990). "Health and Nutrition Survey in a Group of Urban Homeless Adults." *Journal of the American Dietetic Association* 90(10):1387–1392.

Oliviera, N. L., and Goldberg, J. P. "The Nutrition Status of Women and Children Who Are Homeless." *Nutrition Today* 37(2):70–77.

Strasser, J. A.; Damrosch, S.; and Gaines, J. (1991). "Nutrition and the Homeless Person." *Journal of Community Health Nursing* 8(2):65–73.

Wiecha, J. L.; Dwyer, J. T.; and Dunn-Strohecker, M. (1991). "Nutrition and Health Services Needs Among the Homeless." *Public Health Reports* 106(4):364–374.

Wolgemuth, J. C.; Myers-Williams, C.; Johnson, P.; and Henseler, C. (1992). "Wasting Malnutrition and Inadequate Nutrient Intakes Identified in a Multiethnic Homeless Population." *Journal of the American Dietetic Association* 92(7):834–839.

Internet Resources

Action Against Hunger (2002). "Hunger FAQ: Who Is Hungry?" Available from <http://www.aah-usa.org>

Burt, M. R.; Aron, L. Y.; Douglas, T.; Valente, J.; Lee, E.; and Iwen, B. (1999). "An Overview of Homeless Clients." Available from <http://www.huduser.org/publications>

Food Research and Action Center. "Federal Food Programs." Available from <http://www.frac.org>

Global Issues. "Causes of Poverty: Hunger and Poverty." Available from <http://www.globalissues.org>

National Coalition for the Homeless (2002). "Facts about Homelessness." Available from <http://www.nationalhomeless.org>

United Nations (1995). "Global Report on Human Settlements." Available from <http://www.un.org>

United Nations (2000). "Strategies to Combat Homelessness." Available from <http://www.unhabitat.org>

Urban Institute (2000). "Millions Still Face Homelessness in a Booming Economy: New Estimates Reveal a Large and Changing Homeless Population Served by Growing Diverse Network." Available from <http://www.urban.org>

U.S. Census Bureau. "Poverty 2001." Available from <http://www.census.gov/hhes>

U.S. Department of Housing and Urban Development. *Homelessness: Programs and the People They Serve*. Available from <http://www.huduser.org/publications>

World Hunger Year. "Hunger, Poverty and Homelessness in the U.S." Available from <http://www.worldhungeryear.org>

Hunger

Hunger is the **physiological** drive to find and eat food. According to the World Health Organization (WHO), hunger is the world's major health risk. Globally, one in three people suffer from **chronic** hunger, which is a result of a lack of food security. Food insecurity means people do not have access at all times to nutritionally adequate food. There are three dimensions to food insecurity: a lack of (1) purchasing power (lack of money or resources), (2) accessibility (ability to get food), and (3) availability (amount of food). In the United States, hunger is caused by poverty, whereas in developing countries it is caused by poverty, war, civil unrest, or an undeveloped economy. SEE ALSO DISASTER RELIEF ORGANIZATIONS; FOOD INSECURITY; MEALS ON WHEELS; NUTRITIONAL DEFICIENCY.

Delores C. S. James

physiological: related to the biochemical processes of the body

chronic: over a long period

Internet Resources

Brundtland, Gro Harlem. "World Food Summit Plenary Address." Available from <http://www.who.int/dg>

World Health Organization. "Fifty Facts from the World Health Report 1998: Global Health Situation and Trends 1955–2025." Updated 2001. Available from <http://www.who.int/whr2001>

Hyperglycemia

Hyperglycemia, or high blood sugar, is the result of either too little **insulin** or of the body's inefficient use of insulin. Indicators of hyperglycemia include frequent urination, thirst, high levels of sugar in the urine, and high blood sugar. Failure to address hyperglycemia results in **dehydration** and **ketoacidosis**. Over the long term, hyperglycemia causes **heart disease**, foot problems, blindness, kidney disease, and nerve damage.

For diabetics, frequent blood **glucose** testing and **diet** management are critical to preventing hyperglycemia. Regular self-monitoring of blood glucose levels determines the degree of adjustment in insulin and diet. A registered dietician can conduct a nutritional assessment that will reveal nutritional needs critical to preventing and treating **chronic** complications of **diabetes**. This assessment, based on personal, cultural, and **lifestyle** preferences, is the foundation for a diabetic's dietary plan. For meal planning, the diabetic exchange system provides a quick method for estimating and maintaining the proper balance of **carbohydrates**, fats, **proteins**, and **calories**. In the exchange system, foods are categorized into groups, with each group comprised of foods with similar amounts of carbohydrate, protein, **fat**, and calories. Based on the individual's diabetes treatment plan and goals, any food on the list can be exchanged with another food within the same group.

Exercise improves physical fitness, assists in weight control, and provides **psychological** benefits. For those with diabetes, physical activity

insulin: hormone released by the pancreas to regulate level of sugar in the blood

dehydration: loss of water

ketoacidosis: accumulation of ketone bodies along with high acid levels in the body fluids

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

glucose: a simple sugar; the most commonly used fuel in cells

diet: the total daily food intake, or the types of foods eaten

chronic: over a long period

diabetes: inability to regulate level of sugar in the blood

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calorie: unit of food energy

fat: type of food molecule rich in carbon and hydrogen, with high energy content

psychological: related to thoughts, feelings, and personal experiences

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

reduces **cholesterol** levels, lowers **blood pressure**, decreases body fat, and increases sensitivity to insulin. Exercise further contributes to blood glucose control and reduces the risk factors for diabetes-related complications. With meal planning, exercise has the ability to control type 2 diabetes without medications. SEE ALSO DIABETES MELLITUS; EXCHANGE SYSTEM; HYPOGLYCEMIA; INSULIN.

Julie Lager

Bibliography

American Diabetes Association (2003). "Hyperglycemia Crises in Patients with Diabetes Mellitus." *Diabetes Care* 26(4):S109–S117.

Kitabach, Abbas E.; Umpierrez, Guillermo E.; Murphy, Mary Beth; Barrett, Eugene, J.; Kreisberg, R. A.; Malone, J. I.; and Wall, B. M. (2001). "Management of Hyperglycemic Crises in Patients with Diabetes." *Diabetes Care* 24(1):131–153.

Internet Resources

American Diabetes Association. "Hyperglycemia." Available from <http://www.diabetes.org>

National Institute of Diabetes and Digestive and Kidney Diseases. "Diabetes." Available from <http://www.niddk.nih.gov>

WebMD. "Complications of Diabetes: Hyperglycemia." Available from <http://webmd.com>

Hypertension

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

artery: blood vessel that carries blood away from the heart toward the body tissues

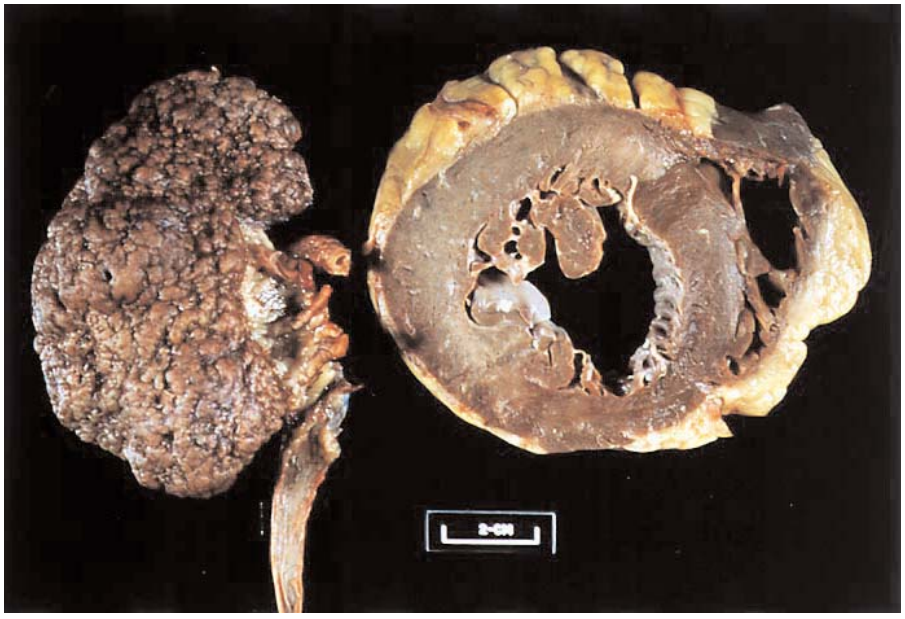
Blood pressure is the force with which blood pushes against the **artery** walls as it travels through the body. Like air in a balloon, blood fills arteries to a certain capacity—and just as too much air pressure can cause damage to a balloon, too much blood pressure can harm healthy arteries. Blood pressure is measured by two numbers—systolic pressure and diastolic pressure. Systolic pressure measures cardiac output and refers to the pressure in the arterial system at its highest. Diastolic pressure measures peripheral resistance and refers to arterial pressure at its lowest. Blood pressure is normally measured at the brachial artery with a sphygmomanometer (pressure cuff) in millimeters of mercury (mm Hg) and given as systolic over diastolic pressure.

A blood pressure reading thus appears as two numbers. The upper number is the systolic pressure, which is the peak force of blood as the heart pumps it. The lower number is the diastolic pressure, which is the pressure when the heart is filling or relaxing before the next beat. Normal blood pressure for an adult is 120/70 (on average), but normal for an individual varies with the height, weight, fitness level, age, and health of a person.

What Is Hypertension?

Hypertension, or high blood pressure, is defined as a reading of 140/90 on three consecutive measurements at least six hours apart. The definition varies for pregnant women, where hypertension is defined as 140/90 on two consecutive measurements six hours apart. Consistently high blood pressure causes the heart to work harder than it should and can damage the coronary arteries, the brain, the kidneys, and the eyes. Hypertension is a major cause of **stroke**.

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain



A kidney (left) and a cross-section of a heart (right) that were affected by hypertension. The heart shows signs of advanced atherosclerosis, one possible complication arising from hypertension. *[Photograph by Dr. E. Walker. Photo Researchers, Inc. Reproduced by permission.]*

Types of Hypertension

Hypertension is classified as either *primary* (or *essential*) *hypertension* or *secondary hypertension.* Primary hypertension has no specific origin but is strongly associated with lifestyle. It is responsible for 90 to 95 percent of diagnosed hypertension and is treated with **stress** management, changes in **diet**, increased physical activity, and medication (if needed). Secondary hypertension is responsible for 5 to 10 percent of diagnosed hypertension. It is caused by a preexisting medical condition such as congestive heart failure, kidney failure, liver failure, or damage to the endocrine (**hormone**) system.

Pregnancy-induced hypertension (PIH) may appear in otherwise healthy women after the twentieth week of pregnancy. It is more likely to occur in women who are **overweight** or **obese**. PIH may be mild or severe, and it is accompanied by water retention and **protein** in the urine. About 5 percent of PIH cases progress to preeclampsia. Preeclampsia is characterized by dizziness, headache, visual disturbance, abdominal pain, facial **edema**, poor appetite, **nausea**, and vomiting. Severe preeclampsia affects the mother's blood system, kidneys, brain, and other organs. In rare cases, the woman can die. Preeclampsia is more likely to occur during first pregnancies, multiple fetuses, in women with existing hypertension, and in women younger than twenty-five years old or over thirty-five years old. If convulsions occur with PIH, it is called eclampsia. PIH disappears within a few weeks after birth.

stress: heightened state of nervousness or unease

diet: the total daily food intake, or the types of foods eaten

hormone: molecules produced by one set of cells that influence the function of another set of cells

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

edema: accumulation of fluid in the tissues

nausea: unpleasant sensation in the gut that precedes vomiting

Causes of Hypertension

Many prescription and **over-the-counter drugs** can cause or exacerbate hypertension. For example, corticosteroids and immunosuppressive drugs increase blood pressure in most solid-organ transplant recipients. Medication taken for pain and inflammation such as nonsteroidal anti-inflammatory drugs (NSAIDs) and cyclooxygenase-2 (COX-2) inhibitors may raise blood pressure since their antiprostaglandin properties affect the kidneys.

over-the-counter: available without a prescription

drugs: substances whose administration causes a significant change in the body's function

Tobacco products (cigarettes, cigars, smokeless tobacco) contain nicotine, which temporarily increases blood pressure (for about thirty minutes or less). The blood pressure of smokers should be rechecked after thirty minutes if initial readings are high. Nicotine patches that are used for smoking cessation do not appear to increase blood pressure.

There does not appear to be a direct relationship between caffeine and **chronic** hypertension, even though caffeine intake can cause an **acute** (rapid but brief) increase in blood pressure. This may be due to the fact that **tolerance** to caffeine develops rapidly.

chronic: over a long period

acute: rapid-onset and short-lived

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

Chronic overuse of alcohol is a potentially reversible cause of hypertension. Five percent of hypertension is due to alcohol consumption and 30 to 60 percent of alcoholics have hypertension. Alcohol-induced hypertension is more likely to occur in women than men.

Diet and Hypertension

Sodium intake has been a primary target for hypertension control, though it is ranked fourth as the lifestyle factor associated with hypertension. About 50 percent of individuals appear to be "sodium sensitive." This means that excessive sodium intake tends to increase blood pressure in these groups of people, and they do not appear to excrete excessive amount of salt via the kidneys. Sodium-sensitive individuals include the elderly, obese individuals, and African Americans. The Dietary Guidelines for Americans recommend that adults consume no more than 2,400 milligrams of sodium daily. There are a number of ways to limit sodium in the diet, including:

- Do not use salt at the table
- Check food labels for sodium content
- Choose unprocessed foods
- Limit processed meats and cheeses
- Limit pickled meats and vegetables
- Limit salty snacks
- Limit intake of soy sauce, BBQ sauce, and other condiments and foods that may be high in sodium

Potassium supplements (2–4 grams daily) have been shown to moderately decrease blood pressure. Fruits and vegetables are excellent sources of potassium. The Dietary Guidelines for Americans recommend that adults consume at least 3,500 milligrams of potassium daily. A diet high in fruits and vegetables has been linked to a decreased risk of both hypertension and stroke. Foods high in omega-3 **fatty acids** have positive effects on hypertension and **cardiovascular** disease by relaxing arteries and thinning the blood. In addition, several studies have demonstrated that individuals with hypertension may benefit from daily doses of **calcium** (800 mg) or magnesium (300 mg).

fatty acids: molecules rich in carbon and hydrogen; a component of fats

cardiovascular: related to the heart and circulatory system

calcium: mineral essential for bones and teeth

The DASH Eating Plan

Research has shown that a diet that is low in sodium but rich in calcium, potassium, and magnesium can decrease blood pressure, especially among African Americans. This eating plan is called the DASH (Dietary Approach

to Stop Hypertension) eating plan and it is as effective in decreasing blood pressure as some medications commonly used to treat hypertension. The DASH eating plan is based on 2,000 **calories** a day with 18 percent of the calories coming from protein, 55 percent from **carbohydrates**, and 27 percent from fats. The eating plan contains less **fat** than the Food Guide Pyramid, more fruits and vegetables, and includes a serving of nuts.

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Pharmacological Treatment of Hypertension

Hypertension is commonly treated with medication, and a combination of two or more drugs is common. Patients are usually given a diuretic to help them excrete excess fluids. However, most **diuretics** also cause excretion of potassium in the urine, and individuals on diuretics should monitor their potassium intakes. Drugs used to control hyertension include beta-blockers (e.g., atenolol [Tenorim]) which act to slow heart rate and cause some vasodilation (widening of the lumen, or interior, of blood vessels). Drugs that contain calcium channel blockers (e.g., amlopidine [Norvasc]) or angiotensin-converting **enzyme** (ACE) inhibitors also cause vasodilation.

diuretic: substance that depletes the body of water

enzyme: protein responsible for carrying out reactions in a cell

Lifestyle Treatment of Hypertension

Most of the risk factors for primary hypertension are preventable, and lifestyle modification may prevent as well as treat the condition. Secondary hypertension can be managed by treating the underlying cause. Individuals in the high normal and stage 1 hypertension categories should attempt to lower blood pressure through diet and lifestyle changes before going on a regimen of medications. Recommendations include:

- Eliminate tobacco
- Control stress
- Maintain weight at 15 percent or less of desirable weight
- Restrict alcohol intake to no more than two drinks a day for men and one for women (one drink equals 12 ounces of beer, 5 ounces of wine, or 1.5 ounces 80-proof whiskey)
- Restrict sodium intake to 1.5 to 2.5 grams per day (4 to 6 tsp salt)
- Exercise five to seven days a week for sixty minutes per session
- Increase intake of fruits and vegetables
- Increase intake of low-fat dairy products

SEE ALSO CARDIOVASCULAR DISEASES; HEART DISEASE.

Delores C. S. James

Bibliography

Anderson, Douglas M., et al. (2003). *Mosby's Medical, Nursing, and Allied Health Dictionary*, 6th edition. St. Louis, MO: Mosby.

Worthington-Roberts, B., and Williams, S. (1997). *Nutrition in Pregnancy and Lactation*, 6th edition. Madison, WI: Brown and Benchmark.

Internet Resources

Onusko, E. (2003). "Diagnosing Secondary Hypertension." *American Family Physician* 67:67–74. Also available from <http://www.aafp.org/afp>

National Heart, Lung, and Blood Institute. "Facts about the DASH Eating Plan." Available from <http://www.nhlbi.gov/health>

Hypoglycemia

glucose: a simple sugar; the most commonly used fuel in cells

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

insulin: hormone released by the pancreas to regulate level of sugar in the blood

hormone: molecules produced by one set of cells that influence the function of another set of cells

diabetes: inability to regulate level of sugar in the blood

Hypoglycemia, or abnormally low blood sugar, is caused by the impaired response (or failure) of the liver to release **glucose** as blood sugar levels decrease. The imbalance in the rate of glucose released from the liver and its use by other body tissues can result in the following hypoglycemic symptoms: hunger, nervousness, dizziness, confusion, sleepiness, difficulty speaking, feeling anxious or weak, irritability, sweating, loss of consciousness, and increased **blood pressure**. In diabetic individuals, too much **insulin**, limited or delayed food intake, a sudden increase in exercise, and excessive alcohol ingestion cause *fasting hypoglycemia*. *Reactive hypoglycemia*, however, occurs about four hours after a meal. The cause is unknown, but experts speculate that deficiencies in the release of glucagon (**hormone** released by the pancreas to increase blood glucose levels) and sensitivity to epinephrine (hormone released by the adrenal glands) contribute to hypoglycemia.

Normal blood sugar levels range from 70 to 110 mg/dl (milligrams per deciliter) upon waking and 70 to 140 mg/dl following meals. For those with **diabetes**, blood glucose levels before meals should be between 90 mg/dl and 130 mg/dl. One to two hours after a meal, blood glucose values should be less than 180 mg/dl. A blood sugar level of 70 mg/dl or less is defined as hypoglycemia. Severe hypoglycemia occurs when values are less than 40 mg/dl. Diagnosis of hypoglycemia requires fasting blood glucose values of less than 50mg/dl or of blood glucose values less than 70 mg/dl after ingesting food or drink. Treatment for hypoglycemia involves administering sugar in the form of glucose tablets, fruit juice, regular soft drinks, milk, hard candy, honey, or sugar. Hypoglycemia is prevented with regular meals and limiting alcohol and caffeine intake. SEE ALSO DIABETES MELLITUS; INSULIN.

Julie Lager

Bibliography

Cryer, Philip E.; Fisher, Joseph N.; and Shamoon, Harry (1994). "Hypoglycemia." *Diabetes Care* 17(7):734–755.

Internet Resources

American Diabetes Association. "Tight Diabetes Control." Available from <http://www.diabetes.org>

National Institute of Diabetes and Digestive and Kidney Diseases. "Hypoglycemia." Available from <http://www.niddk.nih.gov>

National Library of Medicine. "Diabetes." Available from <http://www.medlineplus.gov/>

Glossary

absorption: uptake by the digestive tract

acid reflux: splashing of stomach acid into the throat

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

acidosis: elevated acid level in the blood

acupuncture: insertion of needles into the skin at special points to treat disease

acute: rapid-onset and short-lived

adequate intake: nutrient intake that appears to maintain the state of health

adipose tissue: tissue containing fat deposits

aerobic: designed to maintain adequate oxygen in the bloodstream

allergen: a substance that provokes an allergic reaction

allergic reaction: immune system reaction against a substance that is otherwise harmless

allergy: immune system reaction against substances that are otherwise harmless

amenorrhea: lack of menstruation

Americanized: having adopted more American habits or characteristics

amine: compound containing nitrogen linked to hydrogen

amino acid: building block of proteins, necessary dietary nutrient

anabolic: promoting building up

anaerobic: without air, or oxygen

anaphylaxis: life-threatening allergic reaction, involving drop in blood pressure and swelling of soft tissues especially surrounding the airways

anemia: low level of red blood cells in the blood

angioplasty: reopening of clogged blood vessels

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

anthropometric: related to measurement of characteristics of the human body

antibiotic: substance that kills or prevents the growth of microorganisms

antibody: immune system protein that protects against infection

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

anxiety: nervousness

appendicitis: inflammation of the appendix

aqueous: water-based

artery: blood vessel that carries blood away from the heart toward the body tissues

arthritis: inflammation of the joints

assisted-living: facility that provides aid in meal preparation, cleaning, and other activities to help maintain independent living

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

asymptomatic: without symptoms

atherosclerosis: build-up of deposits within the blood vessels

atole: a porridge made of corn meal and milk

atoms: fundamental particles of matter

ayurvedic: an Indian healing system

B vitamins: a group of vitamins important in cell energy processes

bacteria: single-celled organisms without nuclei, some of which are infectious

bactericidal: a substance that kills bacteria

bacteriostatic: a state that prevents growth of bacteria

basal metabolic rate: rate of energy consumption by the body during a period of no activity

basal metabolism: level of body energy consumption and chemical processes in the absence of exertion

behavioral: related to behavior, in contrast to medical or other types of interventions

bile: substance produced in the liver which suspends fats for absorption

binge: uncontrolled indulgence

bioavailability: availability to living organisms, based on chemical form

biochemical: related to chemical processes within cells

biodiversity: richness of species within an area

biological: related to living organisms

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

biotoxin: poison made by living organisms

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

body mass index: weight in kilograms divided by square of the height in meters times 100; a measure of body fat

bone marrow: dividing cells within the long bones that make the blood

botanical: related to plants

botulism: poisoning from the bacterium Clostridium botulinum

bowel: intestines and rectum

brain allergy: allergy whose symptoms affect brain function

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

calcium: mineral essential for bones and teeth

calorie: unit of food energy

cancer: uncontrolled cell growth

candidal: related to the yeast Candida

candidiasis: a yeast infection

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

carbohydrate metabolism: breakdown and use of sugars and starches in the body

carcinogen: cancer-causing substance

cardiovascular: related to the heart and circulatory system

cardiovascular disease: disease affecting the heart and/or circulatory system

caries: cavities in the teeth

carotenoid: plant-derived molecules used as pigments

carrageenan: a thickener derived from red seaweed

catabolism: breakdown of complex molecules

catalyze: cause to happen more rapidly

cataract: clouding of the lens of the eye

cellulose: carbohydrate made by plants; indigestible by humans

chiropractic: manipulation of the spine and other bones for healing

cholera: bacterial infection of the small intestine causing severe diarrhea, vomiting, and dehydration

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

chronic: over a long period

chronic disease: diseases that occur over a long period, in contrast to acute diseases

clinical: related to hospitals, clinics, and patient care

cloning: creation of an exact genetic copy of an organism

congenital: present from birth

Congregate Dining: a support service that provides a meal at a central location on a specified day

constipation: difficulty passing feces

consumerism: reliance on buying, rather than making, items necessary for living

contraindicated: not recommended

convenience food: food that requires very little preparation for eating

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

cretinism: arrested mental and physical development

crossbreeding: breeding between two different varieties of an organism

cuisine: types of food and traditions of preparation

cytoplasm: contents of a cell minus the nucleus

deamination: removal of an NH2 group from a molecule

dehydration: loss of water

dementia: loss of cognitive abilities, including memory and decision making

dentition: formation of the teeth

deoxyribonucleic acid: DNA, the molecule that makes up genes

dependence: a condition in which attempts to stop use leads to withdrawal symptoms, including irritability and insomnia

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

DETERMINE: checklist used to identify nutritionally at-risk individuals

development: the process of change by which an organism becomes more complex

diabetes: inability to regulate level of sugar in the blood

diet: the total daily food intake, or the types of foods eaten

dietary assessment: analysis of nutrients in the diet

Dietary Reference Intakes: set of guidelines for nutrient intake

diphtheria: infectious disease caused by Cornybacterium diphtheriae, causing damage to the heart and other organs

disaccharide carbohydrate: molecule composed of two linked sugars

diuretic: substance that depletes the body of water

diversity: the variety of cultural traditions within a larger culture

diverticulosis: presence of abnormal small sacs in the lining of the intestine

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

drugs: substances whose administration causes a significant change in the body's function

dyslipidemia: disorder of fat metabolism

dysmorphia: the belief that one's body is different (fatter, thinner, etc.) than it really is

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

ecological: related to the environment and human interactions with it

eczema: skin disease causing itching and flaking

edema: accumulation of fluid in the tissues

efficacy: effectiveness

electrolyte: salt dissolved in fluid

elemental: made from predigested nutrients

elimination diet: diet in which particular foods are eliminated to observe the effect

endotoxin: toxic substance produced and stored within the plant tissue

enema: substance delivered via the rectum

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

enteric: pertaining to the intestine; delivered via a tube into the intestine

entrepreneur: founder of a new businesses

environment: surroundings

environmental illness: illness due to substances in the environment

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

enzyme: protein responsible for carrying out reactions in a cell

epinephrine: hormone that promotes "fight or flight;" also called adrenaline

epithelial cell: sheet of cells lining organs throughout the body

Escherichia coli: common bacterium found in human large intestine

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

estradiol: female hormone; a type of estrogen

estrogen: hormone that helps control female development and menstruation

etiology: origin and development of a disease

eukaryots: organisms whose cells contain nuclei

failure to thrive: lack of normal developmental progress or maintenance of health

famine: extended period of food shortage

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fat-soluble: able to be dissolved in fats, including the membranes of cells

fatigue: tiredness

fatty acids: molecules rich in carbon and hydrogen; a component of fats

fermentation: reaction performed by yeast or bacteria to make alcohol

fiber: indigestible plant material that aids digestion by providing bulk

folate: one of the B vitamins, also called folic acid

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

fortification: addition of vitamins and minerals to improve the nutritional content of a food

fortified: altered by addition of vitamins or minerals

free radical: highly reactive molecular fragment, which can damage cells

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

fungal: of or from fungi

galactosemia: inherited disorder preventing digestion of milk sugar, galactose

gamma rays: very high energy radiation, more powerful than x rays

gastric: related to the stomach

gastric mucosa: lining of the stomach

gastrointestinal: related to the stomach and intestines

gastrointestinal system: the digestive tract (mouth to anus) plus associated organs

gastrointestinal tract: the continuous tube through which food passes including throat, stomach, and intestines

gene: DNA sequence that codes for proteins, and thus controls inheritance

gene expression: use of a gene to make the protein it encodes

genetic: inherited or related to the genes

genetic engineering: manipulation of genes to change the characteristics of a living organism

globalization: development of world-wide economic system

glucagon: hormone that promotes release of sugar from the liver to raise the level of blood sugar

glucose: a simple sugar; the most commonly used fuel in cells

gluten: a protein found in wheat

glycerol: simple molecule that forms a portion of fats

glycogen: storage form of sugar

glycolysis: cellular reaction that begins the breakdown of sugars

growth factor: protein that stimulates growth of surrounding cells

growth hormone: hormone produced by the pituitary gland that increases the rate of growth

growth spurts: periods of rapid growth

guar gum: a thickener made from a tropical bean

Harris-Benedict equation: a formula for calculating a person's minimum energy expenditure

HDL: high density lipoprotein, a blood protein that carries cholesterol

health-promotion: related to advocacy for better health, preventive medicine, and other aspects of well-being

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

heavy metal: lead, chromium, and other metals found in the middle section of the periodic table of the elements

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

hemorrhoids: swollen blood vessels in the rectum

hepatitis: liver inflammation

hepatitis B: viral disease affecting the liver

herbal: related to or made from herbs

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

high potency: a claim about vitamin or mineral content, defined as 100% or more of the Recommended Daily Intake

homeostasis: regulation of the proper internal state

hookworm: parasitic nematode that attaches to the intestinal wall

hormone: molecules produced by one set of cells that influence the function of another set of cells

hydration: degree of water in the body

hydrolyze: to break apart through reaction with water

hygiene: cleanliness

hype: advertising and brash claims

hypercholesterolemia: high levels of cholesterol in the blood

hyperglycemia: high level of sugar in the blood

hyperlipidemia: high levels of lipids (fats or cholesterol) in the blood

hypertension: high blood pressure

hypertrophy: excess increase in size

hypoglycemia: low blood sugar level

hypoglycemic: related to low level of blood sugar

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

immunocompromised: having a weakened immune system

immunologic: related to the immune system, which protects the body from infection

incidence: number of new cases reported each year

incisor: chisel-shaped tooth used for cutting; one of the types of primary teeth

indigestion: reduced ability to digest food

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

informed consent: agreement to a procedure after understanding the risks

injera: spongy flat bread

insoluble: not able to be dissolved in water

insulin: hormone released by the pancreas to regulate level of sugar in the blood

internship: training program

interstitial: between the tissues

intestines: the two long tubes that carry out the bulk of the processes of digestion

intravenous: into the veins

iron: nutrient needed for red blood cell formation

isoflavones: estrogen-like compounds in plants

job sharing: splitting a single job among two or more people

junk food: food with high fat and sugar content, without correspondingly high amounts of protein, vitamins, or minerals

keto-acid: an acid compound containing the reactive CO group

ketoacidosis: accumulation of ketone bodies along with high acid levels in the body fluids

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

ketosis: build-up of ketone bodies in the blood, due to fat breakdown

kidney stones: deposits of solid material in kidney

killer-cell: type of white blood cell that helps protect the body from infection

kinetic: related to speed of reaction

Krebs cycle: cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

lactose intolerance: inability to digest lactose, or milk sugar

learned behaviors: actions that are acquired by training and observation, in contrast to innate behaviors

leavening: yeast or other agents used for rising bread

legumes: beans, peas, and related plants

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

lipid: fats, waxes, and steroids; important components of cell membranes

lipoprotein: blood protein that carries fats

listeriosis: infectious disease caused by Listeria bacteria

long-term care facilities: hospitals or nursing homes in which patients remain for a long time for chronic care, rather than being treated and quickly discharged

lymph node: pocket within the lymph system in which white blood cells reside

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

macrobiotic: related to a specific dietary regimen based on balancing of vital principles

macronutrient: nutrient needed in large quantities

macular degeneration: death of cells of the macula, part of the eye's retina

malabsorption: decreased ability to take up nutrients

malaise: illness or lack of energy

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

malignant: spreading to surrounding tissues; cancerous

malnourished: lack of adequate nutrients in the diet

malnutrition: chronic lack of sufficient nutrients to maintain health

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

meditation: stillness of thought, practiced to reduce tension and increase inner peace

menopausal: related to menopause, the period during which women cease to ovulate and menstruate

menopause: phase in a woman's life during which ovulation and menstruation end

menstrual cycles: the build-up and sloughing off of the lining of the uterus in women commencing at puberty and proceeding until menopause

metabolic: related to processing of nutrients and building of necessary molecules within the cell

metabolic activities: sum total of the body's biochemical processes

metabolism: the sum total of reactions in a cell or an organism

metabolism-free radical: highly reactive molecular fragment, which are created through metabolism, or processing of nutrients

metabolite: the product of metabolism, or nutrient processing within the cell

metabolize: processing of a nutrient

microflora: microscopic organisms present in small numbers

micronutrient: nutrient needed in very small quantities

microorganisms: bacteria and protists; single-celled organisms

mineral: an inorganic (non-carbon-containing) element, ion, or compound

miscarriage: loss of a pregnancy

mitochondria: small bodies within a cell that harvest energy for use by the cell

molar: grinding tooth toward the rear of the mouth

molecule: combination of atoms that form stable particles

monocultural: from a single culture

monoglyceride: breakdown product of fats

morbidity: illness or accident

mucosa: moist exchange surface within the body

muscle wasting: loss of muscle bulk

mycotoxin: poison produced by a fungus

myoglobin: oxygen storage protein in muscle

nandrolone: hormone related to testosterone

nausea: unpleasant sensation in the gut that precedes vomiting

needs assessment: formal procedure for determining needs

nervous system: the brain, spinal cord, and nerves that extend throughout the body

neural: related to the nervous system

neural tube defects: failures of proper development of the spinal cord

neurological: related to the nervous system

neuropathy: malfunction of nerve cells

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

NHANES: National Heath and Nutrition Examination Survey

niacin: one of the B vitamins, required for energy production in the cell

nitrite: NO_2, used for preservatives

nitrogen: essential element for plant growth

nonpathogenic: not promoting disease

nonpolar: without a separation if charge within the molecule; likely to be hydrophobic

nutrient: dietary substance necessary for health

nutrient deficiencies: lack of adequate nutrients in the diet

nutrition: the maintenance of health through proper eating, or the study of same

nutritional deficiency: lack of adequate nutrients in the diet

nutritional requirements: the set of substances needed in the diet to maintain health

obese: above accepted standards of weight for sex, height, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

opacity: impermeability to light

opportunistic infections: infections not normally threatening, which gain a foothold in people with weakened immune systems

oral-pharyngeal: related to mouth and throat

osteoarthritis: inflammation of the joints

osteoblast: cell that forms bone

osteomalacia: softening of the bones

osteopathic: related to the practice of osteopathy, which combines standard medical therapy with manipulation of the skeleton to correct problems

osteoporosis: weakening of the bone structure

over-the-counter: available without a prescription

overweight: weight above the accepted norm based on height, sex, and age

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

oxygen: O_2, atmospheric gas required by all animals

paralysis: inability to move

parasite: organism that feeds off of other organisms

parasitic: feeding off another organism

parasitic diseases: diseases caused by parasites, including amebic diseases, Giardia, roundworms, and others

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

pathogen: organism that causes disease

pH: level of acidity, with low numbers indicating high acidity

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

phospholipid: a type of fat used to build cell membranes

phosphorus: element essential in forming the mineral portion of bone

physiological: related to the biochemical processes of the body

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

phytate: plant compound that binds minerals, reducing their ability to be absorbed

phytochemical: chemical produced by plants

phytoestrogen: plant-derived estrogen compound

pituitary gland: gland at the base of the brain that regulates multiple body processes

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

plasma: the fluid portion of the blood, distinct from the cellular portion

plateaus: periods during which growth is greatly reduced

pluralistic: of many different sources

pneumonia: lung infection

polar: containing regions of positive and negative charge; likely to be soluble in water

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

potable: safe to drink

pre-renal: kidney disease caused by change in the blood supply to the kidney

prevalence: describing the number of cases in a population at any one time

preventive medicine: treatment designed to prevent disease, rather than waiting for it to occur before intervening

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

proscription: prohibitions, rules against

prostaglandin: hormone that helps regulate inflammation and other tissue processes

prostate: male gland surrounding the urethra that contributes fluid to the semen

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

protein digestion: breakdown of proteins into amino acids in the digestive tract

psoriasis: skin disorder characterized by red, dry, scaly skin

psychological: related to thoughts, feelings, and personal experiences

psyllium: bulk-forming laxative derived from the Plantago psyllium seeds

puberty: time of onset of sexual maturity

reactivity: characteristic set of reactions undergone due to chemical structure

Recommended Dietary Allowances: nutrient intake recommended to promote health

renal failure: inability of the kidneys to cleanse the blood

respiratory system: the lungs, throat, and muscles of respiration, or breathing

rice genome: the set of genes possessed by rice

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

ritual: ceremony or frequently repeated behavior

RNA: ribonucleic acid, used in cells to create proteins from genetic information

salmonellosis: food poisoning due to Salmonella bacteria

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

sedentary: not active

serotonin: chemical used by nerve cells to communicate with one another

serum: noncellular portion of the blood

serum estrone: blood level of estrone, a steroid hormone that is one of the estrogens, a type of female hormone

shock: state of dangerously low blood pressure and loss of blood delivered to the tissues

sideroblastosis: condition in which the blood contains an abnormally high number of sideroblasts, or red blood cells containing iron granules

sleep apnea: difficulty breathing while sleeping

smallpox: deadly viral disease

smog: air pollution

social group: tribe, clique, family, or other group of individuals

socioeconomic status: level of income and social class

staples: essential foods in the diet

steroid: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

steroid hormones: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic

sterol: building blocks of steroid hormones; a type of lipid

stillbirth: giving birth to a dead fetus

stress: heightened state of nervousness or unease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

subcutaneous: beneath the skin

sucrose: table sugar

temperate zone: region of the world between the tropics and the arctic or Antarctic

testosterone: male sex hormone

thalassemia: inherited blood disease due to defect in the hemoglobin protein

thermogregulate: regulate temperature

tofu: soybean curd, similar in consistency to cottage cheese

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

toxicant: harmful substance

toxins: poisons

trace: very small amount

trans-fatty acids: type of fat thought to increase the risk of heart disease

triglyceride: a type of fat

tuber: swollen plant stem below the ground

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

tularemia: bacterial infection by Francisella tularensis, causing fever, skin lesions, and other symptoms

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

typhoid: fever-causing bacterial infection due to Salmonella typhi; transmitted contaminated food or water

typhus: bacterial disease transmitted by infected rodents

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

uncharged: neither positively nor negatively charged

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

uric: from urine

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

vegan: person who consumes no animal products, including milk and honey

viral disease: disease caused by viruses, including flu, colds, AIDS, hepatitis, and others

virus: noncellular infectious agent that requires a host cell to reproduce

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

wasting: loss of body tissue often as a result of cancer or other disease

water-soluble: able to be dissolved in water

wean: cease breast-feeding

wellness: related to health promotion

white blood cell: immune system cell that fights infection

yeast allergy: allergy to yeasts used in baking or brewing

zinc: mineral necessary for many enzyme processes

How to go to your page

Index

*Page numbers in **bold** indicate the main article on a subject. Page numbers in italics indicate illustrations. The number preceding the colon indicates the volume number, and the number after the colon indicates the page number. The letter t after a page number indicates a table.*

A

Absorption
  defined, 1:10
  See also Digestion and absorption
Acesulfame potassium, 1:46
Acetyl coenzyme A, 1:96, 2:55, 56, 57
Acid reflux, defined, 1:256
Acidity, defined, 1:86
Acidosis, defined, 1:149
Acquired immunodeficiency syndrome. *See* HIV/AIDS
Activity disorder, 1:184
Acupuncture, 1:*32*, 2:66
  defined, 1:30
Acute, defined, 1:63
Acute diarrhea, 1:149, 150
Acute rheumatic heart disease, 1:272
ADA. *See* American Dietetic Association (ADA)
Addiction, exercise. *See* Exercise addiction
Addiction, food, **1:1**
  See also Eating disorders
Additives and preservatives, **1:1–4,** 1:*3*
  fat substitutes as additives, 1:212, 213
  and hyperactivity, 1:29
  and quackery, 2:162
  safety regulations, 1:2–4
  uses, 1:2
Adenosine triphosphate (ATP)
  carbohydrate metabolism, 2:55
  catabolism, 2:157
  cellular metabolism, 2:54
  as energy unit, 2:92, 241
  glycolysis, 1:96–97
  protein metabolism, 2:55–56
  thiamine, 1:62
Adequate Intake (AI), 1:155, 2:151, 152
  defined, 2:59
Adipose tissue
  defined, 1:68
  See also Body fat distribution
Administrative dietitians, 1:168
Adolescent nutrition, **1:4–7**
  body image, 1:69
  calcium, 1:84–85
  eating and snacking patterns, 1:5–6
  eating disorders, 2:193
  fat intake, 2:192
  high-risk groups, 1:6–7
  marketing strategies aimed at adolescents, 2:38
  nutritional needs, 1:5, *6*, *6*, 2:*103*
  obesity, 2:192–193
  popular culture, 2:192
  pregnancy weight gain, 2:144
  vegetarianism, 2:230
  See also School-aged children, diet of
ADRA (Adventist Development and Relief Agency International), 1:175*t*
Adult nutrition, **1:7–10,** 1:*9*, 84–85
  See also Aging and nutrition
Adventist Development and Relief Agency International (ADRA), 1:175*t*
Adverse reaction, 1:26
Advertising, 2:38–40
Advocacy nongovernmental organizations, 2:83
Aerobic, defined, 1:198
African Americans, diet of, **1:10–15**
  cancer, 2:167
  childhood obesity, 1:121
  diabetes, 1:144, 146
  dietary influences, 1:12–13
  elderly, 2:168
  future, 1:14
  hypertension, 1:14, 14*t*, 290, 2:167
  legacy, 1:*11*, 11–12
  origins, 1:10–11
  poverty and health, 1:13–14, 14*t*
  regional diet, 1:12, 2:166–168
  and television, 2:167–168
  See also Caribbean Islanders, diet of
Africans, diets of, **1:15–20**
  African diet, 1:16
  and African-American diet, 1:10–11
  biotechnology, 1:17
  early history of Africa, 1:15–16
  East Africa, 1:18
  food security, 1:19
  North Africa, 1:16–17, *17*
  nutrition and disease, 1:19
  Southern Africa, 1:18
  underweight, 2:35
  West Africa, 1:17–18
  See also Caribbean Islanders, diet of
Aging and nutrition, **1:20–23**
  African Americans, 2:168
  body mass index, 1:73
  calcium, 1:85, 86
  commodity foods, 1:129
  dietary problems, 1:*21*, 21–22
  medical, physical, and functional problems, 1:22–23
  nutrient-drug interactions, 2:89
  Nutrition Screening Initiative, 1:20–21
  social problems, 1:22
  vegetarianism, 2:230–231
  vitamin D, 2:235
  water, 2:50, 246
  See also Meals On Wheels; Recommended Dietary Allowances

AHA. *See* American Heart Association (AHA)
AI. *See* Adequate Intake (AI)
AIDS. *See* HIV/AIDS
Alanine, 2:155, 156*t*
Albumin, and calcium transport, 1:84
Alcohol and health, **1:23–26,** 1:23*t*, *25*
absorption, 1:172
alcoholism, 1:24–25
cancer, 1:89
college students, 1:25, 124
gastric ulcers, 1:172
heart disease, 1:274
high-risk groups, 1:25
hypertension, 1:290
nutrient-drug interactions, 2:89, 90
pregnancy, 1:220–221
Russia, 1:*119*, 120
Wernicke-Korsakoff syndrome, 2:238
wine as functional food, 1:240, 242*t*
See also Fetal alcohol syndrome (FAS)
Aldosterone, 2:248
Alimentary canal, 1:*171*
Alitame, 1:48
Allergen, defined, 1:26
Allergic reaction, defined, 1:27
Allergies and intolerances, **1:26–30**
controversies, 1:29
definitions, 1:26
food allergy, 1:*27*, 27–28, *38*
food intolerance, 1:*27*, 28
genetically modified foods, 1:66, 67, 246
peanut allergies, 1:29
rice allergies, 2:182
treatment, 1:29
Allergy, defined, 1:26
Alliance for Food Security, 1:238
Alpha tocopherol. *See* Vitamin E
Alpha-carotene, as carotenoid, 1:113
Alternative medicines and therapies, **1:29–34,** 2:161
alternative medicine, complementary medicine, and integrative medicine, 1:30
Dietary Supplement Health and Education Act (1994), 1:31–32, 33
modality selection, 1:33–34
modality types, 1:30–31, 31*t*, *32*
supplement facts label, 1:32–33
See also Dietary supplements; Macrobiotic diet
Alzheimer's disease, 2:75
AMA (American Medical Association), 1:4, 68, 97
Amalyse, 1:169, 170
Amenorrhea, 1:41, 219, 2:218–219
defined, 1:41
American Academy of Pediatrics, 2:112, 153
American Association of Advertising Agencies, 2:40
American Association of Diabetes Educators, 2:44
American Cancer Society, 1:92
American College of Cardiology, 2:30
American Dental Association, 2:10–11
American dietary trends. *See* Dietary trends, American
American Dietetic Association (ADA), **1:34**
biotechnology, 1:68
Commission on Accreditation for Dietetics Education, 1:105, 2:44, 105
Commission on Dietetic Registration, 1:106, 168, 2:44, 105
fat substitutes, 1:213
fiber intake, 1:221
functional foods, 1:243
medical nutrition therapy protocols, 2:45
vegetarianism, 2:230
American Farm Bureau Federation, 1:248
American Heart Association (AHA)
cardiac arrest, 1:*273*
fad diets, 1:205–206
lipid profile, 2:30
Mediterranean diet, 1:259–260
men and heart disease, 2:52
American Indians. *See* Native Americans
American Institute for Cancer Research, 2:117
American Marketing Association, 2:37
American Medical Association (AMA), 1:4, 68, 97
American Psychiatric Association
anorexia nervosa, 1:70–71
binge eating disorder, 1:63–64
bulimia nervosa, 1:71
eating disorders, 1:176, 177
American Public Health Association (APHA), **1:35**
American School Food Service Association (ASFSA), **1:35,** 2:*195*, 196–197
See also School food service
American School Health Association (ASHA), **1:35–36,** 1:130
Americanized, defined, 1:116
Amine, defined, 1:4
Amino acids, **1:36–38,** 1:36*t*
defined, 1:31
essential, 1:36, 36*t*, 38, 2:155–156
food sources, 1:37–38
functions of proteins, 1:37
maize, 1:134
metabolism disorders, 2:5–6
nonessential, 1:36, 36*t*, 2:155–156
protein, 2:55–56, 92, 155–156, 156*t*
structure, 1:36–37
supplements for sports nutrition, 2:218
See also Nutrients; Protein
Amylase, 1:96
Amylopectin, 1:94
Amylose, 1:94
Anabolic, defined, 1:190
Anabolic agents, as ergogenic aids, 1:190–192, *191*
Anabolism, 2:54, 157
Anaerobic, defined, 1:198
Anaphylaxis, defined, 1:28
"The Anatomy Lesson of Dr. Nicolaes Tulp" (Rembrandt), 2:224, *224*
Andorra, life expectancy in, 2:28
Android fat distribution, 1:68–69
Androstenedione, as ergogenic aid, 1:191, *191*
Anemia, **1:38–41**
Asia, 1:56
defined, 1:5
hypochromic, 1:38, 39*t*
iron-deficiency, 1:38–40, 2:153
macrocytic, 1:38, 39*t*, 2:243
megaloblastic, 1:40
microcytic, 1:38, 39*t*
normochronic, 1:38, 39*t*
nutritional deficiency, 2:103
other causes, 1:40
pernicious, 1:40, 2:243
sickle-cell, 1:*39*
treatment, 1:40–41
types and causes, 1:39*t*
women, 2:259
Angioplasty, defined, 1:59
Angiotensin, 2:248
Angular cheilosis, 2:111
Animal proteins, 2:156
Animals, biotechnology in, 1:65–66
Anorexia nervosa, **1:41–42**
binge eating/purging type, 1:177
body image, 1:*70*, 70–71

defined, 1:41
diagnosis, 1:177
inpatient hospitalization, 1:180
malnutrition, 2:140
medication, 1:181
prevalence, 1:184
restricting type, 1:177
treatment outcomes, 1:181
See also Eating disorders
Anthropometric, defined, 1:42
Anthropometric measurements, **1:42,** 2:35, 99–101, 100*t*
See also Body mass index; Nutritional assessment; Waist-to-hip ratio
Anti-aging products, as quackery, 2:162
Antibacterial soaps, 2:3
Antibiotics
defined, 1:91
nutrient-drug interactions, 2:89
resistance to, 1:246
and vitamin K, 2:236
Antibody, defined, 1:37
Antidepressants
for eating disorders, 1:180–181
nutrient-drug interactions, 2:89
Antigens, 1:37
Antigua, 1:110
Antimicrobial agents, as food additive, 1:2
Antioxidants, **1:42–44,** 1:*43*
and cancer prevention, 1:91
carotenoids as, 1:112
defined, 1:1
as food additive, 1:2, 242*t*
as functional food, 1:242*t*
health benefits and food sources, 1:44*t*
vitamin E as, 2:237
Ants, 2:202, *202*
Anxiety, defined, 1:1
APHA (American Public Health Association), 1:35
Apollo space program, 2:212
Appendicitis, defined, 1:8
Appert, Nicholas, 1:4
Appetite, 1:22, **1:44–45,** 2:89
See also Hunger
Apples/apple juice, glycemic index, 1:251*t*
Aquavit, 2:188
Aqueous, defined, 1:216
Arepa, 2:202–203
Argentina, 2:201, 203
Arginine, 2:156*t*
Ariboflavinosis, 2:238
Arteries, hardening of. *See* Atherosclerosis
Arteriosclerosis, **1:45–46**
See also Atherosclerosis; Cardiovascular disease (CVD)
Artery, 1:99, *101*
defined, 1:45
Arthritis
defined, 1:22
remedies as quackery, 2:162
Artificial colors, 1:2
Artificial flavors and flavor enhancers, 1:2
Artificial sweeteners, **1:46–48,** 1:*47*
American dietary trend, 1:160, *160*
FDA-approved artificial sweeteners, 1:46–47
pending FDA approval, 1:48
sugar alcohols, 1:47
See also Generally recognized as safe; Phenylketonuria
Ascorbic acid. *See* Vitamin C
ASFSA (American School Food Service Association), 1:35, 2:*195*, 196–197
ASHA (American School Health Association), 1:35–36, 130
Asian Americans, diets of, **1:48–52**
childhood obesity, 1:122
fiber, 1:221
food habits, 1:*49*, 49–51
traditional Asian diet, 1:50*t*
See also Asians, diet of
Asian Diet Pyramid, 1:51, *57*
Asian Indians, diet of, 1:50*t*, 55
Asians, diet of, **1:52–59,** 1:*57*
body image, 1:*163*
East Asia, 1:53–54
food security, 1:55
fruit, 1:52–53, 54
merits and weaknesses, 1:50*t*
micronutrient deficiency, 1:55–56
nutritional transition, 1:56–57
obesity, 1:*163*
osteomalacia, 2:122
other common ingredients, 1:53
rice, 1:52, *53*
South Asia, 1:55
Southeast Asia, 1:54–55
underweight, 2:35
See also Asian Americans, diets of
Asparagine, 2:156*t*
Aspartame, 1:46
Aspirin, 2:88*t*
Assisted-living, defined, 1:22
Asthma, defined, 1:4
Asymptomatic, defined, 1:149
Atherosclerosis, **1:59,** 1:100, 217, 273–274
defined, 1:59
See also Arteriosclerosis; Cardiovascular disease (CVD)
Athletes. *See* Female athlete triad; Sports nutrition
Atkins, Robert, 1:97, *204*
Atkins Diet, 1:97, 203*t*, 204, *204*, 206
Atole, defined, 1:113
Atoms, defined, 1:47
ATP. *See* Adenosine triphosphate (ATP)
Australia
food-borne illness, 2:118
life expectancy, 2:28
skin cancer, 1:88
Avidin, 2:242
Ayurvedic, defined, 1:30

B

B vitamins
defined, 1:115
and oral health, 2:111
See also specific B vitamins by name
Baby bottle tooth decay, **1:59–60,** 2:10–11, 111, 153
See also Oral health
BAC (blood alcohol concentration), 1:23
Bacillus cereus, 2:120*t*
Baciullus thuringiensis, 1:246–247
Bacteria
defined, 1:1
and food-borne illness, 2:119
Bactericidal, defined, 1:1
Bacteriostatic, defined, 1:1
Bad cholesterol. *See* Low-density lipoprotein (LDL)
Bagels, glycemic index, 1:251*t*
Bam (Iran) earthquake, 2:226
Bananas, 1:110, 251*t*
"Bangers and mash," 2:*85*
Banting, William, 1:205
Baraka, Amiri, 1:12
Barbados, 1:110
Barbecue, 1:12
Basal metabolic rate (BMR)
adults, 1:8, *9*
defined, 1:8
menopause, 2:48
and weight loss, 2:248, 250
Battle Creek Sanitarium, **1:60–62,** 1:*61*, 2:16, 17, 254
See also Kellogg, John Harvey; White, Ellen G.
Beauty pageant contestants, 1:69

Beckham, David, 2:*247*
Behavioral, defined, 1:91
Beikost, **1:62,** 2:*9*, 10–11
Belize, 1:110
Benign tumors, 1:90
Beriberi, **1:62**
  Funk, Casimir, 1:244
  nutritional deficiency, 2:103
  and rice, 2:181
  and thiamine, 2:238
  Tulp, Nicolaas, 2:224
Berndtson, Keith, 1:279–280
Beta-carotene, **1:62–63**
  as antioxidant, 1:43, 44*t*
  as carotenoid, 1:113, 2:232, 234
  and golden rice, 2:182, 264
  and lung cancer, 2:234
  risks, 1:*157*
  supplements during pregnancy, 2:36
  See also Carotenoids; Vitamin A
Beta-hydroxy beta-methylbutyrate (HMB), 1:190
Beta-oxidation, 2:56
Beverages
  with antioxidants, 1:242*t*
  Caribbean Islands, 1:108
  chocolate, 1:81*t*
  glycemic index, 1:251*t*
  nutrient-drug interactions, 2:*89*, 90
Bezoars, **1:63**
Bile, defined, 1:169
Binge, defined, 1:41
Binge eating, **1:63–64**
  diagnosis, 1:177–178
  as eating disturbance, 1:182, 184
  and malnutrition, 2:140
  medication, 1:181
  prevalence, 1:184
  See also Bulimia nervosa; Eating disorders
Bioavailability, **1:64,** 2:59
  defined, 1:64
  See also Nutrients
Biochemical, defined, 1:152
Biodiversity, defined, 1:67
Biological, defined, 1:45
Biologics Control Act (1902), 2:73
Biotechnology, **1:64–68**
  Africa, 1:17
  in animals, 1:65–66
  food production concerns, 1:66–67
  food safety, 1:67–68, 237
  genetic engineering, 1:65, *66*
  and global health, 1:67
  safety and labeling, 1:67–68
  See also Genetically modified foods
Bioterrorism, and food safety, 1:237–238, 2:172
Biotin (vitamin B_8), 2:94, 240*t*, 241–242
  defined, 1:169
Biotoxin, defined, 2:120
Biphosphonates, 2:124
Birth control pills, 2:88*t*
Birth defects, 2:142–143, 234, 243
Bleaching agents, as food additive, 1:2
Blood, and space physiology, 2:212
Blood alcohol concentration (BAC), 1:23
Blood clotting, defined, 1:83
Blood pressure, 1:99, *100*
  defined, 1:13
Blood proteins, 2:158
Blood soup, 2:80
BMI. *See* Body mass index (BMI)
BMR. *See* Basal metabolic rate (BMR)
Body fat distribution, **1:68–69**
  and body mass index, 1:72–73
  measuring with calipers, 2:101, 102, *253*
  menopause, 2:48
  nutritional assessment, 2:100–101
  as physical fitness component, 1:200
  See also Waist-to-hip ratio
Body image, **1:69–71,** 1:*70*, *163*, 179, *179*
  See also Eating disorders
Body mass index (BMI), **1:71–74,** 1:*72*, 73*t*
  and cardiovascular disease, 1:101
  children, 1:121
  defined, 1:42
  in nutritional assessment, 2:100
  and obesity, 2:105, 125, 140
  and overweight, 2:125, 140
  and pregnancy, 2:142, 143, 143*t*, 146
  and underweight, 2:225
  See also Obesity
Bolivia, 2:202, 203
Bone loss
  and menopause, 2:48
  and space travel, 2:210–211, 215
Bone marrow, defined, 1:40
Boron, as ergogenic aid, 1:190
Botanical, defined, 1:31
Botulism, 2:1, 3–4
  defined, 2:1
Bovine somatotropin (BST), 1:65–66, *262*
Bovine spongiform encephalopathy (BSE), 2:118–119, *119*, 187
Bowel, defined, 1:91
Brain allergy, defined, 1:29
Brazil, 2:201, 202
Breadfruit, 1:108, 2:127, 130, *130*
Breads
  glycemic index, 1:251*t*
  marketing strategies, 2:38
  Mediterranean diet, 1:257
Breakfast
  School Breakfast Program, 1:284, 2:97, 190–191, 194
  sports nutrition, 2:216
Breast cancer
  and estrogen replacement therapy, 2:48, *49*
  and letrozol, 2:75
  and physical activity, 1:92
  and soy, 2:208
  women's nutritional issues, 2:260
  See also Cancer
Breastfeeding, **1:74–78,** 1:77
  benefits, 1:75, 75*t*, 2:146
  breast implants and breast reduction, 1:76–77
  contraindications, 1:77
  and diarrhea, 1:150, 151
  infant nutrition, 2:8–9, 11
  mastitis, 2:41, *41*
  nutrition for, 1:76, 2:259
  physiology, 1:76
  policies and recommendations, 1:77–78
  and rickets, 2:184
  supplementing with formula, 2:38–39
  Ten Steps to Successful Breastfeeding program, 2:226
  trends, 1:75–76
  and vegetarianism, 2:230
  and vitamin D, 2:235
  and vitamin K, 2:236
  WIC program, 2:255, 256, 257
  See also Formula feeding; Infant nutrition
Breastfeeding caries. *See* Baby bottle tooth decay
Bright-light therapy, 2:149, *149*
Brillat-Savarin, Jean Anthelme, 1:*78*, **1:78–79**
British Virgin Islands, 1:110
Broth, 2:80
Brush border enzymes, 2:157
BSE (bovine spongiform encephalopathy), 2:118–119, *119*, 187
BST (bovine somatotropin), 1:65–66, *262*
Buddhist food practices, 2:175, 176, 178*t*

Bulgaria, 1:118
Bulimia, defined, 1:70
Bulimia nervosa, **1:79–80**
body image, 1:71
diagnosis, 1:177
history, 1:181
inpatient hospitalization, 1:180
and malnutrition, 2:140
medication, 1:181
nonpurging type, 1:177
prevalence, 1:184
purging type, 1:177
treatment outcomes, 1:181
See also Binge eating; Eating disorders
Burgers, cultural influences on, 1:187–188
Bush, George W., and stem cell research, 2:75
Bush tea, 1:109

C

CACFP (Child and Adult Care Food Program), 1:129, 284
CAD. *See* Coronary artery disease (CAD)
CADE (Commission on Accreditation for Dietetics Education), 1:105, 2:44, 105
Caffeine, **1:80–83**
effect on body, 1:80
effect on mood, 2:66
as ergogenic aid, 1:192
in food and drugs, 1:81, 81*t*
and health, 1:*82*, 82–83
and hypertension, 1:290
nutrient-drug interactions, 2:*89*
during pregnancy, 2:145
religious proscriptions, 2:176
Cajun cooking, 1:12–13
Calcidiol, 2:235
Calciferol. *See* Vitamin D
Calcification, 2:183, 185
Calcitonin, 1:84, 2:124
Calcitriol, 2:183, 235
Calcium, **1:83–87**
adolescents, 1:5, *6*
and caffeine, 1:82
deficiency, 1:84, 2:61
defined, 1:5
disease prevention and treatment, 2:61
functions, 2:60
and lactose intolerance, 2:22–23
lead poisoning prevention, 2:24, 26
in orange juice, 1:242*t*, 243
and osteomalacia, 2:122
and osteoporosis, 1:10, 85, *85*, 2:61, 124
during pregnancy, 2:145
for premenstrual syndrome, 2:148
preschoolers and toddlers, 2:152, 153
requirements and supplementation, 1:84–87, *85*, 86*t*
and soy, 2:208
and space travel, 2:210, 215
sports nutrition, 2:217
supplements, 2:59
toxicity, 1:84, 2:61
in vegetarianism, 2:230
and vitamin D, 2:235
women, 2:259, 260
See also Osteoporosis
Calcium carbonate, 1:86*t*
Calcium citrate, 1:86*t*
Calcium glubionate, 1:86*t*
Calcium gluconate, 1:86*t*
Calcium lactate, 1:86*t*
Calcium phosphate, 1:86*t*
Calipers, skinfold, 2:101, 102, *253*
Calories, **1:87**
adolescents, 1:5
alcoholic beverages and mixers, 1:23*t*
American dietary trends, 1:160, 161
defined, 1:5
effect on mood, 2:66*t*
infant nutrition, 2:8
international dietary trends, 1:162
and marasmus, 2:36, 37
needs of obese, 2:105
preschoolers and toddlers, 2:151–152, 152*t*
during space travel, 2:214
sports nutrition, 2:216
and vegetarianism, 2:230, 231
See also Protein-energy malnutrition (PEM)
CAM (complementary and alternative medicine), 1:30, 2:148–149
See also Alternative medicines and therapies
Cambodians, diet of, 1:50*t*
Campaigning nongovernmental organizations, 2:83
Campylobacter jejuni, 2:1, 119, 120*t*
Canadians, Recommended Nutrient Intakes for, 1:155
Cancer, **1:87–92**
African Americans, 2:167
breast, 1:92, 2:48, *49*, 75, 208, 260
and caffeine, 1:82
carcinogenesis process, 1:90–91
causes, 1:88–90, *90*
colon, 1:91, 92
cures as quackery, 2:163
defined, 1:3
and diet, 1:91, 92
and food additives, 1:3–4
growth and spread, 1:88, *89*
lung, 2:234
macrobiotic diet, 2:*32*, 33
men, 2:51, *52*
nutrition for people with cancer, 1:92
and pesticides, 2:116, 117
and physical activity, 1:91
prevalence, 1:88
prevention, 1:91, 2:234
prostate, 1:91, 2:208, 234
and saccharin, 1:47
and soy, 2:208
types, 1:88
and vitamin C, 2:134, 167
See also Antioxidants; Phytochemicals
Cancer Prevention Study (2002), 2:199
Candidal, defined, 2:154
Candidiasis, defined, 2:108
Canning, discovery of, 1:4
Capillaries, 1:99
Capsaicin intolerance, 1:28
Carbohydrate-based fat substitutes, 1:212, 212*t*, 217–218
Carbohydrates, **1:93–99**
absorption, 1:172
carbohydrate-modified diets, 1:97, 98
chemical structure, 1:93
complex, 1:94–96, *95*, 2:91
counting, 1:98
defined, 1:8
and diabetes, 1:98
digestion and absorption, 1:96
and eating disturbances, 1:184
effect on mood, 2:66*t*
exchange system, 1:98
glycolysis, 1:96–97
low-carb diets, 1:97
metabolism, 2:6–7, 54–55
as nutrient, 2:91–92
recommended intake, 1:93, 97
simple, 1:93–94, 94*t*, 2:91
sports nutrition, 2:216
See also Glycemic index
Carcinogen, 1:89
defined, 1:4

Carcinogenesis process, 1:90–91
Carcinoma, 1:88
Cardiac arrest, 1:272, *273*, 2:75
Cardiovascular, defined, 1:8
Cardiovascular disease (CVD), **1:99–104,** 1:*102*
  Asia, 1:56, 57
  atherosclerosis, 1:100
  and caffeine, 1:82
  Central Europe and Russia, 1:117–118, 119–120
  coronary artery disease, 1:100, *101*
  hypertension, 1:99–100, *100*, 103
  and lipid profile, 2:28
  and lycopene, 2:234
  preventing, 1:100–103
  stroke, 1:100
  See also Arteriosclerosis; Atherosclerosis; Heart disease
Cardiovascular fitness, 1:200
The Care and Feeding of Southern Babies (Wilson), 2:258, *258*
CARE (Cooperative for Assistance and Relief Everywhere), 1:175*t*
Careers in dietetics, **1:104–107**
  knowledge and skills, 1:106
  practice roles, 1:104–105
  registration and licensure, 1:106
  training, 1:105–106
  See also Dietetic technician, registered (DTR); Dietitian; Nutritionist
Caribbean Cooperation in Health, 1:111
Caribbean Food and Nutrition Institute (CFNI), 1:111
Caribbean Islanders, diet of, **1:107–112**
  European settlement, 1:107–108, *108*
  foods of the islands, 1:*108*, 108–110, 110*t*
  health issues, 1:110–111, 112
  public health initiatives, 1:111–112
Caries, 2:110, 111–112, 153
  defined, 1:46
  See also see Baby bottle tooth decay
Carotenoids, 1:43, **1:112–113,** 2:232, 234
  defined, 1:42
  See also Antioxidants; Beta-carotene; Vitamin A
Carpal tunnel syndrome, 2:242
Carrageenan, defined, 1:212
Carrots, glycemic index, 1:251*t*
Catabolism, 2:54, 157
  defined, 1:150
Catalyze, defined, 2:242
Cataracts, 2:234, 238
  defined, 1:56
Catholic food practices, 2:176, *176*, 178–179, 178*t*
Cavities, 2:110, 111–112, 153
  See also see Baby bottle tooth decay
CBOs (community-based organizations), 2:83
CCK (cholecystokinin), 1:170, 216
CDC. *See* U.S. Centers for Disease Control and Prevention (CDC)
CDE (Certified Diabetes Educator), 1:105
CDR. *See* Commission on Dietetic Registration (CDR)
Celebrities, in advertising, 2:*39*
Cellulose, defined, 1:95
Central Americans and Mexicans, diets of, **1:113–117**
  changes in dietary practices, 1:116
  cooking methods, 1:114–115
  dishes, 1:115
  fruits and vegetables, 1:114
  influence of Central American and Mexican culture, 1:116
  nutritional benefits, 1:115
  nutritional limitations, 1:115–116
  traditional dietary habits, 1:113–114, *114*
  See also Hispanics and Latinos, diet of; South Americans, diet of
Central Europeans and Russians, diets of, **1:117–121,** 1:120*t*
  Central Europe, 1:117–118
  former Soviet Union (Russian Federation), 1:118, *119*
  lifestyle and nutrition, 1:118–120, *119*
  See also Northern Europeans, diet of; Southern Europeans, diet of
Ceramic cookware, and lead poisoning, 2:25
Cereal
  Battle Creek Sanitarium, 1:60–61, *61*
  marketing strategies, 2:37, *39*
  Mediterranean diet, 1:257
Cerebrovascular accident (CVA), 1:100, 147
Certification
  nutritionists, 1:105, 266, 2:105
  organic foods, 2:114
Certified Diabetes Educator (CDE), 1:105
Certified health education specialist (CHES), 1:266
Certified in Nutrition Support (CNS), 1:105
CFNI (Caribbean Food and Nutrition Institute), 1:111
CFNP (Community Food and Nutrition Program), 1:285
Champagne, 2:87
Channel One, 2:191
Chasteberry, 2:148
CHD (congenital heart disease), 1:272, 2:48, *49*
Check Out for Children program, 2:227
Chelating agents, as food additive, 1:2
Chelation therapy, for lead poisoning, 2:26–27
CHES (certified health education specialist), 1:266
Chewing difficulties, 1:21, 2:110, 111
Child and Adult Care Food Program (CACFP), 1:129, 284
Child Nutrition Act (1972), 2:255–256
Childhood obesity, **1:121–123,** 1:*122*, 2:153, 192–193
  See also Obesity
Children
  African-American, 2:166–167
  and caffeine, 1:82
  calcium requirements, 1:84–85, 86
  dental caries, 2:110, 111–112
  diarrhea, 1:149–151
  fiber requirements, 1:221–222
  food insecurity, 1:*229*, 229–230
  homeless, 1:283–284
  iron requirements, 1:39
  kwashiorkor, 2:21
  lead poisoning, 2:24, 25, *25*, 26
  malnutrition, 2:33–34, *34*, 35, *36*
  marasmus, 2:35–36
  marketing strategies aimed at, 2:38, *38*
  Mexican-American, 2:168
  nutritional deficiency, 2:*103*
  obesity, 2:153
  overweight, 2:153, 192–193
  protein requirement, 2:159
  and vegetarianism, 2:230
  white American, 2:166–167
  See also Adolescent nutrition; Preschoolers and toddlers, diet of; School-aged children, diet of
Chile, 2:201, 202, 203
China
  food-borne illness, 2:118
  functional foods, 1:241
Chinese, diet of, 1:50*t*, 53, 221
Chinese Americans, diet of, 1:50
Chiropractic, defined, 1:30
Chitin, as ergogenic aid, 1:192
Chloride, 2:60, 61

Chocolate
caffeine in, 1:81*t*
effect on mood, 2:*65*, *66*
Cholecystokinin (CCK), 1:170, 216
Cholera, 2:75
defined, 2:73
Cholesterol
and cardiovascular disease, 1:103
defined, 1:33
and fat intake, 1:217
Healthy Eating Index, 1:268
metabolism, 2:57–58, 77
optimal, borderline, and high levels, 2:29*t*, 30
and rice, 2:181–182
and saturated fatty acids, 2:93
Cholesterol, bad. *See* Low-density lipoprotein (LDL)
Cholesterol, good. *See* High-density lipoprotein (HDL)
Cholesterol to HDL ratio, 2:29*t*, 30
Choline, 2:244
Christmas, 2:189
Chromium, 1:191, 2:62
Chronic, defined, 1:6
Chronic diarrhea, 1:149
Chronic diseases
Asian Americans, 1:51
women's nutritional issues, 2:260–261, *261*
Chronic rheumatic heart disease, 1:272
Church World Service (CWS), 1:175*t*
Chylomicrons, 1:216, 2:29
Chyme, 1:169–170, 171
Chymosin, 1:65
Cigarettes. *See* Smoking
Circadian rhythms, 2:65–66
Cirrhosis of the liver, 1:24, *25*
Citric acid cycle, 1:96–97, 2:55
Clinical, defined, 1:62
Clinical dietitians, 1:104–105, 168
Cloning, defined, 1:66
Clostridium botulinum, 2:1, 120*t*
Clostridium perfringens, 2:1, 119, 120*t*
CNS (Certified in Nutrition Support), 1:105
Cobalamin, 1:40
Coca-Cola, 2:136, *136*
Coconuts, 1:53, 110
Code of Federal Regulations, 1:232, 233
Cod-liver oil, 2:46, *47*, 234–235
Coenzyme A, 2:241
Coffee
caffeine, 1:81, 81*t*
South America, 2:201, 202, 203
Cognitive restructuring, and weight management, 2:251
Colcannon, 2:86
Cold, common
and hand washing, 2:3
and vitamin C, 2:134, 244
Collagen, 2:244
College students, diets of, **1:123–127,** 1:*124*, *126*
alcohol use, 1:25, 124
eating patterns and serving sizes, 1:123
female students, 1:124–125
food and nutrient intake, 1:123–125
male students, 1:124
recommendations for improvement, 1:125–126
Colombia, 2:201, 202, *202*
Colon cancer, 1:91, 92
Color Additives Amendment (1960), 1:2–3
Color food additives, 1:2–4
Colostrum, 1:76
Columbus, Christopher, 2:78, 79
Combs, Sean "P. Diddy," 2:*217*
Comfort foods, 1:137
Commission on Accreditation for Dietetics Education (CADE), 1:105, 2:44, 105
Commission on Dietetic Registration (CDR), 1:106, 168, 2:44, 105
Commodity foods, **1:127–130,** 1:*129*
Commodity Supplemental Food Program, 1:127, 2:97
for disaster relief, 1:128
Emergency Food Assistance Program, 1:128
Food and Nutrition Service (FNS), 1:127, 128
Food Distribution Program on Indian Reservations, 1:128
other programs, 1:128–129
See also Nutrition programs in the community; WIC program
Commodity Supplemental Food Program (CSFP), 1:127, 2:97
Common cold
and hand washing, 2:3
and vitamin C, 2:134, 244
Communion, 2:176, *176*
Community Food and Nutrition Program (CFNP), 1:285
Community gardens, 2:222
Community nutrition programs, 2:96–99, *98*
Community Nutritionists, 1:105
Community-based organizations (CBOs), 2:83
Community-supported agriculture (CSA), 2:222
Complementary and alternative medicine (CAM), 1:30, 2:148–149
See also Alternative medicines and therapies
Complete proteins, 2:156
Complex carbohydrates, 1:94–96, *95*, 2:91
Comprehensive School Health Program (CSHP), **1:130–132,** 1:*131*
Compulsive overeating. *See* Binge eating
Congenital, defined, 1:40
Congenital heart disease (CHD), 1:272, 2:48, *49*
Congenital lactose intolerance, 2:22
Congregate Dining, defined, 1:22
Constipation
and calcium, 1:84
defined, 1:8
Consumerism, defined, 2:139
Contaminated water, 1:150, 173, 174–175, 2:*228*
Continuing Survey of Food Intakes by Individuals (CSFII), 1:160, *269*, 2:72
Contraindicated, defined, 1:192
Convenience foods, **1:132–133**
American dietary trend, 1:160
defined, 1:51
popular culture, 2:141
See also Fast foods
Convention on the Rights of the Child, 2:226, 227–228
Cooking difficulties, 1:22
Cool down, in exercise, 1:201
Cooperative for Assistance and Relief Everywhere (CARE), 1:175*t*
Copper, 2:62, 63
Corn, genetically modified, 1:245, 246–247, 248
Corn flakes cereal, 2:16, *17*
Corn- or maize-based diets, 1:*133*, **1:133–136**
maize varieties, 1:133–134
Native Americans, 2:79
protein quality, 1:134
vitamins, 1:134–136, *135*
See also Rice-based diets
Cornaro, Luigi, 1:255
Coronary artery disease (CAD), 1:272–274
as cardiovascular disease, 1:100, *101*
and fat intake, 1:217
and omega-6 fatty acids, 2:109

Coronary artery disease *(continued)*
prevention, 1:274, *274*
risk factors, 1:274
See also Cardiovascular disease (CVD)
Coronary heart disease
defined, 1:99
and estrogen, 2:48
Coumadin, 2:88*t*, 236, 237
Cous-cous, 1:17
Cows, in Hinduism, 2:176–177, *177*
Cravings, **1:136–139,** 1:*138*
causes, 1:136–138
conquering, 1:138–139
as eating disturbance, 1:184
during pregnancy, 1:136, 2:146
See also Eating disorders
Creatine, as ergogenic aid, 1:190, 2:218
Creole cooking, 1:12–13
Cretinism, defined, 1:252
Creutzfeldt-Jakob disease, 2:118–119
Crossbreeding, 1:65, 245
defined, 1:65
Cruveilhier, Jean, 1:79
Cruveilhier's disease, 1:79, 172
CSA (community-supported agriculture), 2:222
CSFII (Continuing Survey of Food Intakes by Individuals), 1:160, *269*, 2:72
CSFP (Commodity Supplemental Food Program), 1:127, 2:97
CSHP (Comprehensive School Health Program), 1:130–132, *131*
Cuban Americans. *See* Hispanics and Latinos, diet of
Cuisine, defined, 1:12
Cultural competence, **1:139–142**
attaining, 1:140, *140*, 141
and healthcare, 1:139–140
organizational responsibilities, 1:140–142
Curry, 1:109
Cuy, 2:*202*
CVA (cerebrovascular accident), 1:100, 147
CVD. *See* Cardiovascular disease (CVD)
CWS (Church World Service), 1:175*t*
Cyclamate, 1:48
Cyclospora cayetanensis, 2:1, 120
Cysteine, 2:156*t*
Cytoplasm, defined, 1:96
Cytotoxic testing, for food allergies, 1:29

D

Dairy products
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:257
with probiotics, 1:242*t*
See also Milk
DALE (Disability Adjusted Life Expectancy), 2:28
DASH (Dietary Approach to Stop Hypertension), 1:100, 290–291
Deamination, 2:157
defined, 2:56
Defibrillators, 1:*273*
Deficiencies
calcium, 1:84, 2:61
fluoride, 2:63
iodine, 1:56, 2:35, 63, 159–160
iron, 1:38–40, 56, 2:24, 26, 62–63, 153
magnesium, 2:61
minerals, 2:61, 62–63
niacin (vitamin B_3), 2:103
nutritional, 1:38, 2:102–104, *103*
potassium, 2:61
selenium, 2:63
sodium, 2:61
thiamine (vitamin B_1), 1:62, 2:103, 181
vitamin A, 1:56, 2:233*t*, 234, 264
vitamin C, 1:119, 120, 2:219–220, *220*
vitamin E, 2:233*t*, 237
vitamin K, 2:94, 233*t*, 236
zinc, 2:63
See also Vitamin D deficiency
Dehydration, **1:142–143**
defined, 1:142
and fasting, 2:175
and food-borne illness, 2:3, 4
occurrence, 2:247
sports nutrition, 2:217, *217*
See also Oral rehydration therapy
Delaney Clause, 1:3
Dementia, defined, 1:135
Denaturation, of proteins, 1:37
Dent corn, 1:133
Dental caries, 2:110, 111–112, 153
See also see Baby bottle tooth decay
Deoxyribonucleic acid (DNA)
and cancer, 1:90, 91
defined, 1:245
Human Genome Project, 2:75
Dependence, defined, 1:24
Depression
defined, 1:22
and eating disorders, 1:178
and serotonin, 2:66–67, 75
DERA (Disaster Preparedness and Emergency Response Association), 1:175*t*
Dermatitis, 2:135, *135*
DETERMINE, defined, 1:21
Developing countries
breastfeeding, 2:146
diarrhea, 1:149–151
fast food, 1:*165*
food insecurity, 1:228, 229–230
food-borne illness, 2:118
hunger, 1:287
kwashiorkor, 2:20
lead poisoning, 2:24, 26
malnutrition, 2:34, *34*
maternal mortality rate, 2:42
oral health, 2:111
undernutrition, 2:111, 141
underweight, 2:35
vitamin A deficiency, 2:234
water pasteurization, 2:133
Development, defined, 1:272
DEXA (dual energy X-ray absorbitometry) scans, 2:124
DHS (U.S. Department of Homeland Security), 2:172
Diabetes, defined, 1:5
Diabetes mellitus, **1:143–148**
adolescents, 1:6
African Americans, 1:14, 14*t*
and carbohydrates, 1:98, 2:54
complications, 1:146
exchange system, 1:98
gestational diabetes, 1:145, 2:146, 259
glycemic index, 1:250, 251
and heart disease, 1:147, 274
Hispanic Americans, 1:277
and hyperglycemia, 1:287–288
and hypoglycemia, 1:292
men, 2:51
Native Americans, 2:81
Pacific Islander Americans, 2:126
prevalence, 1:143–144, 164
and socioeconomic status, 2:167
and stroke, 1:147
treatment, 1:*144*, *145*, 147–148, 2:77
types, 1:144–146
women, 2:260
See also Exchange system; Hyperglycemia; Insulin
Diabetic ketoacidosis (DKA), 1:146
Diabetic retinopathy, 1:146
Diarrhea, 1:*149*, **1:149–151**
acute, 1:149, 150

causes, 1:149, 150*t*
chronic, 1:149
developing countries, 1:149–151
HIV/AIDS patients, 1:280
traveler's, 1:149
treatment, 1:151, 2:113
See also Oral rehydration therapy
Diastolic pressure, 1:99, *100*, 288
Diet, **1:151–152**
defined, 1:7
high-fiber, 1:222, 2:37
high-protein, 2:249
influence on health, 1:*163*, 164
low-carb, 1:97
macrobiotic, 2:31–33, *32*
whole foods, 1:242*t*, 2:255
See also Eating habits
Diet and Health, 1:154
Dietary Approach to Stop Hypertension (DASH), 1:100, 290–291
Dietary assessment, **1:152,** 2:214
See also Nutritional assessment
Dietary directors, 1:168
Dietary Goals for the United States, 1:153–154
Dietary Guidelines, **1:153–154**
early dietary advice, 1:153
evolution, 1:153–154
versus food guides, 1:153
and Healthy Eating Index, 1:267
and Howard Johnson's restaurants, 2:16
and hypertension, 1:290
school food service, 2:194
school-aged children, 2:191
See also Food Guide Pyramid
Dietary Reference Intakes (DRIs), **1:155**
defined, 1:20
elderly, 1:20
National Academy of Sciences, 2:67
preschoolers and toddlers, 2:151
See also Recommended Dietary Allowances (RDAs)
Dietary Supplement Health and Education Act (DSHEA) (1994), 1:31–32, 33, 156, 157–158, 241–243, 2:74
Dietary supplements, **1:155–159**
American dietary trend, 1:159
baby boomers, 1:156
as biologically-based treatment, 1:31
controversies, 1:157–158
dangerous ergogenic aids, 1:193
Food and Drug Administration, 1:33, 156, 158, 2:59–60
and medical nutrition therapy, 2:43
minerals, 2:59–60, *60*
and popular culture, 2:141
preschoolers and toddlers, 2:153
and quackery, 2:161–162, 163–164
regulation, 1:156–157
selecting, 1:33–34
supplement facts label, 1:32–33
See also Alternative medicines and therapies; Vitamins, fat-soluble; Vitamins, water-soluble
Dietary trends, American, **1:159–162**
away-from-home foods, 1:163–164
by decade, 1:161*t*
dietary patterns, 1:159
nutritional adequacy, 1:161–162
obesity, 1:164
portion sizes, caloric intake, and obesity, 1:160
sweet, quick, and easy, 1:160, *160*
Dietary trends, international, **1:162–165**
food safety, 1:164–165
influence of diet on health, 1:*163*, 164
Westernization of dietary patterns, 1:163–164, *165*
Dietetic technician, registered (DTR), 1:104, 106, **1:166**
See also Careers in dietetics
Dietetics, **1:166–167**
See also Careers in dietetics
Dieting, **1:167–168**
chronic, 1:185
and eating disorders, 1:179
and eating disturbances, 1:184–185
and popular culture, 2:141
and weight cycling, 1:184–185
Dietitian, 1:106, *168*, **1:168–169**
See also Careers in dietetics; Nutritionist
Diets, corn- or maize-based. *See* Corn- or maize-based diets
Diets, fad. *See* Fad diets
Diets, rice-based. *See* Rice-based diets
Digestion and absorption, **1:169–173,** 1:*171*
absorption, 1:172
difficulties, 1:22
factors affecting, 1:250
fat-soluble vitamins, 2:232
fiber, 1:221, 222
GI tract physiology, 1:169
nutrients into blood or to heart, 1:172
protective factors, 1:170–171
protein, 2:157
from stomach to small intestine, 1:169–170
See also Glycemic index (GI)
Dilantin, 2:88*t*
Dipeptides, 1:37
Diphtheria, defined, 2:132
Direct additives, 1:1
Direct Relief International (DRI), 1:175*t*
Disability Adjusted Life Expectancy (DALE), 2:28
Disaccharide carbohydrate, defined, 2:21
Disaccharides, 1:93–94, 94*t*
Disaster Preparedness and Emergency Response Association (DERA), 1:175*t*
Disaster relief organizations, **1:173–176,** 1:175*t*
commodity foods, 1:128
disease risks, 1:174–176
health risks, 1:173–174, *174*
needs assessment, 1:173
See also Emergency Nutrition Network; Famine
Discourse on a Sober and Temperate Life (Cornaro), 1:255
Disease
and exercise, 1:199–200
infectious, 1:35, 2:234
and minerals, 2:60–61, 62
and obesity, 1:217
risks after disasters, 1:174–176
vector-borne, 1:176
Disease-risk reduction claims. *See* Health claims
The Diseases of Children and Their Remedies (Rosenstein), 2:186, *186*
Dispensable amino acids, 1:36, 36*t*, 2:155–156
Diuretics, 1:291
defined, 1:142
Diversity, defined, 1:10
Diverticulosis, defined, 1:8
DKA (diabetic ketoacidosis), 1:146
DNA
and cancer, 1:90, 91
defined, 1:40
Human Genome Project, 2:75
Dominica
popular dishes, 1:110
public health initiative, 1:111
Dopamine, effect on mood, 2:64, 66*t*
Double-blind, placebo-controlled food challenge, 1:28
Dowager's hump, 2:124, *124*
Dr. Atkins' New Diet Revolution, 1:97, 203*t*, 204, *204*, 206

DRI (Direct Relief International), 1:175*t*
Drinking water. *See* Water
DRIs. *See* Dietary Reference Intakes (DRIs)
Drug-nutrient interactions. *See* Nutrient-drug interactions
Drugs
  defined, 1:3
  function, 2:88
DSHEA. *See* Dietary Supplement Health and Education Act (DSHEA) (1994)
DTR (dietetic technician, registered), 1:104, 106, 166
Dual energy X-ray absorbitometry (DEXA scans), 2:124
Duodenum, 1:170
Dyazide, 2:88*t*
Dysentery, 1:149, 2:3
Dyslipidemia, defined, 1:122
Dysmorphia, 1:70, 71
  defined, 1:70

E

E. coli. *See* Escherichia coli
EAR (Estimated Average Requirement), 1:155
Earthquake (Bam, Iran), 2:226
East Africans, diet of, 1:18
East Asians, diet of, 1:53–54
Eastern Orthodox Christianity food practices, 2:176, 178*t*
Eating disorder not otherwise specified (EDNOS), 1:178
Eating disorders, **1:176–182,** 1:*179*, *180*
  adolescents, 1:6, 2:193
  athletes, 1:125
  body image, 1:69–71, *70*
  causes, 1:179
  college students, 1:124–125
  defined, 1:41
  diagnosis, 1:176–178
  in female athlete triad, 1:219, 2:218
  Fiji, 2:131
  history, 1:181
  and malnutrition, 2:140
  outcomes, 1:181
  prevalence, 1:178, 184
  risk factors, 1:178–179
  treatment modalities, 1:179–181
  See also Anorexia nervosa; Bulimia nervosa
Eating disturbances, **1:182–185,** 1:*183*
  binge eating, 1:63–64, 177–178, 181, 182, 184, 2:140
  chronic dieting, 1:185
  cravings, 1:136–139, *138*, 184
  excessive exercising, 1:184
  weight cycling, 1:184–185, 2:250, 264–265
  See also Eating disorders
Eating habits, **1:186–188**
  exposure to foods, 1:187, *187*
  food choice influences, 1:*186*, 187–188
  obtaining, storing, using, and discarding food, 1:187
  what people eat, 1:187
  why and how people eat, 1:186
  See also Popular culture, and food
Ebola vaccine, 2:75
Eclampsia, 1:289
Ecological, defined, 1:188
Ecuador, 2:201, *202*, 203
Eczema, defined, 2:5
Edamame, 2:208, 210
Edema, 2:158, 248
  defined, 1:289
EDNOS (eating disorder not otherwise specified), 1:178
Efficacy, defined, 1:156
EFNEP (Expanded Food Nutrition and Education Program), 1:202–203
Eggs, 1:*241*, 242*t*, 2:242
El Salvador, 1:113
Elderly. *See* Aging and nutrition
Electrolytes
  defined, 1:37
  for dehydration, 2:4
  HIV/AIDS patients, 1:280
Electronic pasteurization, 2:13–14
Elemental, defined, 1:84
Elimination diet, defined, 1:28
The Emergency Food Assistance Program (TEFAP), 1:128, 284–285
Emergency Health Kits, 1:174
Emergency Nutrition Network (ENN), **1:189**
  See also Disaster relief organizations
Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES), 1:225
EMPRES (Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases), 1:225
Endorphins, effect on mood, 2:*65*, 66
Endotoxins
  defined, 1:245
  in genetically modified foods, 1:246–247
Enema, defined, 2:61
Energy, defined, 1:5
Energy boosters (ergogenic aids), 1:192
Energy needs. *See* Calories
Energy therapies, 1:31, 31*t*
England, 2:84, *85*
Enhanced foods, as functional food type, 1:242*t*
ENN (Emergency Nutrition Network), 1:189
Enriched foods, as functional food type, 1:242*t*
Enrichment, 1:239
  defined, 1:2
Enteral nutrition, 1:281
Enteric, defined, 2:35
Entrepreneur, defined, 1:61
Environment, defined, 1:22
Environmental illness, defined, 1:29
Enzymatic, defined, 1:65
Enzymes
  and biotechnology, 1:65
  brush border, 2:157
  defined, 1:24
  and protein, 2:158
  role, 1:37
EPA (U.S. Environmental Protection Agency), 2:172
Ephedra, 1:192, 2:218
Epiglottis, 1:169, 170
Epinephrine, defined, 2:244
Epithelial cells, defined, 1:88
Erectile dysfunction, 2:53
Ergogenic aids, **1:189–193**
  anabolic agents, 1:190–192, *191*
  dangerous supplements, 1:193
  energy boosters, 1:192
  weight loss agents, 1:192
  See also Dietary supplements; Sports nutrition
Errors of metabolism, inborn. *See* Inborn errors of metabolism
ERT. *See* Estrogen replacement therapy (ERT)
Erythrocyte, 1:38, 2:212
Erythrosine, 1:3–4
Escherichia coli, 2:1–2, 3, 118, 119, 120*t*
  defined, 2:1
Essential amino acids, 1:36, 36*t*, 38, 2:155–156
Essential fatty acids, 2:94, 108–109
  defined, 1:210
Essential hypertension, 1:289

Estimated Average Requirement (EAR), 1:155
Estradiol, defined, 1:191
Estrogen
and coronary heart disease, 2:48
defined, 1:92
female athletes, 2:218–219
versus isoflavones, 2:14
Estrogen replacement therapy (ERT), 2:48, *49*, 124, 208
Ethiopian refugees, 2:*165*
Ethnicity, and body mass index, 1:73
Etiology, defined, 2:33
Etiquette, and eating habits, 1:186
Europe, food additive and preservative regulation, 1:4
European Union
artificial sweeteners, 1:48
genetically modified foods, 1:248
organic foods, 2:115
European Union Scientific Committee for Food, 1:4, 47
Europeans, Central. *See* Central Europeans and Russians, diets of
Europeans, Northern. *See* Northern Europeans, diet of
Europeans, Southern. *See* Southern Europeans, diet of
Evaporated milk, 2:10
Exchange system, 1:147, **1:193–197,** 1:287
advantages and disadvantages, 1:194–196
definition, 1:194
history, 1:196–197, 196*t*, 197*t*
using, 1:195
See also Diabetes
Exercise, **1:198–201**
aerobic, 1:198
anaerobic, 1:198
benefits, 1:198–199, *199*
and cancer, 1:91
and cardiovascular disease, 1:100–101, 103
childhood obesity, 1:122
defined, 1:198
and dehydration, 1:143
and diabetes, 1:147, 287–288
and disease prevention, 1:199–200
and endorphins, 2:66
excessive, 1:184
and heart disease, 1:274
and insulin, 2:13
and menopause, 2:48, 50
and obesity, 2:106
physical fitness components, 1:200
and pregnancy, 2:144–145
for premenstrual syndrome, 2:148
recommended, 1:201
and space travel, 2:211–212
strategies, 2:251
trends, 1:161
and weight management, 1:205–206, 2:107, 249, 251, *252*
See also Sports nutrition
Exercise addiction, **1:201–202,** 1:*202*
Expanded Food Nutrition and Education Program (EFNEP), **1:202–203**
"Extra lean," as nutrient content claim, 1:265*t*
Extracellular fluid compartment, 1:37

F

Fad diets, 1:167, **1:203–206,** 1:203*t*, *204*, 2:141, 250
See also Dieting; Weight loss diets
FAE (fetal alcohol effects), 1:25, 220
Failure to thrive, **1:206–207**
defined, 1:167
See also Infant nutrition
Famine, **1:207–208,** 1:*208*
defined, 1:19
See also Food insecurity
FAO (Food and Agriculture Organization), 1:118, 224–225, 248
Farmers markets, 2:97, 222, 256–257
FAS (fetal alcohol syndrome), 1:25, *220*, 220–221
Fast foods, 1:*209*, **1:209–210**
American dietary trend, 1:160
Caribbean Islands, 1:110
defined, 1:111
developing countries, 1:*165*
and health, 2:*52*
popular culture, 2:139–140, *140*
Saudi Arabia, 1:*165*
school-aged children, 2:192
See also Convenience foods
Fasting, **1:210**
and dehydration, 2:175
and gastric acidity, 2:175
and lipid profile, 2:29–30
religion and dietary practices, 2:174–175, 176, 177, 178–179
See also Dieting; Religion and dietary practices
Fasting hypoglycemia, 1:292
Fat substitutes, **1:210–214,** 1:217–219
carbohydrate-based, 1:212, 212*t*, 217–218
categories, 1:*211*, 212–213, 212*t*
described, 1:211–212
effectiveness, 1:213–214, 213*t*
fat-based, 1:212*t*, 213, 218–219
protein-based, 1:212, 212*t*, 218
safety, 1:213
See also Artificial sweeteners; Fats
Fat-free products, 1:219
Fatigue, defined, 1:5
Fats, **1:214–219,** 1:*217*
absorption, 1:172
actual and recommended intake, 1:216–217, *218*
adolescents, 2:192
and cancer, 1:91
and cardiovascular disease, 1:101–102
defined, 1:7
fat-replacement strategies, 1:217–219
function, metabolism, and storage, 1:215–216
Healthy Eating Index, 1:267–268
Mediterranean diet, 1:259, 260
metabolism, 1:216, 2:56–57
as nutrient, 1:210–211, 216, 2:92–94
sports nutrition, 2:216
See also Fat substitutes; Lipid profile
Fat-soluble vitamins. *See* Vitamins, fat-soluble
Fatty acids
defined, 1:31
metabolism disorders, 2:7
FDA. *See* U.S. Food and Drug Administration (FDA)
FDAMA (Food and Drug Administration Modernization Act) (1997), 1:264–265
FD&C Red No. 3, 1:3–4
FD&C Yellow No. 3, 1:4
FDPIR (Food Distribution Program on Indian Reservations), 1:128
Federal Food, Drug, and Cosmetic Act (1938), 1:241–243
Color Additives Amendment (1960), 1:2–3
Food Additives Amendment (1958), 1:2
Federal Register, 1:232
Federation Internationale de Football Association (FIFA), 2:227–228
Feijoda completa, 2:202
Female athlete triad, 1:125, **1:219–220,** 2:218–219
See also Eating disorders; Osteoporosis; Sports nutrition
Females. *See* Women's nutritional issues

Fermentation
as biotechnology technique, 1:65
defined, 1:4
Fertilizers, 2:221
Fetal alcohol effects (FAE), 1:25, 220
Fetal alcohol syndrome (FAS), 1:25, *220*, **1:220–221**
See also Alcohol and health; Pregnancy
Fetus, 2:*145*
FH (Food for the Hungry), 1:175*t*
Fiber, **1:221–223**
actual and recommended intake, 1:221–222
and cancer, 1:91
and cardiovascular disease, 1:103
as complex carbohydrate, 1:94–96, 2:91
defined, 1:8
food content, 1:222*t*
as functional food, 1:242*t*
high-fiber diets, 1:222
insoluble, 1:221
intake during menopause, 2:50
in juices, 1:242*t*
recommended intake, 1:97
soluble, 1:221
types, 1:221
FIFA (Federation Internationale de Football Association), 2:227–228
Fight-or-flight response, 1:138
Fiji, 2:131
Filipinos, diet of, 1:50*t*, 54–55
Finland, vitamin C deficiency in, 1:120
Fish
as functional food, 1:242*t*
and omega-3 fatty acids, 2:108, 109, *109*
Pacific Islanders, 2:130
Scandinavia, 2:188, *188*
Fish stew, 2:204
FITT (Frequency, Intensity, Time, Type) principle, 1:200–201
Flavonoids, and heart disease, 1:240
Flaxseed, as functional food, 1:242*t*
Flexibility, as physical fitness component, 1:200
Flint corn, 1:133
Flower corn, 1:133
Fluids
compartments for, 1:37
pregnancy, 2:144
and protein, 2:158
space travel, 2:214
sports nutrition, 2:*217*, 217–218, 218*t*
Fluoride
deficiency, 2:63
disease prevention and treatment, 2:62
infant nutrition, 2:8
and oral health, 2:112
toxicity, 2:63
Fluorosis, 2:63
FMNV (foods of minimum nutritional value), 2:195, 196
FNS. *See* U.S. Food and Nutrition Service (FNS)
Folate, 2:240*t*, 242–243
and anemia, 1:40
defined, 1:38
fortification of food, 1:242*t*, 2:72
and pregnancy, 1:40, 2:142–143
women, 2:259
Folic acid. *See* Folate
Folk remedies
African Americans, 1:13
lead poisoning, 2:26
Follicular hyperkeratosis, 2:234
Food additives
defined, 1:2
See also Additives and preservatives
Food Additives Amendment (1958), 1:2
Food Aid for Development and the World Food Programme, 1:223–224, *224*
See also Famine; Food insecurity; United Nations
Food and Agriculture Organization (FAO), 1:118, **1:224–225,** 1:248
See also Famine; Food insecurity; United Nations
Food and Agriculture Organization Joint Expert Committee on Food Additives, 1:4
Food and Drug Administration Modernization Act (FDAMA) (1997), 1:264–265
Food Code, 1:235–236
Food Distribution Program on Indian Reservations (FDPIR), 1:128
Food for the Hungry (FH), 1:175*t*
Food Guide Pyramid, **1:225–228,** 1:*227*
alternative pyramids, 1:226–227
and DASH eating plan, 1:291
design and recommendations, 1:225–226
and Dietary Guidelines, 1:153, 154
elderly, 1:20
and Healthy Eating Index, 1:267
nutrients, 2:*93*
school-aged children, 2:191
uses, 1:226
Vegetarian Food Guide Pyramid, 2:231
See also Dietary Guidelines
Food Guide Pyramid for Young Children, 2:151, 191
Food habits. *See* Eating habits
Food insecurity, **1:228–231,** 1:*229*
Africa, 1:19
after disasters, 1:173–174, *174*
Asia, 1:55
and hunger, 1:287
See also Famine; Hunger; Malnutrition
Food jags, 2:153
Food labels, **1:231–235**
dietary supplements, 1:156
fat content, 1:216, *217*, 219
Food and Drug Administration, 1:232–233, 234, 237, 241–243, 2:161
functional foods, 1:241–243
genetically modified foods, 1:67–68, 248
ingredient list, 1:232
and marketing strategies, 2:39
net quantity of contents, 1:232
Nutrition Facts statement, 1:233, *234*
nutrition labeling, 1:232–234, 233*t*
organic foods, 1:237, 2:114
overview, 1:231–232
Percent Daily Value, 1:233*t*, 234
Product Identity statement, 1:232
required nutrients, 1:233–234
serving size, 1:234
See also Health claims; Regulatory agencies
Food poisoning
defined, 1:164
See also Illnesses, food-borne
Food safety, **1:235–239**
additives and preservatives, 1:2–4
biotechnology, 1:67–68, 237
bioterrorism, 1:237–238, 2:172
control and oversight, 1:235–236
fat substitutes, 1:213
food-borne illness, 1:236, *237*
genetically modified foods, 1:246–248
international dietary trends, 1:164–165
organic foods, 2:116–117
pesticides, 1:236–237
regulation history and purpose, 1:238–239, 238*t*

World Health Organization, 2:172–173, 262–263
See also Biotechnology; Genetically modified foods; Irradiation; Pesticides
Food Safety Initiative Activity, 2:172
Food security. *See* Food insecurity
Food Stamp Program, 1:127, 128, 284, 2:97, 256*t*
Food-based dietary guidelines, 2:205
Food-borne illness. *See* Illnesses, food-borne
Food-borne organisms. *See* Organisms, food-borne
Food-for-Growth program, 1:223
Food-for-Life program, 1:223
Food-for-Work program, 1:223–224, *224*
Foods of minimum nutritional value (FMNV), 2:195, 196
Formula feeding, 1:242*t*, 2:9–10, 38–39
See also Breastfeeding; Infant nutrition
Fortification, **1:239,** 1:242*t*, 2:72
defined, 1:2
See also Functional foods
Fortified, defined, 1:2
Fractures, and osteoporosis, 2:124, 125
Framingham Heart Study, 1:103
France
diet, 2:86–87
food-borne illness, 2:118, 119
life expectancy, 2:28
organic foods, 2:115
See also French paradox
Franchising, 2:15, *15*
"Free," as nutrient content claim, 1:265*t*
Free food, in exchange system, 1:195
Free radicals
and antioxidants, 1:42, 43–44
and carotenoids, 2:234
and cigarette smoke, 1:*43*
defined, 1:42
French Guiana, 2:203
French paradox, **1:239–240,** 2:84
See also France; Heart disease
French Wine Coca, 2:135–136
Frequency, Intensity, Time, Type (FITT) principle, 1:200–201
Fructose, 1:93, 94*t*
Fruit juice
glycemic index, 1:251*t*
nutrient-drug interaction, 2:89
and oral health, 2:111–112
Fruits
Asia, 1:52–53, 54
and cancer prevention, 1:91
Caribbean Islands, 1:108–109, 110
Central America and Mexico, 1:114
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:257
FTC (U.S. Federal Trade Commission), 2:164
Functional foods, **1:240–243,** 1:*241*
antioxidants, 1:43–44
defined, 1:43
future, 1:243
popular culture, 2:141
regulations, 1:241–243
types, 1:242*t*
See also Antioxidants; Phytochemicals
Fungal, defined, 1:279
Funk, Casimir, 1:*244*, **1:244–245**
See also Vitamins, fat-soluble; Vitamins, water-soluble

G

Galactose, 1:93, 2:6, 21
Galactosemia, 2:6
defined, 1:75
Gallbladder, 1:170
Gamma butyrolactone and gamma hydroxy butyric acid (GBL/GHB), 1:193
Gamma rays, defined, 2:13
Garlic, 1:242*t*, 2:*161*
Gasoline, leaded, 2:24, 25
Gastric, defined, 1:79
Gastric acidity, 2:175
Gastric ulcer, 1:79, 172
Gastrointestinal, defined, 1:27
Gastrointestinal tract physiology, 1:169
GAVI (Global Alliance for Vaccines and Immunizations), 2:227
GBL/GHB (gamma butyrolactone and gamma hydroxy butyric acid), 1:193
GDNNPP (Global Database on National Nutrition Policies and Programmes), 1:249–250
Gemini space program, 2:212
Gene expression, defined, 2:55
Generally Recognized as Safe (GRAS), **1:245**
artificial sweeteners, 1:46–47
fat substitutes, 1:212, 213
sugar alcohols, 1:47
See also Food safety
Genes
and cancer, 1:90
defined, 1:24
and obesity, 2:106
Genetic, defined, 1:38
Genetic engineering, 1:65, *66*
Genetically modified foods, **1:245–248**
acceptance, 1:*247*, 248
examples, 1:245–246
labeling, 1:248
potatoes, 1:245, 246–247
rice, 1:*66*, 68, 245, 246–247, 2:182, 264
safety, 1:237, 246–248
soybeans, 1:245
tomatoes, 1:65, 245–246
See also Biotechnology; Food safety
Genetics, defined, 2:47
Genistein, 2:208
Germany
herbal therapy, 1:157
organic foods, 2:115
Gestational diabetes, 1:145, 2:146, 259
GI (glycemic index), 1:250–252, 251*t*, 2:13
See also Carbohydrates; Diabetes mellitus
GI tract physiology, 1:169
Giardia lamblia, 2:120, 120*t*
Ginger, for seasickness, 1:33
Gingivitis, 2:*112*
Ginseng, as ergogenic aid, 1:192
Give Me Five program, 2:227
Glandular fever, 2:*12*
Glickman, Dan, 2:*151*
Glisson, Francis, 1:*249*, **1:249**
Global Alliance for Vaccines and Immunizations (GAVI), 2:227
Global Database on National Nutrition Policies and Programmes (GDNNPP), **1:249–250**
Global Movement for Children program, 2:228
Global Outbreak Alert and Response Network (GORAN), 2:262
Global Polio Eradication Initiative, 2:227
Global Public Health Intelligence Network (GPHIN), 2:262
Globalization, defined, 1:116
Glossitis, 2:111
Glucagon, 1:170
Gluconeogenesis, 2:55, 57
Glucose
defined, 1:28

Glucose *(continued)*
and diabetes, 1:*144*, 147
as energy source, 2:91–92
and inborn errors of metabolism, 2:6, 7
and insulin, 1:37, *37*
and lactose intolerance, 2:21
metabolism, 2:54
and pregnancy, 2:144
as simple carbohydrate, 1:93, 94*t*
Glutamine, 2:156*t*
Gluten, defined, 2:42
Glycemic index (GI), **1:250–252,** 1:251*t*, 2:13
See also Carbohydrates; Diabetes mellitus
Glycerol, 2:57
defined, 2:29
Glycine, 2:155, 156*t*
Glycogen
as complex carbohydrate, 1:94
defined, 1:94
and sports nutrition, 2:216
storage diseases, 2:6–7
Glycogenesis, 2:55
Glycogenolysis, 2:55
Glycolysis, 1:96–97, 2:55, 57, 157
defined, 1:93
GMP (Good Manufacturing Practice), 1:158
GnRH (gonadotropin-releasing hormone) agonists, 2:149
Goiter, 1:*252*, **1:252–253**
Goldberger, Joseph, 1:*253*, **1:253–254,** 2:73
See also Pellagra
Golden rice, 1:*66*, 68, 245, 246–247, 2:182, 264
Gonadotropin-releasing hormone (GnRH) agonists, 2:149
Good cholesterol. *See* High-density lipoprotein (HDL)
Good Manufacturing Practice (GMP), 1:158
"Good source," as nutrient content claim, 1:265*t*
GORAN (Global Outbreak Alert and Response Network), 2:262
"Got Milk?" advertisements, 2:37–38
GPHIN (Global Public Health Intelligence Network), 2:262
GR (Green Revolution), 1:261–262, 2:182
Graham, Sylvester, **1:254–255**
Grains, as functional food, 1:242*t*
Grapefruit, glycemic index, 1:251*t*
Grapes/grape juice, 1:240, 242*t*
GRAS. *See* Generally Recognized as Safe (GRAS)
Grazing, **1:255–256**
See also Eating habits; Snacking
Greece, life expectancy in, 2:28
Greeks and Middle Easterners, diet of, **1:256–261,** 1:*257*
culture, 1:259
food preparation and storage, 1:258, 259*t*
Mediterranean Basin, 1:256
nutrition and disease, 1:259–260
present day, 1:258
traditional, 1:256–258
Green Revolution (GR), **1:261–262,** 2:182
Grenada
popular dishes, 1:110
public health initiative, 1:112
Growth charts, **1:262,** 2:72
Growth factor, defined, 1:91
Growth hormone, 1:246, **1:262–263**
See also Ergogenic aids
Growth spurts, defined, 1:86
Guadeloupe, 1:110
Guar gum, defined, 1:212
Guatemala, 1:113
Guinea pigs, 2:*202*
Gumbo, 1:11, *11*, 13
Gums, as dietary fiber, 1:96
Guthrie test, 2:*5*
Guyana, 1:110, 2:203
Gynoid fat distribution, 1:68

H

HACCP (Hazard Analysis Critical Control Point) system, 1:236, 2:121, 172
Haggis, 2:85
Halal foods, 1:258, 259*t*, 2:177
Hand washing, 2:3, 12, 120, 121
Hardening of the arteries. *See* Atherosclerosis
Harris-Benedict equation, 2:101, 102
defined, 2:101
Harvey, William, 1:205
Hawaiians. *See* Pacific Islander Americans, diet of; Pacific Islanders, diet of
Hazard Analysis Critical Control Point (HACCP) system, 1:236, 2:121, 172
HDL
defined, 1:191
See also High-density lipoprotein (HDL)
Head Start program, 2:98
Health, **1:263**
See also Health promotion
Health, or How to Live (Graham), 1:255
Health claims, **1:263–266**
dietary supplements, 1:156
food labels, 1:232
functional foods, 1:242, 243
general requirements, 1:265
"healthy," 1:264
and marketing strategies, 2:37–38
nutrient content claims, 1:264, 265*t*
soy protein, 1:243, 2:207
types, 1:265–266
See also Food labels; Regulatory agencies
Health communication, **1:266**
Health education, 1:131, **1:266–267**
Health promotion, **1:267**
defined, 1:106
"Healthy," on food labels, 1:264
Healthy Eating Index (HEI), **1:267–269,** 1:*268*
Healthy People (1979), 1:269
Healthy People 2000 report, 1:210, 270, 271
Healthy People 2010 report, **1:269–271,** 1:*270*
African Americans, 1:14
childhood obesity, 1:121
dental caries, 2:110
exercise, 1:198, 201
Heart attack, 1:272, *273*, 2:75
defined, 1:59
Heart disease, **1:271–275,** 1:*273*, *274*
adolescent risk, 1:6
congenital, 1:272
coronary artery disease, 1:272–274
defined, 1:5
and diabetes, 1:147
French paradox, 1:239–240
and hypertension, 1:*289*
men, 2:51–53, *52*
myocardial infarction, 1:272, 2:75
Native Americans, 2:81
and omega-3 fatty acids, 2:108–109
Pacific Islander Americans, 2:126–127
rheumatic, 1:272
and soy, 2:207–208
women, 2:260–261
See also Atherosclerosis; Cardiovascular disease (CVD)
Heartburn, during pregnancy, 2:146
Heavy metal, defined, 2:23
HEI (Healthy Eating Index), 1:267–269, *268*

Height and weight tables, 2:99–100, 100*t*
Hemicellulose, 1:95
Hemoglobin, defined, 1:38
Hemorrhoids, defined, 1:8
Henrich, Christy, 1:*180*
Hepatitis, defined, 1:24
Hepatitis A, 2:118, 119, 120*t*
Hepatitis C, and breastfeeding, 2:146
Herbal, defined, 1:54
Herbicide-resistant weeds, 1:246
Herbs
  as dietary supplement, 1:156, 157, 2:49
  in food and beverages, as functional food, 1:242*t*
  in menopause, 2:49
HGH (human growth hormone), 1:262–263
HHANES (Hispanic Health and Nutrition Examination Survey), 2:69
HHS. *See* U.S. Department of Health and Human Services (HHS)
HHS (hyperosmolar hyperglycemia state), 1:146
"High," as nutrient content claim, 1:265*t*
High blood pressure
  defined, 1:14
  See also Hypertension
High potency, defined, 1:33
High-density lipoprotein (HDL)
  and cardiovascular disease, 1:103
  cholesterol/HDL ratio, 2:29*t*, 30
  HDL/LDL ratio values, 2:30*t*
  in lipid profile, 2:29, 30
  optimal, borderline, and high levels, 2:29*t*
  and soy, 2:207
High-fiber diets, 1:222, 2:37
High-protein diets, 2:249
High-quality proteins, 2:156
High-yield variety (HYV) seeds, 1:261–262
Hindu food practices, 2:175, 176–177, *177*, 178*t*
Hispanic Health and Nutrition Examination Survey (HHANES), 2:69
Hispanics and Latinos, diet of, **1:275–279,** 1:278*t*
  acculturation, 1:276–278, 2:169
  characteristics, 1:275–276, *277*
  childhood obesity, 1:121
  diet-related disease, 1:14*t*
  regional diet, 2:168–169
  socioeconomic status, 2:168, 169
  See also Central Americans and Mexicans, diets of
Histidine, 2:156*t*
HIV/AIDS, **1:279–282,** 1:*281*
  antiretrovital drugs, 2:76
  breastfeeding, 2:146
  complications, 1:280
  cures as quackery, 2:163
  ethical considerations for care, 1:281–282
  nutrition, 1:279–280
  oral nutrition alternatives, 1:280–281
  statistics, 1:280
  United Nations Children's Fund (UNICEF), 2:226
  See also Immune system
HMB (beta-hydroxy beta-methylbutyrate), 1:190
Hmongs, diet of, 1:50*t*
Homelessness, **1:282–287,** 1:*283*
  diet deficits, 1:285–286
  government programs, 1:284–285
  organizations, 1:285
  poverty and undernutrition, 1:283
  undernutrition among children, 1:283–284
  See also Food insecurity
Homeostasis, 2:245, 246
  defined, 2:144
Hong Kong, organic foods in, 2:115
Hookworm, defined, 1:40
Hoppin' John, 1:11, 12
Hormiga, 2:202, *202*
Hormone replacement therapy. *See* Estrogen replacement therapy (ERT)
Hormones
  and cravings, 1:137
  defined, 1:31
  production, 2:158
  regulatory functions, 1:37
Howard Johnson's restaurants, 2:15, *15*, 16
HRT (hormone replacement therapy). *See* Estrogen replacement therapy (ERT)
Human Genome Project, 2:75
Human growth hormone (HGH), 1:262–263
Human immunodeficiency virus. *See* HIV/AIDS
Human subjects, 2:75–76
Hungary, 1:118
Hunger, 1:44–45, **1:287**
  See also Appetite; Food insecurity
Hydration, defined, 1:72
Hydrochloric acid, 2:157
Hydrogen breath test, 2:22
Hydrolysis, 2:157
Hydrolyze, defined, 2:157
Hygiene, defined, 1:236
Hygienic Laboratory, 2:73
Hype, defined, 1:33
Hyperactivity, 1:29
Hypercalcemia, 1:84
Hypercarotenemia, 2:234
Hypercholesterolemia, defined, 1:117
Hyperglycemia, 1:146, 148, **1:287–288**
  defined, 1:143
  See also Diabetes mellitus; Insulin
Hyperinsulinemia, 1:145
Hyperlipidemia, defined, 1:164
Hyperosmolar hyperglycemia state (HHS), 1:146
Hypertension, **1:288–291,** 1:*289*
  African Americans, 1:14, 14*t*, 290, 2:167
  Asia, 1:56–57
  as cardiovascular disease, 1:99–100, *100*, 103
  causes, 1:289–290
  DASH eating plan, 1:290–291
  defined, 1:10
  described, 1:288
  and diet, 1:290
  and exercise, 1:199
  lifestyle treatment, 1:291, 2:76–77
  men, 2:53
  pharmacological treatment, 1:291
  and potassium, 2:167
  and pregnancy, 1:289, 2:223
  primary, 1:289
  and rice, 2:181
  secondary, 1:289, 291
  types, 1:289
  women, 2:261
  See also Cardiovascular disease (CVD)
Hypertrophy, defined, 1:190
Hypervitaminosis A, 2:233*t*, 234
Hypochromic anemia, 1:38, 39*t*
Hypoglycemia, 1:24, **1:292**
  defined, 1:24
  See also Diabetes mellitus
HYV (high-yield variety) seeds, 1:261–262

I

IBIDS (International Bibliographic Information on Dietary Supplements), 1:156
Ice cream, glycemic index, 1:251*t*

IFG (impaired fasting glucose), 1:145
IGT (impaired glucose tolerance), 1:145
Ileum, 1:170
Illnesses, food-borne, 1:236, *237*, **2:1–4**
causes, 2:1–3, *2*
historical outbreaks, 2:118–119
international dietary trends, 1:164–165
intoxication and infection, 2:1, 120*t*
magnitude, 2:118
and organic foods, 2:116
Pacific Islands, 2:132
prevention, 2:3, 121
Scandinavia, 2:187
South America, 2:203–204
symptoms, 2:3
treatment, 2:3–4
See also Food safety; Organisms, food-borne
The Immune Advantage (Mazo and Berndtson), 1:279–280
Immune system, 2:1, 3, **2:4,** 2:34, 232
defined, 1:26
See also Infection
Immunocomprised, defined, 2:117
Immunoglobulins, 1:37
Immunologic, defined, 1:75
Immunoproteins, 1:37
Impaired fasting glucose (IFG), 1:145
Impaired glucose tolerance (IGT), 1:145
Impotence, 2:53
Inborn errors of metabolism, **2:4–7,** 2:5
amino acid metabolism disorders, 2:5–6
carbohydrate metabolism disorders, 2:6–7
See also Phenylketonuria (PKU)
Incidence, defined, 1:41
Incisor, defined, 2:153
Incomplete proteins, 2:156
India, oral cancer in, 1:88
Indian corn, 1:134
Indians, American. *See* Native Americans
Indians, Asian, diet of, 1:50*t*, 55
Indigestion, defined, 1:256
Indirect additives, 1:1
See also Additives and preservatives
Indispensable amino acids, 1:36, 36*t*, 38, 2:155–156
Infant mortality rate, **2:7–8**
See also Maternal mortality rate
Infant nutrition, **2:8–12**
beikost (solid food), 1:62, 2:9, 10–11
breastfeeding, 2:8–9, 11
calcium, 1:84–85
formula feeding, 2:9–10
nutrient requirements, 2:8
protein, 2:159
self-feeding, 2:11
South, 2:258, *258*
vegetarianism, 2:230
vitamin D, 2:235
vitamin E, 2:237
WIC program, 2:255, 256, 257, *257*
See also Beikost; Breastfeeding
Infection, 2:*12*, **2:12**
and diarrhea, 1:149, 150
as food-borne illness, 2:1, 120*t*
and malnutrition, 2:34
mastitis, 2:41, *41*
See also Immune system
Infectious agents, and cancer, 1:89–90, 91
Infectious diseases
defined, 1:35
and vitamin A deficiency, 2:234
Informed consent, defined, 2:75
Insoluble, defined, 1:63
Insoluble fiber, 1:221
Institute of Food Technologists, 1:248
Institutional Review Board (IRB), 2:75
Insulin, **2:12–13**
defined, 1:37
and diabetes, 1:143, 144, *145*, 147
in digestion, 1:170
and genetic engineering, 1:65
regulating blood glucose levels, 1:37, *37*
See also Diabetes mellitus; Glycemic index
Insulin injections, 1:*145*, 147, 2:12–13
Insulin pens, 2:12–13
Insulin pumps, 1:*145*, 2:12–13
Integrative medicine, 1:30
See also Alternative medicines and therapies
International Bibliographic Information on Dietary Supplements (IBIDS), 1:156
International Children's Day of Broadcasting, 2:226
International Conference on Child Labour, 2:227
International Conference on Health Promotion (1986), 1:263
International Conference on Nutrition, 2:205
International dietary trends. *See* Dietary trends, international
International disaster relief organizations. *See* Disaster relief organizations
International nongovernmental organizations, 2:83
International Space Station, 2:210, 212, *213*, 214, 215
Internships, 1:105–106
defined, 1:105
Interstitial, defined, 2:246
Intestines, defined, 1:64
Intolerances. *See* Allergies and intolerances
Intoxication, as food-borne illness, 2:1, 120*t*
Intracellular fluids, 1:37, 2:246
Intrauterine growth retardation, 2:197–198
See also Low birth weight infant
Intravascular fluid compartment, 1:37
Intravenous, defined, 1:84
Intrinsic factor, 1:40, 2:243
Iodine
Asia, 1:56
deficiency, 1:56, 2:35, 63, 159–160
functions, 2:62
poisoning, 1:253
Iodism, 1:253
Iran
eating habits, 1:*186*
United Nations Children's Fund (UNICEF), 2:226
Iraq, disaster relief in, 1:*174*
IRB (Institutional Review Board), 2:75
Ireland, 2:86
Iron
adolescents, 1:5
Asia, 1:56
children, 1:39
deficiency, 1:38–40, 56, 2:24, 26, 62–63, 153
defined, 1:5
disease prevention and treatment, 2:62
fortification of food, 2:72
as functional food, 1:242*t*
functions, 2:62
infant nutrition, 1:242*t*, 2:9, 10
and lead poisoning, 2:24, 26
and menopause, 2:50
and pregnancy, 1:40, 2:145
preschoolers and toddlers, 2:152, 153

and space travel, 2:212, 215
sports nutrition, 2:217
supplements, 2:59
toxicity, 2:63
vegetarians, 2:230
women, 2:259
Iron-deficiency anemia, 1:38–40, 2:153
Irradiation, **2:13–14**
See also Biotechnology; Food safety
Irritability, defined, 1:249
Islam. *See* Muslims
Isoflavones, **2:14,** 2:207, 208
defined, 2:14
Isoleucine, 2:6, 156*t*
Italy
cuisine, 2:204, 205, 206
life expectancy, 2:28
organic foods, 2:115

J

Jamaica, 1:110
Japan
diet, 1:53–54
food-borne illness, 2:118
life expectancy, 2:28
organic foods, 2:115
postmenopausal symptoms, 2:208
stomach cancer, 1:88
Japanese Americans, diet of, 1:50
Jefferson, Thomas, 2:79
Jejunum, 1:170
Jerk meat, 1:108, 109
Jewish food practices, 1:259, 2:176, 177–178, 178*t*
Job sharing, defined, 1:77
Johnson, Howard, **2:14–16,** 2:*15*
Joint Centre for Bioethics, University of Toronto, 1:67, 68
Joint United Nations Programme on HIV/AIDS, 1:280
Judaism. *See* Jewish food practices
Juices, as functional food, 1:242*t*, 243
Junk food
defined, 2:191
in schools, 2:191, 192

K

Kashrut, 1:259, 2:177–178
Kava, 2:131
Kcalorie, 1:87, 216
See also Calories
Kellogg, John Harvey, 1:60, 61, 255, **2:16–18,** 2:*17*, 254
See also Battle Creek Sanitarium
Kellogg, Will Keith, 2:16, 17, *17*
Kempner, Walter, 2:181–182
Keto-acid, defined, 2:157
Ketoacidosis, defined, 1:146
Ketones, 1:210
defined, 1:146
Ketosis, 1:97, 2:56
defined, 1:97
Kidney
and diabetes, 1:146
and hypertension, 1:289, *289*
and mineral toxicity, 2:61
Kidney stones, defined, 1:84
Killer-cell, defined, 1:43
Kilocalorie, 1:87, 216
See also Calories
Kimchi, 1:50, 54
Kinetic, defined, 2:158
Kiwanis Worldwide Service Project, 2:227
Korean Americans, diet of, 1:50
Koreans, diet of, 1:54
Kosher, 1:259, 2:177
Krebs Cycle, 1:96–97, 2:55
defined, 1:96
Kroc, Ray, **2:18–20,** 2:*19*
See also Fast foods
Kwanzaa, 1:13
Kwashiorkor, 1:40, **2:20–21,** 2:35, 92, 160
defined, 1:40
See also Malnutrition; Protein

L

Lactase, 1:26, 28, 172, 2:21, 22
Lactation. *See* Breastfeeding
Lacteals, 1:216
Lactic acid, defined, 1:96
Lacto vegetarians, 2:229
Lacto-ovo vegetarians, 2:179, 229
Lactose, 1:93, 94, 94*t*, 2:6, 21
Lactose intolerance, 1:26, 28, **2:21–23**
and absorption, 1:172
Asia, 1:56
clinical diagnosis, 2:22
congenital, 2:22
defined, 1:18
nutrition for, 2:22–23
prevalence, 2:21–22, *22*
secondary, 2:22
structure and functions of lactose, 2:21
treatment, 1:29
types, 2:22
Lactose tolerance test, 2:22
Laotians, diet of, 1:50*t*
Lasix, 2:88*t*
Latin America, underweight in, 2:35
Latinos. *See* Hispanics and Latinos, diet of
Latvia, cardiovascular disease mortality in, 1:118
Laws
Biologics Control Act (1902), 2:73
Child Nutrition Act (1972), 2:255–256
Color Additives Amendment (1960), 1:2–3
Dietary Supplement Health and Education Act (DSHEA) (1994), 1:31–32, 33, 156, 157–158, 241–243, 2:74
Federal Food, Drug, and Cosmetic Act (1938), 1:241–243
Food Additives Amendment (1958), 1:2
Food and Drug Administration Modernization Act (FDAMA) (1997), 1:264–265
National Consumer Health Information and Health Promotion Act (1970), 1:269
National Health Survey Act (1956), 2:68–69
Nutrition Labeling and Education Act (NLEA) (1990), 1:232–233, 263–264, 266
Older Americans Act (1965), 2:42
Organic Foods Production Act (1990), 2:113–114
Pure Food and Drug Act (1906), 2:162, 171
Lay health advisor (LHA), **2:23**
LDL. *See* Low-density lipoprotein (LDL)
Lead poisoning, **2:23–27,** 2:72
definition, 2:24
educational interventions, 2:26
medical treatment, 2:26–27
nutritional interventions, 2:26
populations at risk, 2:24
prevalence, 2:26
sources of lead, 2:*25*, 25–26
symptoms, 2:24
Leading health indicator (LHI), 1:*270*
League of Red Cross and Red Crescent Societies (LICROSS), 1:175*t*
"Lean," as nutrient content claim, 1:265*t*
Learned behaviors, defined, 1:186
Leavening, defined, 1:2
Leeks, 2:85–86

Legumes, 1:109, *2:27*, **2:27–28**
defined, 1:5
See also Vegetarianism
Leptin, 2:77
"Less," as nutrient content claim, 1:265*t*
Letrozol, 2:75
Letter on Corpulence (Banting), 1:205
Leucine, 2:6, 156*t*
Leukemia, 1:88
LHA (lay health advisor), 2:23
LHI (leading health indicator), 1:*270*
Licensing, of nutritionists, 1:106, 2:104
LICROSS (League of Red Cross and Red Crescent Societies), 1:175*t*
Life expectancy, 1:120*t*, **2:28**
See also Infant mortality rate
Lifestyle, defined, 1:24
"Light"
as marketing strategy, 2:39
as nutrient content claim, 1:265*t*
"Light in sodium," as nutrient content claim, 1:265*t*
Light therapy, 2:149, *149*
Lignin, 1:95
Lind, James, 2:197, *220*, 244
Linoleic acids. *See* Omega-3 and omega-6 fatty acids
Linolenic acids. *See* Omega-3 and omega-6 fatty acids
Lipase, 1:170, 172, 2:29
Lipid
defined, 1:36
See also Fats
Lipid profile, **2:28–31,** 2:29*t*, 30*t*
blood lipids and lipid transport, 2:29
and exercise, 1:199–200
treating abnormal blood lipids, 2:30
See also Cardiovascular disease (CVD)
Lipitor, 2:88*t*
Lipogenesis, 2:57
Lipolysis, 2:56
Lipoprotein, 1:37
defined, 1:103
Listeria monocytogenes, 2:2, 116, 119, 120*t*
Listeriosis, defined, 2:118
Lithuania
obesity, 2:105
vitamin C deficiency, 1:120
Liver
and alcohol, 1:24, *25*
in digestion, 1:170, 171
Lobsters, 1:*187*
Long-term care facilities, defined, 1:105
"Low," as nutrient content claim, 1:265*t*
Low birth weight infant, **2:31,** 2:197
See also Pregnancy
Low-carb diet, 1:97
Low-density lipoprotein (LDL)
and cardiovascular disease, 1:103
and carotenoids, 1:112
drug treatment, 2:30
HDL/LDL ratio values, 2:30*t*
in lipid profile, 2:29
and Mediterranean diet, 1:259, 260
optimal, borderline, and high levels, 2:29*t*
and soy, 2:207
Lower-quality proteins, 2:156
Low-fat products, 1:219
Luau, 2:131
Lunch Program, National School, 1:284, 2:96–97, 190–191, 194
Lung cancer, 2:234
Lutefisk, 2:189–190
Lutein, 1:113, 2:234
Lutheran World Federation (LWF), 1:175*t*
Lycopene, 1:91, 113, 2:53, 234
Lymph node, defined, 1:90
Lymph system, defined, 1:88
Lymphatic system, defined, 1:88
Lymphoma, 1:88
Lysine, 1:134, 2:156*t*

M

Macaroni and cheese, glycemic index, 1:251*t*
Macrobiotic, defined, 1:31
Macrobiotic diet, **2:31–33,** *2:32*
Macrocytic anemia, 1:38, 39*t*, 2:243
Macrominerals, 2:95
Macronutrient, defined, 1:113
Macrophage, 2:29
Macrovascular disease. *See* Atherosclerosis
Macular degeneration, 2:234
defined, 1:112
Mad cow disease, 2:118–119, *119*, 187
Magnesium
deficiency, 2:61
disease prevention and treatment, 2:61
functions, 2:60
premenstrual syndrome, 2:148
toxicity, 2:61
Maize
Central America and Mexico, 1:113, 114–115
varieties, 1:133–134
Maize-based diets. *See* Corn- or maize-based diets
Major minerals, 2:60–61
Malabsorption
defined, 2:101
in HIV/AIDS patients, 1:280
Malaria, defined, 1:40
Malaysians, diet of, 1:55
Males. *See* Men's nutritional issues
Malignant, defined, 1:88
Malignant tumors, 1:88, 90
Malnourished, defined, 1:39
Malnutrition, **2:33–36,** *2:36*
and alcohol, 1:24–25
Caribbean Islands, 1:110
defined, 1:22
and diarrhea, 1:150
and growth, 2:35–36
and infection, 2:34
necessary nutrients, 2:35
people at risk, 2:33–35, *34*
and popular culture, 2:140–141
Maltose, 1:94, 94*t*
Manganese toxicity, 2:63
Mangoes, 1:108
Maple sugar, 2:80
Maple syrup urine disease (MSUD), 2:6
Marasmus, **2:36–37**
defined, 1:40
malnutrition, 2:35, 92
vitamin deficiencies, 1:40
March of Dimes, 2:143
Marijuana, 2:176
Marine Hospital Service (MHS), 1:253, 2:73
Marker genes, 1:246
Marketing strategies, **2:37–41**
impact and influence, 2:37–38, *38*
inappropriate advertisements, 2:38–40, *39*
recommendations for responsible food marketing, 2:40
See also Health claims
Martinique, 1:110
Masa, 1:114–115
Mastitis, 2:*41*, **2:41–42**
See also Breastfeeding
Matambre, 2:203
Maté;, 2:201
Maternal Child Health Program Title V, 2:98
Maternal mortality rate, 2:36, **2:42**

See also Infant mortality rate
Maturity onset diabetes of the young (MODY), 1:145
Mazo, Ellen, 1:279–280
McDonald, Maurice (Mac), 2:18–19
McDonald, Richard, 2:18–19
McDonald's restaurants, 2:18–19, *19*, 20, *38*
McGwire, Mark, 1:*191*
Meals On Wheels, 1:*23*, 129, **2:42**
See also Nutrition programs in the community
Measurements, anthropometric. *See* Anthropometric measurements
Meat
Africa, 1:16, 18
Central America and Mexico, 1:115
Mediterranean diet, 1:257
Scandinavia, 2:188–189
Meat analogs, **2:42–43**
See also Vegetarianism
Medical nutrition therapists, 1:104–105, 168
Medical nutrition therapy (MNT), **2:43–46**
assessment components, 2:43–44
for diabetes, 1:147
insurance coverage, 2:45–46
therapy provision, 2:44–45
See also Nutritional assessment
Medicare, medical nutrition therapy coverage, 2:45
Meditation, defined, 1:30
Mediterranean diet. *See* Greeks and Middle Easterners, diet of
Mediterranean Pyramid, 1:226–227
Megaloblastic anemia, 1:40
Melatonin, and premenstrual syndrome, 2:*149*
Mellanby, Edward, **2:46–47,** 2:*47*
See also Rickets
Melo Palheta, Francisco de, 2:201
Menaquinones, 2:236
Menopausal, defined, 2:47
Menopause, **2:47–50,** 2:260
defined, 1:10
dietary and lifestyle changes, 2:50
physiological changes, 2:47–48
and soy, 2:48–49, 208, 260
stages, 2:47
treatments and remedies, 2:48–49, *49*
See also Women's nutritional issues
Men's nutritional issues, **2:51–54**
body image, 1:69, 70, 71
cancer, 2:51, *52*
college students, 1:124
cravings, 1:137–138, *138*
diabetes mellitus, 2:51
eating disorders, 1:177, 178, 184
heart disease, 2:51–53, *52*
hypertension, 2:53
impotence, 2:53
life expectancy in Europe, 1:120*t*
prostate health, 1:91, 2:53, 208, 234
Menstrual cycles, defined, 2:47
Metabolic, defined, 1:46
Metabolic disorders. *See* Inborn errors of metabolism
Metabolism, **2:54–58,** 2:57
carbohydrates, 2:6–7, 54–55
cholesterol, 2:57–58, 77
defined, 1:42
fats, 1:216, 2:56–57
during menopause, 2:260
protein, 2:55–56, 157
Metabolism, inborn errors of. *See* Inborn errors of metabolism
Metabolite, defined, 1:31
Metabolize, defined, 1:24
Metastasis, 1:88
Methionine, 2:156*t*
Metropolitan Life Insurance Company height and weight tables, 2:99, 100*t*
Mexican Americans
children, 2:168
diabetes, 1:277
diet, 1:276–277, 278*t*
See also Hispanics and Latinos, diet of
Mexicans. *See* Central Americans and Mexicans, diets of
Mexico
fruits and vegetables, 1:114
traditional dietary habits, 1:113
MHS (Marine Hospital Service), 1:253, 2:73
Micelles, 1:216
Microbial fermentation, 1:65
Microcytic anemia, 1:38, 39*t*
Microflora, defined, 2:154
Microminerals, 2:95
Micronutrients
deficiency in Asia, 1:55–56
defined, 1:19
Microorganisms, defined, 1:2
Middle Easterners. *See* Greeks and Middle Easterners, diet of
Midsummer's Day, 2:190
Mid-upper arm circumference (MUAC), 1:74
Midwest cooking, 2:167
Milk
and bovine somatotropin, 1:262
evaporated, 2:10
as functional food, 1:242*t*
glycemic index, 1:251*t*
health claims, 2:37–38
and infants, 2:9, *197*
pasteurization, 2:133
and scurvy, 2:*197*
with vitamin D, 1:242*t*, 2:122, 235
Milk sugar. *See* Lactose
Mind-body interventions, 1:31, 31*t*
Minerals, **2:58–64**
bioavailability, 2:59
deficiency, 2:61, 62–63
defined, 1:2
disease prevention and treatment, 2:60–61, 62
functions, 2:60, 62
major, 2:60–61
as nutrient, 2:94–95
pregnancy requirements, 2:145, *145*
sports nutrition, 2:217
supplementation, 2:59–60, *60*
toxicity, 2:61, 63
trace, 2:61–63
See also Dietary supplements; Vitamins, fat-soluble; Vitamins, water-soluble
Miscarriage, defined, 1:82
Mitochondria, defined, 2:55
MNT. *See* Medical nutrition therapy (MNT)
Models, fashion, 1:69
MODY (maturity onset diabetes of the young), 1:145
Molar, defined, 2:153
Mold, and food poisoning, 2:3
Molecule, defined, 1:36
Monaco, life expectancy in, 2:28
Monckeberg's arteriosclerosis, 1:45
Monocultural, defined, 1:140
Monoglycerides, 1:216
defined, 1:170
Mononucleosis, 2:*12*
Monosaccharides, 1:93, 94*t*, 2:54
Monosodium glutamate (MSG), 1:2, 4, 28
Monounsaturated fat, 1:102, 215, 217, 260
Montserrat, 1:110
Mood-food relationships, **2:64–67,** 2:66*t*
circadian rhythms, 2:65–66
meal size, 2:65
neurotransmitter effects, 2:64–65, 66*t*
positive moods and stress reduction, 2:*65*, 66–67

Mood-food relationships *(continued)*
See also Cravings
Moore, Mary Tyler, 2:*76*
Morbidity, defined, 1:73
"More," as nutrient content claim, 1:265*t*
Mormon food practices, 2:176, 178, 178*t*
Motor proteins, 1:37
MSG (monosodium glutamate), 1:2, 4, 28
MSUD (maple syrup urine disease), 2:6
MUAC (mid-upper arm circumference), 1:74
Mucilages, 1:96
Mucosa, defined, 1:159
Multiple cropping, 1:261–*262*
Muscle wasting
defined, 1:202
during space travel, 2:211–212
Muscular endurance and strength, 1:200, 2:216
Muslims
alcohol, 1:259
food practices, 1:16–17, 259, 2:177, 178*t*
Halal foods, 1:258, 259*t*, 2:177
southern Europe, 2:204
Mycotoxins, 2:120–121
defined, 2:3
Myocardial infarction, 1:272, *273*, 2:75
Myoglobin, defined, 2:62
Myristicin intolerance, 1:28

N

Nandrolone, defined, 1:191
National Academy of Sciences (NAS), **2:67**
diet, 1:97
food additives, 1:4
health claims, 1:264–265
Recommended Dietary Allowances, 2:164
See also Dietary Reference Intakes (DRIs); Recommended Dietary Allowances (RDAs)
National Center for Complementary and Alternative Medicine, 1:30–31, 31*t*, 2:*161*
National Center for Health Statistics (NCHS), 2:68
National Cholesterol Education Program, 2:29–30
National Consumer Health Information and Health Promotion Act (1970), 1:269
National Diabetes Education Program, 1:147
National Food Processors Association, 1:238
National Health and Nutrition Examination Survey (NHANES), 1:72, 73, **2:68–73**
caloric intake, 1:161
childhood obesity, 1:121, 122
data collection procedures, 2:71
future, 2:72
and Healthy Eating Index, 1:268–269
history, 2:68–70, *70*
procedures, 2:70–71
results, 2:71–72
sampling, 2:70
National Health Examination Survey (NHES), 1:121, 2:68–69
National Health Interview Survey (NHIS), 2:72
National Health Survey Act (1956), 2:68–69
National Immunization Days, 2:227
National Institute of Mental Health, 1:184
National Institute on Alcohol Abuse and Alcoholism, 1:24
National Institutes of Health (NIH), **2:73–78**
accomplishments, 2:75
Atkins Diet, 1:97
childhood obesity, 1:*122*
diarrhea, 1:149
funding, 2:76, *76*, *77*
history, 2:73–74
human subjects, 2:75–76
impotence, 2:53
institutes and centers, 2:74–75
mission, 2:74
Office of Dietary Supplements, 1:156, 2:74
Office of Legislative Policy and Analysis, 2:74
Office of Science Policy, 2:75–76
research and biomedical advances, 2:76–78
Trans-NIH Bioethics Committee, 2:76
National nongovernmental organizations, 2:83
National Nutrition Surveillance System, 2:69
National Osteoporosis Foundation, 2:123, 124
National Research Council, 1:154
National School Lunch Program (NSLP), 1:284, 2:96–97, 190–191, 194
Native Americans, diet of, **2:78–82**
alcohol use, 1:25
childhood obesity, 1:122
before colonial period, 2:79–80
current food practices, 2:80, *81*
diet-related health issues, 2:79*t*, 81
Food Distribution Program on Indian Reservations, 1:128
homelessness, 1:*283*
overweight and obesity, 2:79*t*, 81
sacred and ceremonial foods, 2:80
settlement hardships, 2:78–79
See also Corn- or maize-based diets
Nausea
defined, 1:27
during pregnancy, 2:146
NBI (nitrogen balance index), 2:159–160
NCHS (National Center for Health Statistics), 2:68
Needs assessment, defined, 1:173
Needy Family Program, 1:127
Negative nitrogen balance, 2:160
Neoplasm, 1:88, 90
Neotame, 1:46–47
Nervous system, defined, 1:38
Neural, defined, 1:40
Neural tube defects (NTDs), 2:142–143, 243
Neurological, defined, 1:184
Neuropathy, defined, 2:181
Neurotransmitters
defined, 1:137
mood-food relationships, 2:64–65, 66*t*
Nevis, 1:110
New England cooking, 2:167
NGOs (nongovernmental organizations), 2:82–83
NHANES. *See* National Health and Nutrition Examination Survey (NHANES)
NHES (National Health Examination Survey), 1:121, 2:68–69
NHIS (National Health Interview Survey), 2:72
Niacin (vitamin B_3), 2:239–241, 240*t*
in corn- or maize-based diets, 1:134–136, *135*
deficiency, 2:103
defined, 1:2
and pellagra, 2:135
Nicotinamide, 2:239
Nicotine. *See* Smoking
Nicotinic acid, 1:244, 254, 2:239
Night blindness, 2:234

NIH. *See* National Institutes of Health (NIH)
Nitrite, defined, 1:4
Nitrogen
  defined, 1:134
  and inborn errors of metabolism, 2:7
Nitrogen balance index (NBI), 2:159–160
Nitrosamines, and cancer, 1:4
Nixtamalizacion, 2:79
NLEA (Nutrition Labeling and Education Act) (1990), 1:232–233, 263–264, 266
NLM (U.S. National Library of Medicine), 2:74
Nonessential amino acids, 1:36, 36*t*, 2:155–156
Nongovernmental organizations (NGOs), **2:82–83**
  See also Disaster relief organizations
Nonpathogenic, defined, 2:154
Nonpolar, defined, 2:155
Noodles, glycemic index, 1:251*t*
Norepinephrine, effect on mood, 2:64, 66*t*
Normochronic anemia, 1:38, 39*t*
North Africans, diet of, 1:16–17, *17*
Northern Europeans, diet of, **2:83–87**
  eating habits and meal patterns, 2:84
  England, 2:84, *85*
  France, 2:86–87
  Ireland, 2:86
  nutritional status, 2:84
  Scotland, 2:84–85
  Wales, 2:85–86
  See also Central Europeans and Russians, diets of; Southern Europeans, diet of
Norvasc, 2:88*t*
Norwalk-type viruses, 2:119, 120*t*
NOSB (U.S. National Organic Standards Board), 2:113–114
NSLP. *See* National School Lunch Program (NSLP)
NTDs (neural tube defects), 2:142–143, 243
Nursing bottle mouth syndrome. *See* Baby bottle tooth decay
NutraSweet, 1:46
Nutrient additives, 1:2
  See also Additives and preservatives
Nutrient content claims, 1:156, 232
Nutrient density, **2:87**
Nutrient-drug interactions, **2:88–90,** 2:88*t*, *89*
  adverse effects, 2:88–89
  avoiding, 2:90
  drug functions, 2:88
  elderly, 2:89
  impact, 2:89
Nutrients, **2:90–95,** 2:*93*
  carbohydrates, 2:91–92
  defined, 1:2
  functions, 2:91*t*
  lipids, 2:92–94
  minerals, 2:94–95
  proteins, 2:92
  vitamins, 2:94
  water, 2:95
  See also specific nutrients by name
Nutrition, **2:95**
  defined, 1:7
Nutrition education, **2:96**
Nutrition Educators, 1:105
Nutrition Facts statement, 1:233, *234*
Nutrition Labeling and Education Act (NLEA) (1990), 1:232–233, 263–264, 266
Nutrition managers, 1:104–105, 168
Nutrition Program for Older Americans, 2:98
Nutrition programs in the community, **2:96–99**
  Food and Nutrition Service programs, 2:96–98, *98*
  Health and Human Services Department programs, 2:98
  See also Meals On Wheels
Nutrition Screening Initiative, 1:20–21
Nutritional assessment, **2:99–102**
  anthropometrics, 2:99–101, 100*t*
  biochemical data, 2:101
  clinical data, 2:101
  dietary data, 2:101–102
  elements, 2:99–102
  evaluation, 2:102
  See also Dietary assessment
Nutritional deficiency, **2:102–104,** 2:*103*
  defined, 1:38
Nutritional requirements, defined, 1:7
Nutritional transition
  Asia, 1:56–57
  Central America and Mexico, 1:116
  Hispanics and Latinos, 1:276–278, 2:169
  Pacific Islander Americans, 2:128
  Pacific Islanders, 2:131–132
Nutritionist, 1:106, 2:44, *104*, **2:104–105**
  See also Careers in dietetics; Dietitian
Nutrition-support-team dietitians, 1:168
Nuts, 1:53, 242*t*, 2:108

O

Oats, as functional food, 1:242*t*
Obese, defined, 1:64
Obesity, **2:105–108**
  adolescents, 1:6, 2:192–193
  adults, 1:8
  African Americans, 1:14, 14*t*
  Asia, 1:56, 57, *163*
  body mass index, 2:105, 125, 140
  causes, 2:106
  costs, 2:106
  defined, 1:6
  and disease, 1:217
  as health risk, 2:105–106
  international dietary trends, 1:164
  and leptin, 2:77
  Native Americans, 2:79*t*, 81
  and oral health, 2:111–112
  versus overweight, 2:125
  Pacific Islander Americans, 2:126
  Pacific Islanders, 2:129, 131
  and popular culture, 2:140
  and portion sizes, 1:160
  prevalence, 1:203, 2:105
  treatment, 2:106–107, *107*
  water in body, 2:245–246
  See also Body mass index; Childhood obesity; Overweight
Observationes Medicae (Tulp), 2:224
Ohsawa, George, 2:31
Okra, 1:11, *11*, 12, 13
Older adults. *See* Aging and nutrition
Older Americans Act (1965), 2:42
Olestra, 1:*211*, 212, 213, 218–219
Oligosaccharides, 1:93
Olive oil, 1:256, 258, 259, 260
Olives, 2:204
Omega-3 and omega-6 fatty acids, **2:108–110,** 2:*109*
  benefits, 2:108–109
  and cardiovascular disease, 1:102–103
  in eggs, 1:*241*, 242*t*
  Mediterranean diet, 1:260
  types, 2:108
  See also Heart disease
Oncogenes, and cancer, 1:91
Oneworld Alliance for UNICEF, 2:227
Opacity, defined, 2:264
Operational nongovernmental organizations, 2:83

Opportunistic infections, defined, 1:279
Opsin, 2:232
Oral contraceptives, 2:88*t*
Oral health, **2:110–112**
factors affecting, 2:110
and fluoride, 2:112
and overnutrition, 2:111–112, *112*
and undernutrition, 2:111
See also Baby bottle tooth decay
Oral rehydration therapy (ORT), 1:151, **2:113,** 2:226, 247
See also Dehydration; Diarrhea
Oral-pharyngeal, defined, 1:280
Orange juice
calcium-fortified, 1:242*t*, 243
glycemic index, 1:251*t*
Organic foods, **2:113–117**
advantages and disadvantages, 2:114, *115*
certification and labeling, 1:237, 2:114
market, 2:115, *116*
nutrition quackery, 2:162
safety and nutritional value, 2:116–117
sustainable food systems, 2:222
See also Food safety
Organic Foods Production Act (1990), 2:113–114
Organisms, food-borne, **2:117–122**
mad cow and Creutzfeldt-Jakob, 2:118–119, *119*
magnitude of food-borne illness, 2:118
outbreaks, 2:118–119
prevention of food-borne illness, 2:121
types, 2:119–121, 120*t*
See also Food safety; Illnesses, food-borne
ORT. *See* Oral rehydration therapy (ORT)
Osteoarthritis, defined, 1:217
Osteoblast, defined, 2:123
Osteomalacia, 1:84, **2:122,** 2:183, 235
defined, 1:84
See also Rickets
Osteopathic, defined, 1:30
Osteopenia, **2:122–123**
Osteoporosis, **2:123–125,** 2:*124*
and calcium, 1:85, *85*, 2:61, 124
defined, 1:5
in female athlete triad, 1:219, 2:219
and nutritional deficiency, 2:103
prevalence, 2:124–125
risk factors, 2:123–124
and soy, 2:208
and spaceflight bone loss, 2:211
and vitamin D deficiency, 2:235
women, 1:10, 219, 2:123, *124*, 125, 219, 260
See also Calcium; Women's nutritional issues
Outcrossing, 1:248
Overnutrition, and oral health, 2:111–112, *112*
Over-the-counter, defined, 1:31
Overweight, **2:125–126**
body mass index, 2:125, 140
children, 2:153, 192–193
defined, 1:64
international dietary trends, 1:164
Native Americans, 2:79*t*, 81
versus obesity, 2:125
prevalence, 1:203, 2:105
southern Europe, 2:206
See also Obesity
OXFAM International, 1:175*t*
Oxidative, defined, 2:56
Oxygen, defined, 1:2
Oxytocin, 1:76

P

Pabellón caraqueño, 2:203
Pacific Islander Americans, diet of, **2:126–128,** 2:127*t*
eating habits and meal patterns, 2:127
nutrition and health status, 2:126–127
nutritional transition, 2:128
Pacific Islanders, diet of, **2:128–132**
childhood obesity, 1:122
eating habits and meal patterns, 2:129–130
nutritional status, 2:129
nutritional transition, 2:131–132
traditional cooking methods and food habits, 2:*130*, 130–131
See also Asians, diet of
Pacific Northwest cooking, 2:167
Pacifier caries, 2:111
Paella, 2:*205*, 206
Pain, and endorphins, 2:66
Paint, lead-based, 2:24, 25, 26
Palestinian refugees, 2:*165*
Pancreas, 1:170, 171
Pantothenic acid (vitamin B_5), 2:240*t*, 241
Papain, 1:65
Papayas, 1:108
Paraguay, 2:201, 203
Paralysis
and bone loss, 2:211
defined, 1:236
Parasites
defined, 1:41
and food-borne illness, 2:120
Parasitic, defined, 1:40
Parathyroid hormone (PTH), 1:83–84
Parenteral nutrition, 1:280
Parkinson's disease, 2:75
Pasta, glycemic index, 1:251*t*
Pasteur, Louis, **2:132–133,** 2:*133*
Pasteurization, **2:133**
defined, 1:65
electronic, 2:13–14
invention of, 2:132–133
See also Food safety
Patent medicines, 2:161, 162
Pathogen, defined, 1:235
A Pattern for Daily Food Choices, 1:225
Pauling, Linus, **2:133–134,** 2:*134*
PCM (protein-calorie malnutrition), 2:35, 159–160
PDD (premenstrual dysphoric disorder), 2:147
Peanut allergies, 1:29
Peas, glycemic index, 1:251*t*
Pectin, 1:96
Pediatric Nutrition Surveillance System, 2:153
Pellagra, 2:*135*, **2:135**
corn- or maize-based diets, 1:134–136, *135*
Funk, Casimir, 1:244
Goldberger, Joseph, 1:*253*, 253–254, 2:73
and nutritional deficiency, 2:103, 240–241
PEM (protein-energy malnutrition), 2:35, 36, 141
Pemberton, John S., **2:135–136,** 2:*136*
Penicillin, 2:89
Pepsinogen, 2:157
Percent Daily Value, 1:233*t*, 234
Perimenopausal period, 2:47
Periodontitis, 2:*112*
Peristalsis, 1:169
Pernicious anemia, 1:40, 2:243
Persistent diarrhea, 1:149
Peru
food habits, 2:202, 203
food-borne illness, 2:118
Pesticides, **2:137**
food safety, 1:236–237, 2:116–117
genetically modified foods, 1:247

nutrition quackery, 2:162
organic foods, 2:116
sustainable food systems, 2:221
See also Food safety; Organic foods
Petechiae, 2:111
pH, 1:37
defined, 1:1
Phenylalanine, 1:46, 2:5–6, 137–138, 156*t*
Phenylethylamine, 2:66
Phenylketonuria (PKU), 1:46, 2:5–6, **2:137–138**
defined, 1:46
See also Amino acids
Phosphate toxicity, 2:61
Phospholipids, 1:215–216
defined, 2:29
Phosphorus
defined, 2:58
functions, 2:60
and osteomalacia, 2:122
and vitamin D, 2:235
PHS (U.S. Public Health Service), 1:238–239, 253, 2:73
Phylloquinone, 2:236
Physical activity. *See* Exercise
Physical education, 1:*131*, 131–132
Physical fitness, 1:200
Physicians Committee for Responsible Medicine, 2:37–38
Physiological, defined, 1:8
Physiology, defined, 1:168
Physiology of Taste, or Meditations on Transcendental Gastronomy (Brillat-Savarin), 1:78
Phytate, defined, 2:59
Phytochemicals, 1:91, **2:138,** 2:207
defined, 1:91
Phytoestrogens, 2:48–49
defined, 2:48
Pica, **2:138,** 2:146
See also Cravings
Pickling, as preservative, 1:1
Pick-your-own farms, 2:222
Pigs, in Pacific Islander diet, 2:130
PIH (pregnancy-induced hypertension), 1:289
Pipes, lead-soldered, 2:24, 25, 26
Pituitary gland, defined, 1:244
PKU. *See* Phenylketonuria (PKU)
Plant proteins, 2:156
Plantains, 1:18
Plant-based diets, **2:138–139**
See also Vegetarianism
Plaque, 1:59, 60
defined, 1:60
Plasma, defined, 1:120
PLP (pyridoxal phosphate), 2:242
Plumbism. *See* Lead poisoning
Pluralistic, defined, 1:140
PMS. *See* Premenstrual syndrome (PMS)
Pneumonia, defined, 1:146
Pod corn, 1:134
Poi, 2:127, 130
Poland, 1:118
Polar, defined, 2:155
Polydextrose, as fat substitute, 1:211–212
Polypeptides, 2:155
Polyphenols, and heart disease, 1:240
Polysaccharides, 1:94–96, *95*, 2:91
Polyunsaturated, defined, 1:101
Polyunsaturated fat, 1:102, 215, 217
Popcorn, 1:133
Popular culture, and food, **2:139–142**
adolescents, 2:192
convenience foods, 2:141
current trends, 2:139
dieting, 2:141
eating away from home, 2:139–140, *140*
ethnic foods, 2:142
functional foods, 2:141
obesity and malnutrition, 2:140–141
supplements, 2:141
Population, world, 1:230
Pork, folk beliefs about, 1:13
Porridge, 2:84–85, 189
Portion sizes, 1:123, 160, 234, 2:65, 106, 140
Portugal, cuisine of, 2:204, 205
Positive nitrogen balance, 2:160
Post, C. W., 2:17
Postmenopausal period, 2:47
Potable, defined, 1:173
Potassium
and cardiovascular disease, 1:103
deficiency, 2:61
disease prevention and treatment, 2:60–61
functions, 2:60
and hypertension, 1:290, 2:167
toxicity, 2:61
Potassium iodide, 2:62
Potatoes
genetically modified, 1:245, 246–247
glycemic index, 1:251*t*
Ireland, 2:86
Poverty
and WIC program, 2:255, 256
worldwide, 1:230
Prednisone, 2:88*t*
Preeclampsia, 1:289, 2:146, 223
See also Pregnancy
Preformed retinoids, 2:232, 234
See also Vitamin A
Pregnancy, **2:142–147**
alcohol use, 1:25
aspartame, 1:46
beta-carotene, 2:36
caffeine, 1:82
calcium, 1:85
cravings, 1:136, 2:146
folate, 1:40, 2:243
iron, 1:40
nutrition requirements, 2:144–145, 144*t*, *145*, 146, 259
pica, 2:138, 146
protein, 2:159
smoking, 2:198
teens, 1:7
vegetarians, 2:230
vitamin A, 2:36, 234
vitamin and mineral requirements, 2:145, *145*
weight gain, 2:143–144, 143*t*
WIC program, 2:146–147, 255, 256, 257
See also Breastfeeding; Low birth weight infant
Pregnancy-induced hypertension (PIH), 1:289
Premenstrual dysphoric disorder (PDD), 2:147
Premenstrual syndrome (PMS), **2:147–150,** 2:*148*, 259
symptoms, 2:148
treatments, 2:148–149, *149*
See also Women's nutritional issues
Pre-renal, defined, 2:45
Preschoolers and toddlers, diet of, **2:150–154**
energy and protein needs, 2:151–152, 152*t*
nutritional requirements, 2:150–153
potential feeding problems, 2:153–154
vitamin and mineral needs, 2:152–153
WIC program, 2:255, 256, 257–258
See also Baby bottle tooth decay
Preservatives. *See* Additives and preservatives
Pressure cuffs, 1:99, *100*
Prevalence, defined, 1:14
Preventive medicine, defined, 1:253
Primary hypertension, 1:289
Primary lactose intolerance, 2:22

Primary sampling unit (PSU), 2:70
Probiotics, 1:242*t*, **2:154–155**
See also Functional foods
Problem solving, and weight management, 2:253
Processed foods
Central America, 1:113
defined, 1:12
and food allergens, 1:27
Mexico, 1:113
and vitamin C, 2:197
versus whole foods, 2:255
Product Identity statement, 1:232
Proenzymes, 1:37
Progesterone, and premenstrual syndrome, 2:149
Prolactin, 1:76
Proline, 2:156*t*
Proscription, defined, 1:188
Prostaglandin, defined, 2:108
Prostate, defined, 1:88
Prostate cancer, 1:91, 2:208, 234
Prostate health, 2:53
Protein, **2:155–160**
absorption, 1:172, 2:157
adolescents, 1:5
amino acids, 2:155–156, 156*t*
animal, 2:156
blood, 2:158
cancer patients, 1:92
and cardiovascular disease, 1:103
Caribbean Islands, 1:108
corn- or maize-based diets, 1:134
cravings, 1:137–138
defined, 1:5
denaturation, 1:37
digestion, 2:157
effect on mood, 2:66, 66*t*
functions, 1:37, 2:158–159
high-quality, 2:156
infants, 2:8
and kwashiorkor, 2:20, 21
in legumes, 2:27–28
lower-quality proteins, 2:156
metabolism, 2:55–56, 157
motor, 1:37
as nutrient, 2:92
plant, 2:156
preschoolers and toddlers, 2:151–152, 152*t*
protein-calorie malnutrition, 2:35, 159–160
protein-energy malnutrition, 2:35, 36, 141
quality, 1:134, 2:156
requirement, 2:159
sources, 2:159, 159*t*
soy, 1:243, 2:207, 207*t*, 208
sports nutrition, 1:192, 2:216, 218
structural, 1:37
supplements, 1:192, 2:218
See also Amino acids
Protein Power, 1:203*t*, 204
Protein-based fat substitutes, 1:212, 212*t*, 218
Protein-calorie malnutrition (PCM), 2:35, 159–160
Protein-energy malnutrition (PEM), 2:35, 36, 141
Protestant food practices, 2:176, 178*t*
Psoriasis, defined, 2:108
PSU (primary sampling unit), 2:70
Psychological, defined, 1:1
Psyllium, defined, 1:240
PTH (parathyroid hormone), 1:83–84
Puberty
defined, 1:4
See also Adolescent nutrition
Public Health Nutritionists, 1:105
Pubs, 2:84, *85*, 86
Puerto Rican Americans. *See* Hispanics and Latinos, diet of
Pure Food and Drug Act (1906), 2:162, 171
Pyridoxal phosphate (PLP), 2:242
Pyruvate, 2:55
Pyruvic acid, 1:96

Q

QPM (quality protein maize), 1:134
Quackery, **2:160–164**
claims and promises, 2:161, *161*, *163*
nutrition quackery, 2:161–162
patent medicines, 2:161, 162
victims, 2:162–164
See also Fad diets
Quality protein maize (QPM), 1:134
Quinoa, 2:202
Quinones, 2:236

R

RACC (Reference Amounts Customarily Consumed Per Eating Occasion), 1:234
Radiation, and cancer, 1:89
Radio programming, for children, 2:226
Radura, 2:14
Ramadan, 2:175, 177
Rastafarian food practices, 2:175, 176, 178, 178*t*
Ravioli, glycemic index, 1:251*t*
RD. *See* Registered dietitian (RD)
Reactive hypoglycemia, 1:292
Reactivity, defined, 1:275
Recombinant bovine growth hormone, 1:246
Recombinant DNA technology. *See* Biotechnology
Recombinant human growth hormone, 1:262
Recommended Dietary Allowances (RDAs), **2:164**
during breastfeeding, 1:76
defined, 1:20
and Dietary Reference Intakes, 1:155, 2:164
dietary trends, 1:161
elderly, 1:20
National Academy of Sciences, 2:67
preschoolers and toddlers, 2:151, 152, 152*t*
school food service, 2:194, 196*t*
school-aged children, 2:190–191
See also Dietary Reference Intakes (DRIs)
Recommended Nutrient Intakes for Canadians, 1:155
Red blood cell, 1:38, 2:212
"Reduced," as nutrient content claim, 1:265*t*
Reduced-fat products, 1:219
Reeve, Christopher, 2:*76*
Reference Amounts Customarily Consumed Per Eating Occasion (RACC), 1:234
Refugee Nutrition Information System (RNIS), **2:164–166,** 2:*165*
See also Disaster relief organizations
Regional diet, American, **2:166–170**
African Americans, 1:12, 2:166–168
Hispanics, 2:168–169
regional cooking, 2:167
See also Dietary trends, American
Regional diet, South American, 2:*202*, 202–203
Registered dietetic technician. *See* Dietetic technician, registered (DTR)
Registered dietitian (RD)
careers in dietetics, 1:105, 106, *106*
as dietitian, 1:168, 169
as medical nutrition therapy provider, 2:44–45, *45*
as nutritionist, 2:104
Registration Examination, 1:105, 106

Regulations
additives and preservatives, 1:2–4
dietary supplements, 1:156–157
drugs and food additives, 1:158
food safety, 1:238–239, 238*t*
functional foods, 1:241–243
Regulatory agencies, **2:170–174**
United States, 2:170–172, *171*
worldwide, 2:172–173
See also Food safety; *specific agencies by name*
Relief organizations. *See* Disaster relief organizations
Religion and dietary practices, **2:174–179**
fasting, 2:174–175, 176, 177, 178–179
food customs, 2:174, *176*
food proscriptions, 2:176–179, *177*, 178*t*
health benefits and risks, 2:175–176
stimulants, 2:176, 177
See also Eating habits; Fasting; *specific religions by name*
Rembrandt, 2:224, *224*
Renal failure, defined, 2:21
Renaud, Serge, 1:240
Rennin, 2:248
Report on the Nutrition Situation of Refugees and Displaced Populations, 2:165
Respiratory system, defined, 1:27
Retinoids, 2:232, 234
Rewards, and weight management, 2:253
R-group, 2:155
Rheumatic heart disease, 1:272
Rhodopsin, 2:232
Riboflavin (vitamin B_2), 2:238, 240*t*
Rice
in African-American diet, 1:11, 13
genetically modified (golden rice), 1:*66*, 68, 245, 246–247, 2:182, 264
Rice porridge, 2:189
Rice-based diets, **2:179–183,** 2:*180*
Asia, 1:52, *53*
genetically modified rice, 1:*66*, 68, 245, 246–247, 2:182, 264
for medical therapy and prevention, 2:181–182
nutritional properties, 2:180–181, 181*t*
and thiamine deficiency, 2:181
See also Asians, diet of; Corn- or maize-based diets
Rickets, **2:183–186,** 2:*184*
defined, 1:84
Glisson, Francis, 1:249, *249*
Mellanby, Edward, 2:46, *47*
nutritional deficiency, 2:104
vitamin D deficiency, 1:84, 2:46, *47*, 104, 183, 184, *184*, 185, 235
See also Osteomalacia
Ritual, defined, 1:11
RNA, defined, 1:40
RNIS (Refugee Nutrition Information System), 2:164–166, *165*
Roadside stands, 2:222
Roman Catholic food practices, 2:176, *176*, 178–179, 178*t*
Romania, 1:118
Ronald McDonald (fictional character), 2:*38*
Rosenstein, Nils Rosén von, 2:*186*, **2:186**
Rotary International, 2:227
Roti, 2:203
Roughage. *See* Fiber
Rugby, 1:*199*
Runner's high, 2:66
Russia
cardiovascular disease mortality in, 1:118
vitamin C deficiency, 1:120
See also Central Europeans and Russians, diets of

S

Saccharin, 1:47
Saffron, 2:204, *205*
Salmonella
food-borne illness, 1:236, 2:2, 119, 120*t*
hand washing, 2:3
organic foods, 2:116
photographs, 1:*237*, 2:*2*
Scandinavia, 2:187
Salmonellosis, defined, 2:118
Salt. *See* Sodium
Salvation Army World Service Office (SAWSO), 1:175*t*
Sanitarium Food Company, 2:17
Sarcoma, 1:88
SARS (Severe Acute Respiratory Syndrome), 2:262
Satiety, **2:187**
See also Appetite; Weight management
Saturated fat
actual and recommended intake, 1:217, *218*
and cardiovascular disease, 1:101
chemical structure, 1:214–215
defined, 1:51
Healthy Eating Index, 1:268
Mediterranean diet, 1:260
as nutrient, 2:93
Saudi Arabia, fast food in, 1:*165*
SAWSO (Salvation Army World Service Office), 1:175*t*
Say Yes for Children program, 2:227
SBP (School Breakfast Program), 1:284, 2:97, 190–191, 194
Scandinavians, diet of, **2:187–190**
eating habits and dietary patterns, 2:187–189, *188*, *189*
nutrition and health status, 2:187
special meals, 2:189–190
See also Central Europeans and Russians, diets of; Northern Europeans, diet of
Scavenger cell, 2:29
School Breakfast Program (SBP), 1:284, 2:97, 190–191, 194
School dietitians, 1:168
School food service, **2:194–197,** 2:*195*, 196*t*
competitive foods, 2:195–197
plate waste, 2:195
School gardens, 2:222
School health services, 1:110, 131
School-aged children, diet of, **2:190–194**
dietary patterns, 2:191–192
junk food in schools, 2:191, 192
nutritional needs, 2:190–191
obesity, 2:192–193
snacking, 2:192
See also Adolescent nutrition; Preschoolers and toddlers, diet of
Schools/Child Nutrition Commodity Programs, 1:129
Scotland, 2:84–85
Scurvy, 2:*197*, **2:197**
defined, 1:156
Glisson, Francis, 1:249, *249*
Stark, William, 2:219–220, *220*
and vitamin C, 2:219–220, *220*
SDR (standardized death rate), 1:117
Seasickness, ginger for, 1:33
Secondary hypertension, 1:289, 291
Secondary lactose intolerance, 2:22
Second-hand smoke, 2:198
Secretin, 1:170
Sedentary, defined, 1:51
Selective serotonin reuptake inhibitor (SSRI), 1:180–181, 2:149
See also Serotonin

Selenium
as antioxidant, 1:43, 44*t*
deficiency, 2:63
disease prevention and treatment, 2:62
functions, 2:62
Self-monitoring, and weight management, 2:251
Self-starvation, 1:181, 2:140
See also Anorexia nervosa
Semi-vegetarians, 2:229
Sen, Amartya, 1:207–208
Serine, 2:156*t*
Serotonin
cravings, 1:137
defined, 1:137
depression, 2:75
eating disorders, 1:178
effect on mood, 2:64, *65*, 66–67, 66*t*
premenstrual syndrome, 2:*149*
selective serotonin reuptake inhibitor (SSRI), 1:180–181, 2:149
Serum, defined, 1:103
Service-systems paradox, 1:282
Seventh-day Adventist Church, 2:17, 175, 178*t*, 179
Severe Acute Respiratory Syndrome (SARS), 2:262
Shigella, 2:2, 119, 120*t*
Shock, defined, 1:149
Shuttle space program, 2:212, *213*, 214
Shuttle-Mir program, 2:213, 214
Sickle-cell anemia, 1:*39*
Sideroblastosis, defined, 1:38
Sierra Leone, life expectancy in, 2:28
Siesta, 2:201, 206
Simple sugars, 1:93–94, 94*t*, 2:91
Simplesse, 1:218
Singapore, 1:55, 2:115
Skinfold calipers, 2:101, 102, *253*
Skylab space program, 2:212, 214
Slavery
and African-American diet, 1:10–11
and Caribbean Islanders diet, 1:107, *108*
Sleep apnea, defined, 1:122
Small for gestational age, **2:197–198**
See also Low birth weight infant
Smog, defined, 2:183
Smoking, **2:198–200,** 2:*199*
and atherosclerosis, 1:59
and cancer, 1:89, *90*, 91, 2:51
and cardiovascular disease, 1:101
and free radicals, 1:*43*
and heart disease, 1:274
and hypertension, 1:290
and pregnancy, 2:198
religious proscriptions, 2:176
Smorgasbords, 2:188
Snacking
adolescents, 1:5–6
American dietary trends, 1:159
college students, 1:123
eating habits, 1:186
school-aged children, 2:192
See also Grazing
SNE (Society for Nutrition Education), 2:200
Social group, defined, 1:143
Social support, and weight management, 2:252–253
Society for Nutrition Education (SNE), **2:200**
Socioeconomic status
defined, 1:20
and diabetes, 2:167
Hispanics and Latinos, 2:168, 169
and maternal mortality rate, 2:42
Sodium
and cardiovascular disease, 1:103
deficiency, 2:61
disease prevention and treatment, 2:60, 61
as food additive, 1:1, 2
functions, 2:60
Healthy Eating Index, 1:268
and hypertension, 1:290, 2:53
nutrient content claims, 1:265*t*
and space travel, 2:211, 215
toxicity, 2:61
Sodium-sensitive individuals, 1:290, 2:53
Soft drinks
American dietary trends, 1:160, *160*
caffeine, 1:81, 81*t*
glycemic index, 1:251*t*
and oral health, 2:111–112
school-aged children, 2:192
Solder, lead, 2:24, 25, 26
Soluble fiber, 1:221
Somalia, 1:*224*
Soul food, 1:11–12
Soursop, 1:109
South Americans, diet of, **2:200–204**
eating habits and meal patterns, 2:201
nutritional status, 2:201
regional food habits, 2:*202*, 202–203
traditional cooking methods and food habits, 2:201–202
See also Central Americans and Mexicans, diets of
South Asians, diet of, 1:55
South Beach diet, 1:97
Southeast Asians, diet of, 1:54–55
Southern Africans, diet of, 1:18
Southern cooking, 1:11–12, 2:167
Southern Europeans, diet of, **2:204–207,** 2:*205*
dietary benefits, deficits, and changes, 2:205–206
influences on American diet, 2:206
traditional foods, 2:204–205
See also Central Europeans and Russians, diets of; Northern Europeans, diet of
Southwest cooking, 2:167
Soy, **2:207–210,** 2:*209*
and cancer, 2:208
as functional food, 1:242*t*
genetically modified, 1:245
and heart, 2:207–208
and menopause, 2:48–49, 208, 260
and osteoporosis, 2:208
protein, 1:243, 2:207, 207*t*, 208
sources, 2:207*t*
See also Legumes; Meat analogs
Space travel and nutrition, **2:210–215**
dietary intake during spaceflight, 2:214–215
space food systems, 2:212–214, *213*
space physiology, 2:210–212
Spaghetti, glycemic index, 1:251*t*
Spain, 2:204, 205, *205*, 206
Special Milk Program, 2:97
Special Supplemental Program for Women, Infants, and Children (WIC). *See* WIC program
Sphygmomanometers, 1:99, *100*
Spices, 1:108, 2:204, *205*
Splenda, 1:47
Spores, and food-borne illness, 2:119
Sports bars, as functional food, 1:242*t*
Sports drinks, 2:4, 217–218
Sports nutrition, **2:215–219**
caffeine, 1:83
calories, 2:216
carbohydrates, 2:216
eating disorders, 1:125
fat, 2:216
female athlete triad, 2:218–219
fluids, 2:*217*, 217–218, 218*t*
glycemic index, 1:251–252
human growth hormone, 1:262–263
nutritional needs, 1:7

protein, 2:216
sports supplements, 2:218
timing of meals, 2:218
vitamins and minerals, 2:217
water, 2:245, 246, 247, *247*
See also Ergogenic aids; Female athlete triad
Sri Lankans, diet of, 1:55, 2:*180*
SSRI (selective serotonin reuptake inhibitor), 1:180–181, 2:149
See also Serotonin
St. Vincent and the Grenadines, 1:110
Stabilizing agents, 1:2
Stacking, 1:190
Standardized death rate (SDR), 1:117
Stanol esters, 1:242*t*
Staphylococcus aureus, 2:3, 119, 120*t*
Staples, defined, 1:16
Starch, 1:94
Stark, William, **2:219–220,** 2:*220*
See also Scurvy
Starvation, self-imposed, 1:181, 2:140
See also Anorexia nervosa
Steam doctors, 2:135
Stem cell research, 2:74–75
Steroid hormones, 1:215
Steroids, defined, 1:190
Sterol, defined, 2:30
Stevioside, 1:48
Still birth, defined, 1:252
Stimulants, religion and dietary practices, 2:176, 177
Stimulus control, and weight management, 2:251
Stool acidity test, 2:22
Stress, defined, 1:44
Stress management
mood-food relationships, 2:*65*, 66–67
and weight management, 2:251–252
Stress response, 1:138
Stroke, 1:100, 147
defined, 1:24
See also Cardiovascular disease (CVD)
Structural proteins, 1:37
Structure and function claims
for dietary supplements, 1:33, 156
for functional foods, 1:241–243
Subcutaneous, defined, 2:37
Sucralose, 1:47
Sucrose, 1:93–94, 94*t*
defined, 1:46
Sudan refugees, 2:*165*
Sugar
Caribbean Islands, 1:107
comparison, 1:94*t*
maple, 2:80
and oral health, 2:110
and pregnancy, 2:144
simple, 1:93–94, 94*t*, 2:91
Sugar alcohols, 1:47, 242*t*
Sugar Busters!, 1:203*t*, 204
Sulfite intolerance, 1:28
Summer Food Service Program for Children, 1:284, 2:97
Sun exposure, and vitamin D, 2:183, *184*, 184–185, *235*, 235–236
Sunette, 1:46
Sunscreens, 2:235, *235*
Superweeds, 1:246
Supplements, dietary. *See* Dietary supplements
Surgeon General's Report on Nutrition and Health, 1:154
Suriname, 2:203
Sustainable food systems, **2:220–223,** 2:*222*
importance, 2:221
promoting, 2:221–222
See also Organic foods; Pesticides
Swallowing difficulties, 1:21, 2:110, 111
Swanson TV Dinner, 2:141
Sweden
life expectancy, 2:28
obesity, 2:105
vitamin C deficiency, 1:120
Sweet corn, 1:133–134
Sweeteners, artificial. *See* Artificial sweeteners
Sweet'n Low, 1:47
Switzerland
food-borne illness, 2:118
life expectancy, 2:28
Systolic pressure, 1:99, *100*, 288

T

Tacos, 1:115, 116, 2:*81*
Taiwan, organic foods in, 2:115
Tajines, 1:17, *17*
Tamales, 1:115
Tartrazine, 1:4
Tea
caffeine, 1:81, 81*t*
England, Wales, and Scotland, 2:84
Ireland, 2:86
South America, 2:201
Teenagers. *See* Adolescent nutrition
TEFAP (The Emergency Food Assistance Program), 1:128, 284–285
Television
African Americans, 2:167–168
body image, 2:131
International Children's Day of Broadcasting, 2:226
obesity, 2:106
TV Dinners, 2:141
Temperance, 1:254, 255, 2:254
Temperate zone, defined, 1:18
Ten Steps to Successful Breastfeeding program, 2:226
Testosterone, defined, 1:137
Tetracycline, 2:88*t*, 89
Tex-Mex cuisine, 1:116
Thailand, food insecurity, 1:*229*, 230
Thalassemia, defined, 1:38
Thermoregulate, defined, 2:225
Thiamine (vitamin B_1), 2:238, 240*t*
and beriberi, 1:62
Casimir, Funk, 1:244
deficiency, 1:62, 2:103, 181
and rice, 2:181
Thiazide, 2:88*t*
Thickening agents, 1:2
Thirst, 2:217, *217*, 247
Threonine, 2:156*t*
Thrifty Food Plan, 1:153
Thrifty gene, 1:145, 2:126
Title V Maternal Child Health Program, 2:98
Tobacco. *See* Smoking
Tocopherol. *See* Vitamin E
Toddlers. *See* Preschoolers and toddlers, diet of
Tofu, 2:207, *209*, 230, *231*
defined, 1:5
Tolerable Upper Intake Level, 1:155
Tolerance, defined, 1:24
Tomatoes
carotenoids, 1:113, 2:234
genetically modified, 1:65, 245–246
and prostate cancer, 1:91, 2:234
Tortillas, 1:113, *114*, 114–115, 116
Total vegetarians, 2:229, 243
Toxemia, 1:289, 2:146, **2:223**
See also Pregnancy
Toxicant, defined, 1:4
Toxicity
calcium, 1:84, 2:61
fluoride, 2:63
iron, 2:63
magnesium, 2:61
manganese, 2:63
minerals, 2:61, 63

Toxicity *(continued)*
phosphate, 2:61
potassium, 2:61
sodium, 2:61
vitamin A, 2:233*t*, 234
vitamin D, 2:233*t*, 236
vitamin E, 2:233*t*, 237
vitamin K, 2:233*t*, 236
Toxins
defined, 1:77
in genetically modified foods, 1:246
Trace, defined, 1:43
Trace minerals, 2:61–63
Traditional Healthy Mediterranean Diet Pyramid, 1:226–227
Trall, Russell, 2:17
Trans-fatty acids
defined, 1:100
on food labels, 1:*217*
Mediterranean diet, 1:260
Traveler's diarrhea, 1:149
A Treatise of the Rickets, 1:249, *249*
Treatise on Bread and Bread Making (Graham), 1:255
Trichinella spiralis, 2:3, 120*t*
Trick or Treat for UNICEF, 2:228
Triglycerides
as basic fat unit, 1:215, 216, 2:92–93
defined, 1:68
in fat metabolism, 2:56
optimal, borderline, and high levels, 2:29*t*
Trinidad and Tobago, 1:110
Tripeptides, 1:37
Tryptophan, 2:156*t*
in maize, 1:134
and niacin, 2:239, 240–241
and pellagra, 2:135, 240–241
as precursor of serotonin, 2:64
and pyridoxal phosphate, 2:242
Tuber, defined, 1:108
Tuberculosis
and breastfeeding, 2:146
defined, 1:51
Tularemia, defined, 2:187
Tulp, Nicolaas, **2:223–225,** 2:*224*
See also Beriberi
Tumor, 1:88, 90
Tumor suppressor gene, 1:91
TV. *See* Television
Type I diabetes, 1:144, *145*, 146
Type II diabetes, 1:144–145, 146, 147
defined, 1:14
and exercise, 1:288
Native Americans, 2:81
prevalence, 1:164
Typhoid, defined, 1:253
Typhus, defined, 1:253
Tyramine, 1:28, 2:89
Tyrosine, 2:66, 137, 156*t*
Tzotzil, 1:*114*

U

Ulcer, defined, 1:79
Ulcer, gastric, 1:79, 172
Ultraviolet radiation
and space travel, 2:211
and vitamin D, 2:183, *184*, 184–185, *235*, 235–236
UN. *See* United Nations
Uncharged, defined, 2:155
Undernutrition
defined, 1:113
developing countries, 2:111, 141
homelessness, 1:283–285
oral health, 2:111
prevalence, 2:33
Underweight, 2:35, **2:225**
See also Body mass index
UNHCR (United Nations High Commissioner for Refugees), 1:189
UNICEF. *See* United Nations Children's Fund (UNICEF)
United Kingdom
mad cow disease, 2:118
organic foods, 2:115
United Nations
Administration Committee on Coordination Sub Committee on Nutrition (ACC/SCN), 2:165
Economic and Social Council, 2:198
food insecurity, 1:228
Food Safety Agency, 1:246
homelessness, 1:282
nongovernmental organizations, 2:82–83
Office for the Coordination of Humanitarian Affairs (OCHA), 1:175*t*
Universal Declaration of Human Rights, 2:35–36
urban population, 2:221
world population, 1:230
See also Food and Agriculture Organization (FAO)
United Nations Children's Fund (UNICEF), 1:175*t*, **2:225–228,** 2:*228*
accomplishments, 2:226–227
administration, 2:226
in Bam (Iran), 2:226
mission, 2:226
oral rehydration therapy, 2:113, 226
programs and operations, 2:227–228
resources, 2:226
United Nations High Commissioner for Refugees (UNHCR), 1:189
Universal Declaration of Human Rights, 2:35–36
University of Toronto Joint Centre for Bioethics, 1:67, 68
Unsaturated fatty acids, 1:215, 2:93, 94
Urban growth, and sustainable food systems, 2:221
Urban Institute, 1:282
Urea cycle disorders, 2:7
Uric, defined, 2:6
Uruguay, 2:201, 203
U.S. Agency for Healthcare Research and Quality, 2:198
U.S. Agency for International Development (USAID), 1:175*t*
U.S. Census Bureau, 1:275, 284
U.S. Centers for Disease Control and Prevention (CDC)
bioterrorism, 1:237
body mass index, 1:121
fetal alcohol syndrome, 1:*220*
food-borne illnesses, 1:236, 2:4
Global Polio Eradication Initiative, 2:227
growth charts, 1:262
high school students, 2:191–192
hypertension, 2:53
National Immunization Days, 2:227
physical activity, 1:161
prostate cancer, 2:53
as regulatory agency, 2:172
U.S. Department of Agriculture (USDA)
Center for Nutrition and Public Policy, 1:269
commodity foods, 1:127–129, *129*, 284–285
Continuing Survey of Food Intakes by Individuals, 1:160
Dietary Guidelines, 1:153–154
Economic Research Service, 2:116
Emergency Food Assistance Program, 1:128, 284–285
Food and Nutrition Information Center, 2:171
Food and Nutrition Service (FNS), 1:127, 128, 2:96–98, *98*, 194, 255

Food Guide Pyramid for Young Children, 2:151
food insecurity, 1:228
food labels, 1:232, 233
food safety, 1:164
Food Safety and Inspection Service, 2:*171*
food-borne organisms, 2:118
genetically modified foods, 1:247–248
health claims, 1:263, 264, 266, 2:37–38
Healthy Eating Index, 1:267–269, *268*
junk food in schools, 2:191
mad cow disease, 2:*119*
organic foods, 2:114, 116, 162
as regulatory agency, 2:171, *171*
school food service, 2:194, 195
See also Food Guide Pyramid
U.S. Department of Health and Human Services (HHS)
community nutrition programs, 2:98
cultural competence, 1:141–142
Dietary Guidelines, 1:154
nutrition programs for elderly, 1:129
U.S. Department of Homeland Security (DHS), 2:172
U.S. Environmental Protection Agency (EPA), 2:172
U.S. Federal Trade Commission (FTC), 2:164
U.S. Food and Drug Administration (FDA)
additive definition, 1:1
additive regulation, 1:2–4, 158
approved artificial sweeteners, 1:46–47
artificial sweeteners pending approval, 1:48
bioterrorism, 1:238, 2:172
dietary supplements, 1:33, 156, 158, 2:59–60
drug regulation, 1:158
fat intake, 1:*217*
fat substitutes, 1:211–212, 213
food labels, 1:232–233, 234, 237, 241–243, 2:161
food safety, 1:164, 235–236, 238
functional foods, 1:241–243
Generally Recognized as Safe (GRAS), 1:245
genetic engineering, 1:66–67, *68*
Hazard Analysis Critical Control Point program, 1:236
health claims, 1:263, 264, 266
nutrition quackery, 2:161
organic food, 1:237
as regulatory agency, 2:171–172
soy, 2:207
U.S. Food and Nutrition Board, 2:59
U.S. Food and Nutrition Service (FNS)
commodity foods, 1:127, 128
community nutrition programs, 2:96–98, *98*
school food service, 2:194
WIC program, 2:255
U.S. Institute of Medicine
beta-carotene, 1:63
homelessness, 1:283
pregnancy weight gain, 2:143
U.S. National Center for Environmental Health, 2:26
U.S. National Library of Medicine (NLM), 2:74
U.S. National Organic Standards Board (NOSB), 2:113–114
U.S. Office of Minority Health, 1:141–142
U.S. Public Health Service (PHS), 1:238–239, 253, 2:73
U.S. Senate Select Committee on Nutrition and Human Needs, 1:153–154
U.S. Surgeon General
college binge drinking, 1:25
dental caries, 2:110
diabetes, 1:164
nutrition and health report, 1:154
USAID (U.S. Agency for International Development), 1:175*t*
USDA. *See* U.S. Department of Agriculture

V

Vaccine, defined, 1:91
Valine, 2:6, 156*t*
Vector-borne diseases, 1:176
Vegan, **2:229,** 2:243
defined, 1:7
See also Plant-based diets; Vegetarianism
Vegetable oils, 2:108
Vegetables
and cancer prevention, 1:91
Caribbean Islands, 1:108
Central America and Mexico, 1:114
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:258
Vegetarian Food Guide Pyramid, 2:231
Vegetarianism, **2:229–232,** 2:*231*
Battle Creek Sanitarium, 1:60, *61*
benefits, 2:229–230
at different ages, 2:230–231
legumes, 2:27–28
nutritional adequacy, 1:7, 2:230
and osteomalacia, 2:122
and religion, 2:175–176, 176, *177*, 179
types, 2:229
and vitamin D, 2:236
See also Meat analogs
Vegetative bacteria, and food-borne illness, 2:119
Veins, 1:99
Venezuela, 2:202–203
"Very low," as nutrient content claim, 1:265*t*
Very low-density lipoprotein (VLDL), 2:29
Vietnamese, diet of, 1:50*t*, 54
Viral disease, defined, 2:262
Virus
defined, 1:37
and food-borne illness, 2:119–120
Vitamin A, 2:232, 233*t*, 234
Asia, 1:56
and beta-carotene, 1:62–63
from carotenoids, 1:112, 113
daily recommended intakes, 2:233*t*
deficiency, 1:56, 2:233*t*, 234, 264
functions, 2:232, 233*t*
and golden rice, 2:182
people at risk, 2:233*t*
sources, 2:233*t*
supplements during pregnancy, 2:36
toxicity, 2:233*t*, 234
and vitamin E, 2:232
and vitamin K, 2:236
and xerophthalmia, 2:264
Vitamin B_1. *See* Thiamine (vitamin B_1)
Vitamin B_2 (riboflavin), 2:238, 240*t*
Vitamin B_3. *See* Niacin (vitamin B_3)
Vitamin B_5 (pantothenic acid), 2:240*t*, 241
Vitamin B_6, 2:240*t*, 242
Vitamin B_8. *See* Biotin (vitamin B_8)
Vitamin B_9. *See* Folate
Vitamin B_{12}, 1:40, 2:230–231, 241*t*, 243
Vitamin C, 2:241*t*, 244
as antioxidant, 1:42, 44*t*
and cancer, 2:167
Central Europe and Russia, 1:119, 120

Vitamin C *(continued)*
deficiency, 1:119, 120, 2:219–220, *220*
and illness, 2:134
and oral health, 2:111
processed foods, 2:197
and scurvy, 2:197, 219–220, *220*
Vitamin D, 2:233*t*, 234–236
and calcium, 1:84, 86, 2:235
daily recommended intakes, 2:233*t*
defined, 1:2
functions, 2:233*t*, 235
infant nutrition, 2:8
in milk, as functional food, 1:242*t*
and osteomalacia, 2:122
and osteoporosis, 2:124
people at risk, 2:233*t*
and phosphorus, 2:235
preschoolers and toddlers, 2:152
sources, 2:233*t*
during space travel, 2:211
and sun exposure, 2:183, *184*, 184–185, *235*, 235–236
toxicity, 2:233*t*, 236
and vegetarianism, 2:230–231
Vitamin D deficiency, 2:235–236
and cod liver oil, 2:234–235
and osteomalacia, 1:84, 2:183, 235
and osteoporosis, 2:235
and rickets, 1:84, 2:46, *47*, 104, 183, 184, *184*, 185, 235
symptoms, 2:233*t*
Vitamin E, 2:233*t*, 236–237
as antioxidant, 1:43, 44*t*, 2:237
daily recommended intakes, 2:233*t*
deficiency, 2:233*t*, 237
functions, 2:233*t*
people at risk, 2:233*t*
sources, 2:233*t*
toxicity, 2:233*t*, 237
and vitamin A, 2:232
and vitamin K, 2:236, 237
Vitamin K, 2:233*t*, 236
daily recommended intakes, 2:233*t*
deficiency, 2:94, 233*t*, 236
functions, 2:233*t*, 236
people at risk, 2:233*t*
sources, 2:233*t*
toxicity, 2:233*t*, 236
and vitamin A, 2:236
and vitamin E, 2:236, 237
Vitamins
in corn- or maize-based diets, 1:134–136
defined, 1:2
discovery, 1:244, *244*
as nutrient, 2:94
pregnancy, 2:145
sports nutrition, 2:217
Vitamins, fat-soluble, 2:94, 153, **2:232–237,** 2:233*t*, *235*
See also Vitamin A; Vitamin D; Vitamin E; Vitamin K
Vitamins, water-soluble, 2:94, **2:230–244,** 2:*239*, 240–241*t*
See also Choline; Vitamin C; *specific B vitamins by name*
VLDL (very low-density lipoprotein), 2:29

W

Waist circumference, 1:73–74
Waist-to-hip ratio, 1:68–69, **2:245**
See also Anthropometric measurements
Wales, 2:85–86
Warfarin, 2:88*t*, 236, 237
Warm-up, in exercise, 1:201
Wasting
defined, 1:73
HIV/AIDS patients, 1:280
and malnutrition, 2:35
Water, **2:245–248,** 2:*246*
contaminated, 1:150, 173, 174–175, 2:*228*
functions, 2:245
in human body, 245–246
as nutrient, 2:95
older women and men, 2:50
pasteurization, 2:133
recommendations, 2:246
sports nutrition, 2:217
water balance, 2:246
water excretion regulation, 2:*247*, 247–248
water intake regulation, 2:247
water intoxication, 2:248
See also Dehydration; Oral rehydration therapy (ORT)
Waterhouse, Debra, 1:137
Water-soluble, defined, 1:42
Water-soluble vitamins. *See* Vitamins, water-soluble
Wean, defined, 1:76
Weight and height tables, 2:99–100, 100*t*
Weight cycling, 1:184–185, 2:250, 264–265
Weight gain
menopause, 2:50
pregnancy, 2:143–144, 143*t*
Weight loss
diarrhea, 1:149
HIV/AIDS patients, 1:280
Weight loss agents, as ergogenic aids, 1:192
Weight loss diets, 1:167, 2:106–107, **2:248–250,** 2:*249*
See also Dieting; Fad diets; Yo-yo dieting
Weight loss soap, 2:*163*
Weight management, **2:250–253,** 2:*252*, *253*
adults, 1:7–8
and caffeine, 1:83
methods, 2:106–107, *107*, 251–253
See also Eating habits; Exercise; Fad diets; Weight loss diets
Weight Watchers, 1:167
Wellness, **2:253**
defined, 1:7
See also Health
Wernicke-Korsakoff syndrome, 1:62, 2:238
West Africans, diet of, 1:17–18
West Indies, 1:11
West Nile Virus vaccine, 2:75
Western Health Reform Institute, 1:60, 2:254
See also Battle Creek Sanitarium
Westernization of dietary patterns, 1:163–164, *165*
See also Nutritional transition
WFP (World Food Programme). *See* Food Aid for Development and the World Food Programme
White, Ellen G., 1:60, 2:17, *254*, **2:254–255**
See also Battle Creek Sanitarium
White blood cell, defined, 2:4
Whites
childhood obesity, 1:121
diet-related disease, 1:14*t*
specific food consumption, 1:278*t*
WHO. *See* World Health Organization (WHO)
Whole foods diet, 1:242*t*, **2:255**
WIC program, 2:97, **2:255–258,** 2:256*t*, *257*
and Commodity Supplemental Food Program, 1:127
history, 2:255–256
and homelessness, 1:284
new directions, 2:258
outcomes and evaluation, 2:257–258
and pregnancy, 2:146–147, 255, 256, 257
rules, 2:256–257

See also Infant nutrition; Pregnancy; Preschoolers and toddlers, diet of
Wilson, Owen, 2:*258*, **2:258**
See also Infant nutrition
Wine, as functional food, 1:240, 242*t*
Women, Infants, and Children (WIC) program. *See* WIC program
Women's Health Initiative, 2:48, *49*
Women's nutritional issues, **2:259–261**
anemia, 2:259
body image, 1:69, *70*, 71
breast cancer, 2:260
calcium, 2:259, 260
chronic diseases, 2:260–261, *261*
college students, 1:124–125
cravings, 1:137, *138*
diabetes, 2:260
eating disorders, 1:177, 178, 184
folic acid, 2:259
heart attack symptoms, 2:75
heart disease, 2:260–261
hypertension, 2:261
iron, 2:259
life expectancy in Europe, 1:120*t*
menopause, 2:260
osteoporosis, 1:10, 2:123, *124*, 125, 260
pregnancy and breastfeeding, 2:259
premenstrual syndrome, 2:259
serotonin, 2:64
See also Menopause; Pregnancy; Premenstrual syndrome (PMS)
World Bank, 1:230
World Declaration and Plan of Action for Nutrition (1992), 1:250
World Food Programme (WFP). *See* Food Aid for Development and the World Food Programme
World Food Summit, 1:225, 230
World Health Organization (WHO), **2:262–264,** 2:*263*
Applied Nutrition Program, 2:262
artificial sweeteners, 1:48
biotechnology, 1:67, 68
breastfeeding, 1:75, 2:226, 263
Department of Nutrition for Health and Development, 2:35
diabetes, 1:143
diarrhea, 1:149, 151
dietary supplements, 1:156
food insecurity, 1:229
Food Safety Department, 2:172–173
Food Safety Program, 2:262–263
food-borne illness prevention, 2:121
Global Database on National Nutrition Policies and Programmes, 1:249–250
Global Outbreak Alert and Response Network, 2:262
Global Public Health Intelligence Network, 2:262
health definition, 1:263
Health for All Database, 1:117
history and mission, 2:262
HIV/AIDS, 1:280
hunger, 1:287
irradiation, 2:13
lead poisoning, 2:26
life expectancy, 2:28
malaria prevention, 2:227
malnutrition, 2:34, 35
marasmus, 2:36
nutritional deficiency, 2:*103*
obesity, 1:164
oral rehydration therapy, 2:113
osteoporosis, 2:122
programs, 2:262–264
Severe Acute Respiratory Syndrome (SARS), 2:262
smoking, 2:198
See also Food Aid for Development and the World Food Programme
World Health Organization (WHO) Joint Expert Committee on Food Additives, 1:4, 46, 47
Wurtman, Judith, 2:64

X

Xerophthalmia, 2:234, **2:264**
See also Beta-carotene; Vitamin A

Y

Yeast allergy, defined, 1:29
Yellow root, 1:13
Yerba maté;, 2:201
Yin and yang, in macrobiotic diet, 2:31
Yogurt, 2:22–23, 154
Yohimbe, as ergogenic aid, 1:190–191, 2:218
Yo-yo dieting, 1:184–185, 2:250, **2:264–265**
See also Dieting; Weight loss diets

Z

Zeaxanthin, 1:113, 2:234
Zein, in maize, 1:134
Zeisel, Steven H., 1:157–158
Zinc
deficiency, 2:63
defined, 1:41
disease prevention and treatment, 2:62
functions, 2:62
preschoolers and toddlers, 2:152
Zocor, 2:88*t*
The Zone (diet), 1:203*t*, 204

This page intentionally left blank

Nutrition and Well-Being A to Z

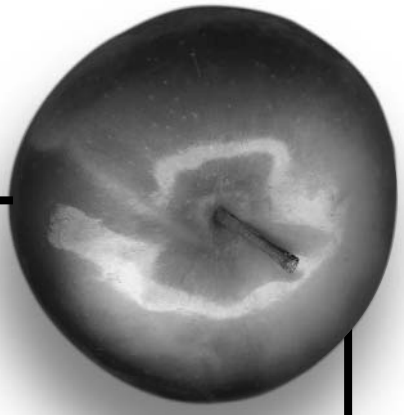
EDITORIAL BOARD

EDITORIAL AND PRODUCTION STAFF

Ray Abruzzi, Mark Drouillard, *Project Editors*
Peter Jaskowiak, *Copyeditor*
Dorothy Bauhoff, Jessica Hornik Evans, *Proofreaders*
Wendy Allex, *Indexer*
Marc Borbely, Justin Crawford, Tom Crippen, Victor Inzunza, Paula Kepos, Richard Robinson, *Editorial Support*
Michelle Dimercurio, *Senior Art Director*
Wendy Blurton, *Senior Manufacturing Specialist*
Shalice Shah-Caldwell, *Permissions Specialist*
Denay Wilding, *Image Acquisition Editor*, *Imaging and Multimedia Content*
Lezlie Light, *Imaging Coordinator*, *Imaging and Multimedia Content*
Randy Bassett, *Imaging Supervisor*, *Imaging and Multimedia Content*

Macmillan Reference USA

Frank Menchaca, *Vice President and Publisher*
Hélène Potter, *Director*, *New Product Development*



Nutrition and Well-Being A to Z

2 VOLUME I–Z

Delores C. S. James, Editor in Chief

Nutrition and Well-Being A to Z

Delores C. S. James, Editor in Chief

For more information contact
The Gale Group, Inc.
27500 Drake Rd.
Farmington Hills, MI 48331-3535
Or you can visit our Internet site at
http://www.gale.com

LIBRARY OF CONGRESS CATALOGING-IN-PUBLICATION DATA

Nutrition and well being A to Z / Delores C.S. James, editor in chief.
p. cm.
Includes bibliographical references and index.
ISBN 0-02-865707-1 (set hardcover)—ISBN 0-02-865708-X (volume 1)—
ISBN 0-02-865709-8 (volume 2)
1. Nutrition—Encyclopedias. 2. Health—Encyclopedias.
I. James, Delores C.S., 1961–

RA784.N838 2004
613.2′03—dc22 2004006088

This title is also available as an e-book
ISBN 0-02-865990-2 (set)
Contact your Gale sales representative for ordering information

Printed in the United States of America
10 9 8 7 6 5 4 3 2 1

Table of Contents

Volume 1

Table of Contents v
Preface ix
Topical Outline xi
For Your Reference xv
Contributors xxi

Addiction, Food 1
Additives and Preservatives 1
Adolescent Nutrition 4
Adult Nutrition 7
African Americans, Diet of 10
Africans, Diets of 15
Aging and Nutrition 20
Alcohol and Health 23
Allergies and Intolerances 26
Alternative Medicines and Therapies 30
American Dietetic Association 34
American Public Health Association 35
American School Food Service Association 35
American School Health Association 35
Amino Acids 36
Anemia 38
Anorexia Nervosa 41
Anthropometric Measurements 42
Antioxidants 42
Appetite 44
Arteriosclerosis 45
Artificial Sweeteners 46
Asian Americans, Diets of 48
Asians, Diets of 52
Atherosclerosis 59
Baby Bottle Tooth Decay 59
Battle Creek Sanitarium, Early Health Spa 60
Beikost 62
Beriberi 62
Beta-Carotene 62
Bezoars 63
Binge Eating 63
Bioavailability 64
Biotechnology 64
Body Fat Distribution 68
Body Image 69
Body Mass Index 71
Breastfeeding 74
Brillat-Savarin, Jean Anthelme 78
Bulimia Nervosa 79
Caffeine 80
Calcium 83
Calorie 87
Cancer 87
Carbohydrates 93
Cardiovascular Diseases 99
Careers in Dietetics 104
Caribbean Islanders, Diet of 107
Carotenoids 112
Central Americans and Mexicans, Diets of 113
Central Europeans and Russians, Diets of 117
Childhood Obesity 121
College Students, Diets of 123
Commodity Foods 127
Comprehensive School Health Program 130
Convenience Foods 132
Corn- or Maize-based Diets 133
Cravings 136
Cultural Competence 139
Dehydration 142

Diabetes Mellitus 143
Diarrhea 149
Diet 151
Dietary Assessment 152
Dietary Guidelines 153
Dietary Reference Intakes 155
Dietary Supplements 155
Dietary Trends, American 159
Dietary Trends, International 162
Dietetic Technician, Registered (DTR) . . 166
Dietetics 166
Dieting 167
Dietitian 168
Digestion and Absorption 169
Disaster Relief Organizations 173
Eating Disorders 176
Eating Disturbances 182
Eating Habits 186
Emergency Nutrition Network 189
Ergogenic Aids 189
Exchange System 193
Exercise 198
Exercise Addiction 201
Expanded Food and Nutrition Education Program 202
Fad Diets 203
Failure to Thrive 206
Famine 207
Fast Foods 209
Fasting 210
Fat Substitutes 211
Fats 214
Female Athlete Triad 219
Fetal Alcohol Syndrome 220
Fiber 221
Food Aid for Development and the World Food Programme 223
Food and Agriculture Organization (FAO) 224
Food Guide Pyramid 225
Food Insecurity 228
Food Labels 231
Food Safety 235
Fortification 239
French Paradox 239
Functional Foods 240
Funk, Casimir 244
Generally Recognized as Safe (GRAS) . . . 245
Genetically Modified Foods 245
Glisson, Francis 249
Global Database on National Nutrition Policies and Programs 249
Glycemic Index 250
Goiter 252
Goldberger, Joseph 253
Graham, Sylvester 254
Grazing 256
Greeks and Middle Easterners, Diet of . . . 256
Green Revolution 261
Growth Charts 262
Growth Hormone 262
Health 263
Health Claims 263
Health Communication 266
Health Education 266
Health Promotion 267
Healthy Eating Index 267
Healthy People 2010 Report 269
Heart Disease 271
Hispanics and Latinos, Diet of 275
HIV/AIDS 279
Homelessness 282
Hunger 287
Hyperglycemia 287
Hypertension 288
Hypoglycemia 292

Glossary 293
Index 309

Volume 2

Table of Contents v
Preface ix
Topical Outline xi
For Your Reference xv
Contributors xxi

Illnesses, Food-Borne 1
Immune System 4
Inborn Errors of Metabolism 4
Infant Mortality Rate 7
Infant Nutrition 8
Infection 12
Insulin 12
Irradiation 13
Isoflavones 14

Johnson, Howard 14
Kellogg, John Harvey 16
Kroc, Ray 18
Kwashiorkor 20
Lactose Intolerance 21
Lay Health Advisor 23
Lead Poisoning 23
Legumes 27
Life Expectancy 28
Lipid Profile 28
Low Birth Weight Infant 31
Macrobiotic Diet 31
Malnutrition 33
Marasmus 36
Marketing Strategies 37
Mastitis 41
Maternal Mortality Rate 42
Meals On Wheels 42
Meat Analogs 42
Medical Nutrition Therapy 43
Mellanby, Edward 46
Menopause 47
Men's Nutritional Issues 51
Metabolism 54
Minerals 58
Mood-Food Relationships 64
National Academy of Sciences (NAS) 67
National Health and Nutrition Examination Survey (NHANES) 68
National Institutes of Health (NIH) 73
Native Americans, Diet of 78
Nongovernmental Organization (NGO) 82
Northern Europeans, Diet of 83
Nutrient Density 87
Nutrient-Drug Interactions 88
Nutrients 90
Nutrition 95
Nutrition Education 96
Nutrition Programs in the Community . . . 96
Nutritional Assessment 99
Nutritional Deficiency 102
Nutritionist 104
Obesity 105
Omega-3 and Omega-6 Fatty Acids 108
Oral Health 110
Oral Rehydration Therapy 113
Organic Foods 113
Organisms, Food-Borne 117
Osteomalacia 122
Osteopenia 122
Osteoporosis 123
Overweight 125
Pacific Islander Americans, Diet of 126
Pacific Islanders, Diet of 128
Pasteur, Louis 132
Pasteurization 133
Pauling, Linus 133
Pellagra 135
Pemberton, John S. 135
Pesticides 137
Phenylketonuria (PKU) 137
Phytochemicals 138
Pica 138
Plant-Based Diets 138
Popular Culture, Food and 139
Pregnancy 142
Premenstrual Syndrome 147
Preschoolers and Toddlers, Diet of 150
Probiotics 154
Protein 155
Quackery 160
Recommended Dietary Allowances 164
Refugee Nutrition Information System (RNIS) 164
Regional Diets, American 166
Regulatory Agencies 170
Religion and Dietary Practices 174
Rice-based Diets 179
Rickets 183
Rosenstein, Nils Rosén von Satiety 187
Scandinavians, Diet of 187
School-Aged Children, Diet of 190
School Food Service 194
Scurvy 197
Small for Gestational Age 197
Smoking 198
Society for Nutrition Education 200
South Americans, Diet of 200
Southern Europeans, Diet of 204
Soy 207
Space Travel and Nutrition 210
Sports Nutrition 215
Stark, William 219
Sustainable Food Systems 220
Toxemia 223

Tulp, Nicholaas 223
Underweight 225
United Nations Children's Fund (UNICEF) 225
Vegan 229
Vegetarianism 229
Vitamins, Fat-soluble 232
Vitamins, Water-soluble 238
Waist-to-Hip Ratio 245
Water 245
Weight Loss Diets 248
Weight Management 250
Wellness 253
White, Ellen G. 254
Whole Foods Diet 255
WIC Program 255
Wilson, Owen 258
Women's Nutritional Issues 259
World Health Organization (WHO) 262
Xerophthalmia 264
Yo-Yo Dieting 264

Glossary 267
Index 283

Preface

Nutrition is one of the most important factors that impact health in all areas of the lifecycle. Pregnant women need adequate food and health care to deliver a healthy baby who has a good birth weight and a fighting chance for survival. In many regions of the world, the infant mortality rate is very high, meaning that many infants will not live to see their first birthday. Breastfeeding is the ideal method of feeding and nurturing infants, because breast milk contains many immunologic agents that protect the infant against bacteria, viruses, and parasites. Yet, less than 40 percent of infants worldwide are exclusively breastfed (no other food or drink, not even water) for the first four months of life. Children need adequate nutrition to develop and grow to their full potential.

Malnutrition, both undernutrition and overnutrition, is at an all time high, with close to one-third of the world's children suffering from it. The number of undernourished people in the world continues to increase because of little or no progress to reduce poverty. Thousands of children die daily from hunger and its effects, even in technologically advanced countries. Without adequate nutrition, a person's cognitive ability is diminished, which adversely affects their ability to get a good paying job and contribute to their local economy. Paradoxically, childhood and adult obesity in many parts of the developed world are also near epidemic proportions. There are 300 million obese people in the world. In the United States, about 34 percent of Americans are overweight and 30.5 percent are obese.

Life expectancy has increased in many countries and the population of older adults is growing at an unprecedented rate in the United States and other technologically advanced countries. In the United States the average life expectancy is 70, while globally, the average rose to 67 years in 1998, up from 61 in 1980. These countries are unsure of how they will provide adequate health care for this growing segment of the population. Cardiovascular disease (coronary heart disease, hypertension, stroke) and cancer are top killers in many countries and HIV/AIDS continue to ravage our societies, taking individuals in the productive years of their lives.

Arrangement of the Material

Nutrition and Well-Being A to Z is a two-volume set that provides timely information on the personal, cultural, and global issues that affect (or have an impact on) health and nutritional status. Users will find detailed coverage of topics covered in general nutrition, food science, and personal and

family courses. This encyclopedia explains fundamental concepts such as amino acids, cutting-edge ideas such as functional foods, social issues such as food insecurity, and political issues such as bioterrorism.

The set was also designed to meet consumer needs. Users will be able to spot a quack health-care provider, discriminate between reliable and unreliable health claims, as well as understand the role of government in keeping food safe. The set also profiles individuals who have made a social, historical, or scientific impact on health, nutrition, and food trends. Most entries are written from a global perspective, and dietary patterns from different regions of the world are discussed. Many professional health organizations are described.

The information in *Nutrition and Well-Being A to Z* is clearly presented and easy to find. Professionals in the field of nutrition, dietetics, food science, agriculture, medicine, health education, and public health wrote with the student in mind. Students and teachers can use the set to reinforce classroom topics on food, nutrition, and health, and to expand discussions on special or new topics. The extensive use of illustrations enhances the learning of the material. Entries are arranged alphabetically and an extensive cross-referencing system encourages the user to further explore other entries. All topics in a volume can be found in the index at the back of the book.

Acknowledgements and Thanks

A project of this magnitude would not be possible without the dedication and hard work of many people. I wish to thank the associate editors, Dr. Catherine Christie and Dr. Ranjita Misra, for the many hours they spent recruiting authors and editing entries. Thank you for your timely turnaround of the materials. The project would not have been possible without the many authors who wrote, and sometimes rewrote, the entries. Thank you for sharing your expertise and time. Amanda Foote, Senior Secretary in the Department of Health Science Education, was extremely valuable in copying and mailing the edited materials to the publishers. I wish to thank the many people at Macmillan Reference USA and the Gale Group for conceiving the project and providing direction throughout the entire project, especially the copyeditors and illustrators. I also send special thanks to Mr. Raymond Abruzzi.

Delores C. S. James

Topical Outline

American Dietary Habits

African Americans, Diet of
Asian Americans, Diets of
Dietary Trends, American
Hispanics and Latinos, Diet of
Native Americans, Diet of
Pacific Islander Americans, Diet of
Regional Diets, American

Biographies

Battle Creek Sanitarium
Brillat-Savarin, Jean Anthelme
Funk, Casimir
Glisson, Francis
Goldberger, Joseph
Graham, Sylvester
Johnson, Howard
Kellogg, John Harvey
Krock, Ray
Mellanby, Edward
Pasteur, Louis
Pauling, Linus
Pemberton, John S.
Rosenstein, Nils Rosén von
Stark, William
Tulp, Nicholaas
White, Ellen G.
Wilson, Owen

Body Function and Processes

Digestion and Absorption
Immune System
Insulin
Metabolism

Dieting, Weight Management, Exercise, Eating Disorders

Addiction, Food
Anorexia Nervosa
Appetite
Binge Eating
Body Image
Bulimia Nervosa
Cravings
Diet
Dieting
Eating Disorders
Eating Disturbances
Eating Habits
Ergogenic Aids
Exercise
Exercise Addiction
Fad Diets
Female Athlete Triad
Grazing
Mood-Food Relationships
Pica
Satiety
Sports Nutrition
Weight Loss Diets
Weight Management
Yo-Yo Dieting

Diseases and Disorders

Arteriosclerosis
Atherosclerosis
Bezoars
Cancer
Cardiovascular Disease
Diabetes Mellitus
Heart Disease
HIV/AIDS
Hyperglycemia
Hypertension
Hypoglycemia
Obesity

Food Habits, Trends, and Alternative Choices

Alternative Medicines and Therapies
Fat Substitutes
Legumes
Macrobiotic Diet
Plant-Based Diets
Popular Culture, Food and
Quackery
Soy
Vegan
Vegetarianism
Whole Foods Diet

Food Industry, Technology, and Food Safety

Additives and Preservatives
Artificial Sweeteners
Biotechnology
Commodity Foods
Convenience Foods
Fast Foods
Fat Substitutes
Food Safety
Fortification
Generally Recognized as Safe
Genetically Modified Foods
Green Revolution
Illnesses, Food-Borne
Irradiation
Marketing Strategies
Meat Analogs
Organic Foods
Organisms, Food-Borne
Pasteurization
Pesticides
Probiotics
Regulatory Agencies

Space Travel and Nutrition
Sustainable Food Systems

Health Programs and Organizations

American Dietetic Association
American Public Health Association
American School Food Service Association
American School Health Association
Comprehensive School Health Program
Disaster Relief Organizations
Emergency Nutrition Network
Expanded Food and Nutrition Education Program (EFNEP)
Food Aid for Development and the World Food Programme
Food and Agriculture Organization (FAO)
Global Database on National Nutrition Policies and Programmes
Meals On Wheels
National Academy of Sciences (NAS)
National Institutes of Health (NIH)
Nongovernmental Organization (NGO)
Nutrition Programs in the Community
Refugee Nutrition Information System (RNIS)
School Food Service
Society for Nutrition Education
United Nations Children's Fund (UNICEF)
WIC Program
World Health Organization (WHO)

Health Risks and Health Assessment

Alcohol and Health
Allergies and Intolerances
Anthropometric Measurement
Body Fat Distribution
Body Mass Index
Caffeine
Dehydration
Diarrhea
Dietary Assessment
Fasting
Food Insecurity
Growth Charts
Homelessness
Hunger
Infection
Lead Poisoning
Lipid Profile
Malnutrition
Nutrient-Drug Interactions
Nutritional Assessment
Nutrient Density
Nutritional Deficiency
Oral Rehydration Therapy
Overweight
Smoking
Underweight
Waist-to-Hip Ratio

International Dietary Habits

Africans, Diets of
Asians, Diets of
Caribbean Islanders, Diets of
Central Americans and Mexicans, Diets of
Central Europeans and Russians, Diets of
Corn- or Maize-based Diets
Dietary Trends, International
Famine
French Paradox
Greeks and Middle Easterners, Diet of
Northern Europeans, Diet of
Pacific Islanders, Diet of
Religion and Dietary Practices
Rice-based Diets
Scandinavians, Diet of
South Americans, Diet of
Southern Europeans, Diet of

Nutrients and Chemical Properties of Food

Amino acids
Antioxidants
Beta-Carotene
Bioavailability
Carbohydrates
Calcium
Calorie
Carotenoids
Fats
Fiber
Functional foods
Glycemic Index
Isoflavones
Minerals
Nutrients
Omega-3 and Omega-6 Fatty Acids
Phytochemicals
Protein
Vitamins, Fat-Soluble
Vitamins, Water-Soluble
Water

Nutritional Deficiencies

Anemia
Beriberi
Goiter
Kwashiorkor
Lactose Intolerance
Marasmus
Osteoporosis
Osteomalacia
Osteopenia
Pellagra
Rickets
Scurvy
Xerophthalmia

Nutrition and the Life Cycle

Adolescent Nutrition
Adult Nutrition
Aging and Nutrition
Baby Bottle Tooth Decay
Beikost
Breastfeeding
Childhood Obesity
College Students, Diets of
Failure to Thrive
Fetal Alcohol Syndrome
Growth Hormone
Inborn Errors of Metabolism
Infant Mortality Rate
Infant Nutrition
Life Expectancy
Low Birth Weight Infant
Mastitis
Maternal Mortality Rate
Menopause
Men's Nutritional Issues
Phenylketonuria (PKU)
Pregnancy
Premenstrual Syndrome
Preschoolers and Toddlers, Diet of
School-Aged Children, Diet of
Small for Gestational Age
Toxemia
Women's Nutritional Issues

Nutrition, Health, and Professional Issues

Careers in Dietetic
Cultural Competence
Dietetics

Dietetic Technician, Registered (DTR)
Dietitian
Health
Health Communication
Health Education
Health Promotion
Lay Health Advisor
Medical Nutrition Therapy
Nutrition
Nutrition Education
Nutritionist
Oral Health
Wellness

Nutrition Standards, Guidelines, Reports

Dietary Guidelines
Dietary Reference Intakes
Dietary Supplements
Exchange System
Food Guide Pyramid
Food Labels
Health Claims
Healthy Eating Index
Healthy People 2010 Report
National Health and Nutrition Examination Survey (NHANES)
Recommended Dietary Allowances (RDA)

This page intentionally left blank

For Your Reference

TABLE 1. SELECTED METRIC CONVERSIONS

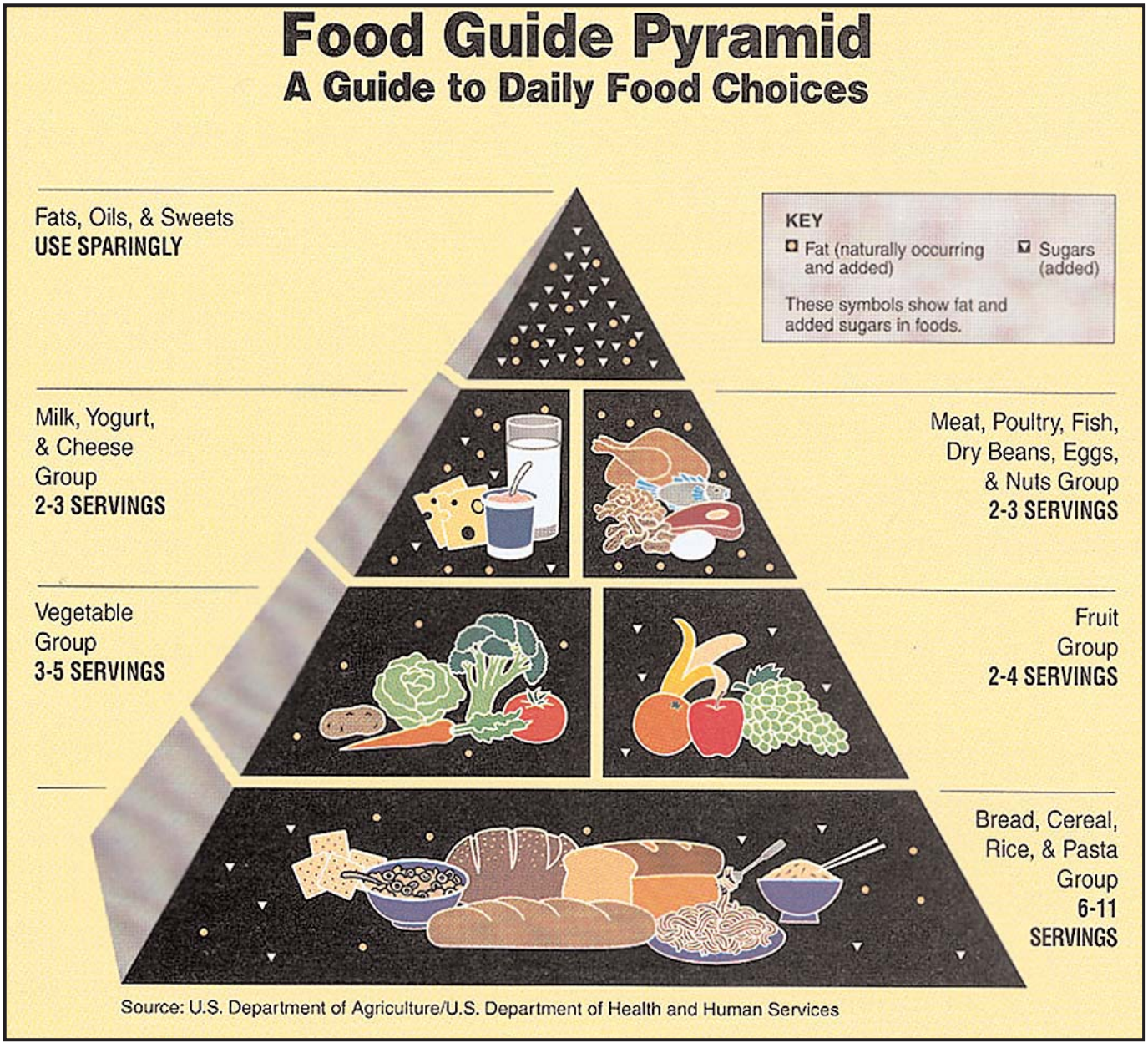
WHEN YOU KNOW	MULTIPLY BY	TO FIND
Temperature		
Celsius (˚C)	1.8 (˚C) +32	Fahrenheit (˚F)
Celsius (˚C)	˚C +273.15	Kelvin (K)
degree change (Celsius)	1.8	degree change (Fahrenheit)
Fahrenheit (˚F)	[(˚F) −32] / 1.8	Celsius (˚C)
Fahrenheit (˚F)	[(˚F −32) / 1.8] +273.15	Kelvin (K)
Kelvin (K)	K −273.15	Celsius (˚C)
Kelvin (K)	1.8(K −273.15) +32	Fahrenheit (˚F)

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Distance/Length		
centimeters	0.3937	inches
kilometers	0.6214	miles
meters	3.281	feet
meters	39.37	inches
meters	0.0006214	miles
microns	0.000001	meters
millimeters	0.03937	inches

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Capacity/Volume		
cubic kilometers	0.2399	cubic miles
cubic meters	35.31	cubic feet
cubic meters	1.308	cubic yards
cubic meters	8.107×10^{-4}	acre-feet
liters	0.2642	gallons
liters	33.81	fluid ounces

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Area		
hectares (10,000 square meters)	2.471	acres
hectares (10,000 square meters)	107,600	square feet
square meters	10.76	square feet
square kilometers	247.1	acres
square kilometers	0.3861	square miles

WHEN YOU KNOW	MULTIPLY BY	TO FIND
Weight/Mass		
kilograms	2.205	pounds
metric tons	2205	pounds
micrograms (μg)	10^{-6}	grams
milligrams (mg)	10^{-3}	grams
nanograms (ng)	10^{-9}	grams


Food Guide Pyramid
A Guide to Daily Food Choices
Fats, Oils, & Sweets
USE SPARINGLY
KEY
Fat (naturally occurring and added)
Sugars (added)
These symbols show fat and added sugars in foods.
Milk, Yogurt, & Cheese Group
2-3 SERVINGS
Meat, Poultry, Fish, Dry Beans, Eggs, & Nuts Group
2-3 SERVINGS
Vegetable Group
3-5 SERVINGS
Fruit Group
2-4 SERVINGS
Bread, Cereal, Rice, & Pasta Group
6-11 SERVINGS
Source: U.S. Department of Agriculture/U.S. Department of Health and Human Services

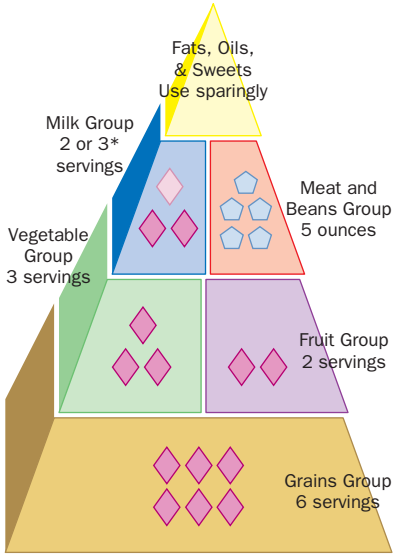
VITAMINS IN FOODS

Vitamin A	liver, carrots, kale, red peppers, milk, spinach, eggs, butter
Vitamin B_6	meat, whole grains, cabbage, peanuts, potatoes, soybeans, liver, fish, beans, milk
Vitamin B_{12}	liver, fish, eggs, milk
Vitamin B_9 (Folate)	tomatoes, spinach, beets, asparagus, potatoes, liver, wheat germ, soybeans, cabbage, whole grains, eggs, milk, meats
Vitamin C	tomatoes, potatoes, most fruits and vegetables
Vitamin D	milk, liver, fatty fish like herring, chicken skin, egg yolks
Vitamin E	most vegetable oils
Vitamin K	broccoli, turnip greens, lettuce, liver, cauliflower, spinach, cabbage, asparagus, Brussels sprouts
Thiamin	meats, whole grains, potatoes, fish, liver, legumes (like beans and peas)
Biotin	liver, soybeans, egg yolks, peanuts, cauliflower, carrots, oatmeal
Riboflavin	eggs, asparagus, liver, milk, fish, meat, whole grains
Pantothenic Acid	liver, fish, eggs, milk, whole grains, meats, legumes (like beans and peas)
Niacin	meats, whole grains, eggs, fish, milk, legumes (like beans and peas)

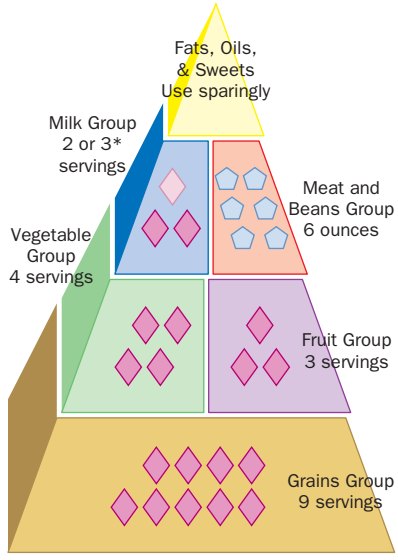
SOURCE: Adapted from "The Vitamins" by G. F. Coombs Jr.

RECOMMENDED PYRAMID SERVINGS FOR INDIVIDUALS

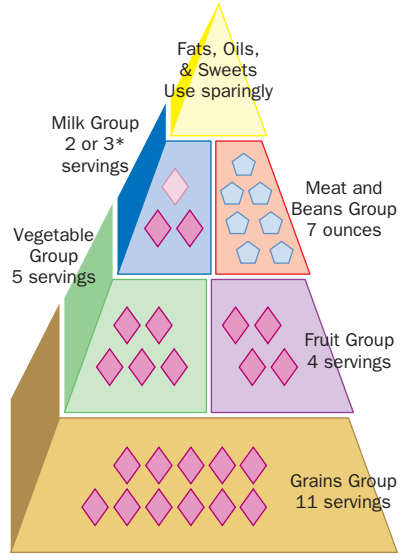
Children 2 to 6, most women, some older adults (about 1,600 calories)



Older children, teen girls, active women, most men (about 2,200 calories)



Teen boys, active men (about 2,800 calories)



=1 serving *=1 ounce*

*Older children and teens 9 to 18 and adults over 50 need 3 servings from the Milk group. Others need 2 servings daily.

WHAT COUNTS AS A PYRAMID SERVING?

Grains Group
- 1 slice of bread
- About 1 cup of ready to eat cereal flakes
- ½ cup of cooked cereal, rice, or pasta

Vegetable Group
- 1 cup of raw leafy vegetables
- ½ cup of other vegetables—cooked or raw*
- ¾ cup of vegetable juice

Fruit Group
- 1 medium apple, banana, orange, pear
- ½ cup of chopped, cooked or canned fruit
- ¾ cup of fruit juice

Milk Group
- 1 cup of milk of yogurt
- 1½ ounces of natural cheese (such as Cheddar)
- 2 ounces of processed cheese (such as American)

Meat and Beans Group
The Pyramid recommends 2 to 3 servings for a total of 5 to 7 ounces. The following all count as 1 ounce equivalent:

- 1 ounce of cooked lean meat, poultry, or fish
- ½ cup of cooked, dry beans*
- ½ cup of tofu or 2½-ounce soyburger
- 1 egg
- 2 tablespoons of peanut butter
- ⅓ cup of nuts

*Dry beans, peas, and lentils can be counted as servings in either the Meat and Beans group of the Vegetable group. As a vegetable, ½ cup of cooked, dry beans counts as 1 serving. As a meat substitute, ½ cup of cooked, dry beans counts as 1 ounce of meat.

SOURCE: Adapted from *Home and Garden Bulletin* 267–3. USDA.

BODY MASS INDEX TABLE

	Normal						Overweight					Obese										Extreme Obesity															
BMI	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**	**53**	**54**
Height (inches)	**Body Weight (pounds)**																																			
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186	191	196	201	205	210	215	220	224	229	234	239	244	248	253	258
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193	198	203	208	212	217	222	227	232	237	242	247	252	257	262	267
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199	204	209	215	220	225	230	235	240	245	250	255	261	266	271	276
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206	211	217	222	227	232	238	243	248	254	259	264	269	275	280	285
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213	218	224	229	235	240	246	251	256	262	267	273	278	284	289	295
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220	225	231	237	242	248	254	259	265	270	278	282	287	293	299	304
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227	232	238	244	250	256	262	267	273	279	285	291	296	302	308	314
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294	300	306	312	318	324
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241	247	253	260	266	272	278	284	291	297	303	309	315	322	328	334
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249	255	261	268	274	280	287	293	299	306	312	319	325	331	338	344
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256	262	269	276	282	289	295	302	308	315	322	328	335	341	348	354
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263	270	277	284	291	297	304	311	318	324	331	338	345	351	358	365
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271	278	285	282	299	306	313	320	327	334	341	348	355	362	369	376
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279	286	293	301	308	315	322	329	338	343	351	358	365	372	379	386
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287	294	302	309	316	324	331	338	346	353	361	368	375	383	390	397
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295	302	310	318	325	333	340	348	355	363	371	378	386	393	401	408
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303	311	319	326	334	342	350	358	365	373	381	389	396	404	412	420
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311	319	327	335	343	351	359	367	375	383	381	399	407	415	423	431
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320	328	336	344	353	361	369	377	385	394	402	410	418	426	435	443

SOURCE: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.*

This page intentionally left blank

Contributors

Karen Ansel
Walnut Creek, California

Katherine Beals
Ball State University
Muncie, Indiana

Mindy Benedict
Ponte Vedra Beach, Florida

Frances Berg
Healthy Weight Network and University of North Dakota School of Medicine
Hellinger, North Dakota

Linda B. Bobroff
University of Florida
Gainesville, Florida

Leslie Bonci
University of Pittsburgh Medical Center
Pittsburgh, Pennsylvania

Susan T. Borra
International Food Information Council Foundation
Washington, DC

Karen Bryla
University of Kentucky
Lexington, Kentucky

Lori Keeling Buhi
Bryan-College Station Community Health Center
Bryan, Texas

Slande Celeste
University of Florida
Gainesville, Florida

Nilesh Chatterjee
Texas A&M University
College Station, Texas

Sara Chelland
Department of Nutrition, Food and Exercise Science
Tallahassee, Florida

Catherine Christie
University of North Florida
Jacksonville, Florida

Sonja Connor
Portland, Oregon

William Connor
Oregon Health Sciences University
Portland, Oregon

Marilyn Dahl
Preferred Nutrition Services
Jacksonville Beach, Florida

Raju Das
University of Dundee
Dundee, UK

Ruth DeBusk
Private Practice
Tallahassee, Florida

Sharon Doughten
Cuyahoga Community College
Cleveland, Ohio

Karen Drummond
Yardley, Pennsylvania

M. Cristina Flaminiano Garces
University of North Carolina at Chapel Hill

Beth Fontenot
McNeese State University
Lake Charles, Louisiana

John P. Foreyt
Baylor College of Medicine
Houston, Texas

Mohammed Forouzesh
California State University at Long Beach
Long Beach, California

Marion J. Franz
Nutrition Concepts by Franz, Inc.
Minneapolis, Minnesota

Marjorie Freedman
San Jose, California

Keri M. Gans
New York, New York

Chandak Ghosh
Harvard Medical School
Boston, Massachusetts

Gita C. Gidwani
Johns Hopkins University
Baltimore, Maryland

Emil Ginter
Institute of Preventive and Clinical Medicine
Bratislava, Slovak Republic

Diane Golzynski
California State University
Fresno, California

Leslene E. Gordon
Pasco County Health Department Nutrition Division
New Port Ritchey, Florida

Marcus Harding
International Medical Volunteers Association
Woodville, Massachusetts

Karen Hare
Nutrition Services, Inc.
Fort Collins, Colorado

Beth Hensleigh
Texas A&M University
College Station, Texas

Kirsten Herbes
University of Florida
Gainesville, Florida

Susan Himburg
Florida International University
Miami, Florida

Lenore S. Hodges
Florida Hospital
Orlando, Florida

Steve Hohman
Ohio University
Athens, Ohio

Elissa M. Howard-Barr
Coastal Carolina University
Conway, South Carolina

Delores C. S. James
University of Florida
Gainesville, Florida

Sunitha Jasti
University of North Carolina,
Chapel Hill, North Carolina

Warren B. Karp
The Medical College of Georgia
Augusta, Georgia

Susan Kim
Williams College
Williamstown, Massachusetts

Seema Pania Kumar
Alexandria Primary Care Associates
Alexandria, Virginia

M. Elizabeth Kunkel
Clemson University
Clemson, South Carolina

Julie Lager
Texas A&M University
College Station, Texas

Jens Levy
University of North Carolina
Chapel Hill, North Carolina

Kheng Lim
University of Medicine and Dentistry of New Jersey
Camden, New Jersey

Nadia Lugo
University of Florida
Gainesville, Florida

Teresa Lyles
University of Florida
Gainesville, Florida

Carole Mackey
Agency for Health Care Administration
St. Petersburg, Florida

Amy N. Marlow
New York, New York

Cindy Martin
Texas A&M University
College Station, Texas

Toni Martin
Duval County Health Department
Jacksonville, Florida

Kiran Misra
Texas A&M University
College Station, Texas

Ranjita Misra
San Diego State University
San Diego, California

Braxton D. Mitchell
University of Maryland
Baltimore, Maryland

Susan Mitchell
Practicalories, Inc.
Winter Park, Florida

Robert J. Moffatt
Florida State University
Tallahassee, Florida

Melissa Morris
University of Florida
Gainesville, Florida

Kweethai C. Neill
University of North Texas
Denton, Texas

Laura Nelson
Texas A&M University
College Station, Texas

Virginia Noland
University of Florida
Gainesville, Florida

Neelima Pania
New York University Hospital
New York, New York

Mary Parke
Duval County Health Department, UIC and Nutrition Program
Jacksonville, Florida

Isabel Parraga
Case Western Reserve University
Cleveland, Ohio

Gita Patel
Nutrition Consultant
Etna, New Hampshire

Nadine Pazder
Morton Plant Hospital
Clearwater, Florida

Judy E. Perkin
University of North Florida
Jacksonville, Florida

Jeffrey Radecki
Robert Wood Johnson Medical School
Piscataway, New Jersey

Sheah Rarback
University of Miami School Medicine
Miami, Florida

Catherine Rasberry
Texas A&M University
College Station, Texas

Barbara L. Rice
Enterprise Advisory Services, Inc.
Houston, Texas

Carlos Robles
University of the Virgin Islands

Judy Rodriguez
University of North Florida
Jacksonville, Florida

Kim Schenck
Colorado Springs, Colorado

Claire D. Schmelzer
Virginia Polytechnic Institute and State University
Blacksburg, Virginia
University of Kentucky
Lexington, Kentucky

Louise Schneider
Lorna Linda University
Lorna Linda, California

Jessica Schulman
University of Florida
Gainesville, Florida

Kyle Shadix
Art Institute of New York City

Jackie Shank
Southeast Nutrition Consultants
St. Augustine, Florida

Heidi J. Silver
National Policy and Resource Center on Nutrition and Aging
Miami, Florida

Donna Staton
International Medical Volunteers Association

Tanya Sterling
Duval County Health Department
Jacksonville, Florida

Milton Stokes
New York, New York

Lisa A. Sutherland
University of North Carolina
Chapel Hill, North Carolina

Marie Boyle Struble
College of Saint Elizabeth
Morristown, New Jersey

D. Michelle Swords
Gainesville, Florida

Patricia Thomas
San Antonio, Texas

Delores Truesdell
Florida State University
Tallahassee, Florida

Katherine Tucker
USDA/HNRCA at Tufts University
Boston, Massachusetts

Simin Vaghefi
University of North Florida
Jacksonville, Florida

Pauline Vickery
Suwannee River Area Health Education Center

Ruth Waibel
Ohio University
Athens, Ohio

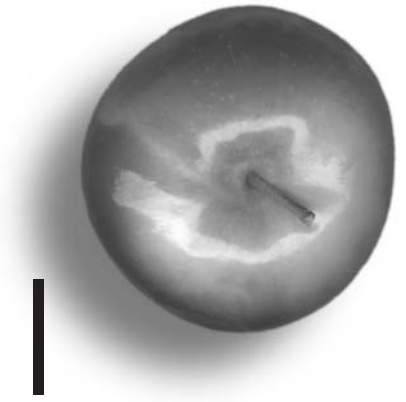
Daphne C. Watkins
Texas A&M University
College Station, Texas

Sally Weerts
University of North Florida
Jacksonville, Florida

Paulette Weir
Elmont, New York

Katherine Will
Ohio University
Athens, Ohio

Heidi Williams
Gainesville, Florida



Illnesses, Food-Borne

Food-borne illness, often called **food poisoning**, is caused by **pathogens** or certain chemicals present in ingested food. **Bacteria**, **viruses**, molds, worms, and protozoa that cause disease are all pathogens, though there are also harmless and beneficial bacteria that are used to make yogurt and cheese. Some chemicals that cause food-borne illness are natural components of foods, while others may be accidentally added during production and processing, either through carelessness or pollution. The main causes of food-borne illness are bacterial (66%), chemical (26%), viral (4%) and **parasitic** (4%).

food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

pathogen: organism that causes disease

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

parasitic: feeding off another organism

toxins: poison

Intoxication and Infection

The two most common types of food-borne illness are intoxication and infection. Intoxication occurs when **toxins** produced by the pathogen cause food poisoning. Infection is caused by the ingestion of food containing pathogens. Some people develop symptoms after ingesting a pathogen, while others never know that they are suffering from food-borne illness. The people that are most at risk are those with compromised immune systems. For these individuals, an incident of food-borne illness can be life threatening. Sanitation procedures, such as hand washing, separating at-risk foods (such as raw meat) from fresh vegetables, cooking foods, and chilling prepared foods, can help prevent food poisoning.

Causes

The following organisms can cause food-borne illness: *Campylobacter jejuni*, *Clostridium botulinum*, *Clostridium perfringens*, *Cyclospora cayetanensis*, **Escherichia coli**, (*E. coli* 0157:H7), *Listeria monocytogenes*, *Salmonella*, *Shigella*, and *Staphylococcus aureus. Campylobacter jejuni* is caused by the ingestion of live bacteria and can be transmitted to humans via unpasteurized milk, contaminated water, and raw or undercooked meats, poultry, and shellfish. *Clostridium botulinum*, which causes **botulism**, is the most deadly of all food pathogens. It is transmitted by improperly canned food, whether it is home-canned or commercially prepared. *Clostridium perfringens* is transmitted by eating heavily contaminated food, and it tends to infect those who eat food that has been left standing on buffets or steam tables for long periods. Feces-contaminated food or water transmits *Cyclospora cayetanensis.* Foods such

Escherichia coli: common bacterium found in human large intestine

botulism: poisoning from the bacterium Clostridium botulinum

A transmission electron micrograph (TEM) shows a Salmonella sp. bacterium. The bacterium is transmitted through contact with a carrier or by ingestion of contaminated meat or dairy products. *[USDA/Science Source/Photo Researchers, Inc. Reproduced by permission.]*

as undercooked hamburger or ground poultry and unpasteurized milk or apple juice can transmit *E. coli* 0157:H7. *Listeria monocytogenes* can be transmitted to humans via unpasteurized dairy foods, such as milk, soft cheeses, and ice creams, and via leafy vegetables and processed meats. *Salmonella* is transmitted by eating contaminated food or by contact with a carrier (a human or animal capable of transmitting infectious organisms). Salmonella poisoning may also occur through cross-contamination of uncontaminated foods that have come into contact with uncooked foods. This may occur when one uses the same cutting board to cut both raw chicken and fresh vegetables.

Shigella is a contamination of food by infected food handlers; it is primarily transmitted in cold salads such as tuna, chicken, or potato salad.

Staphylococcus aureus is transmitted by carriers and by eating foods that contain the toxin.

Other substances that cause food poisoning include: mold, *Trichinella spiralis*, and dysentery. Mold is a type of fungus. Some molds produce a **mycotoxin** called aflatoxin that can develop in spoiled peanuts and peanut butter, soybeans, grains, nuts, and spices. *Trichinella spiralis* is a parasitic worm that can be present in undercooked pork. Dysentery is a disease caused by **microorganisms** (protozoa) that are introduced to food by carriers or contaminated water.

Symptoms

Symptoms of food-borne illness often resemble intestinal flu, and they may last a few hours or several days. Serious complications may include bloody diarrhea, severe abdominal cramps, severe illness, or death. Typical symptoms include diarrhea, vomiting, abdominal cramps, headaches, **nausea**, dry mouth, double vision, difficulty swallowing, and flu-like symptoms (such as fever, chills, and backache). Older adults, pregnant women, infants, and people with compromised immune systems (such as those with **diabetes**, AIDS, or **cancer**) may face greater risks and have a higher **incidence** of food-borne illness.

Prevention

It is important to prevent food-borne illness by cleaning, separating, cooking, and chilling foods appropriately. Hands and surface areas should be cleaned with hot soapy water, and food handlers must practice good personal **hygiene** and sanitary food preparation. Raw fruits and vegetables should be washed thoroughly, and unpasteurized milk, bulging cans, and foods showing signs of mold should always be avoided. In order to avoid cross-contamination, raw foods should be kept separate from cooked foods.

Hot foods should be kept hot (at or above 140 degrees Fahrenheit), and cold foods cold (at or below 40 degrees Fahrenheit). Leftovers should be heated to at least 165 degrees before serving.

Ground meats should be cooked at or above 165 degrees. Cooking to proper temperatures and time will kill harmful bacteria that cause food-borne illness. Bacteria multiply rapidly between 40 and 140 degrees. However, the danger zone is between 60 and 125 degrees Fahrenheit. Temperatures in this zone allow rapid growth of bacteria and production of toxins by some bacteria. Therefore, foods should be refrigerated, since cold temperatures keep most harmful bacteria from growing and multiplying. It is recommended that refrigerators be kept between 34 and 38 degrees, while freezers should be kept at 0 degrees. Most food-borne illnesses occur because of the ignorance or carelessness of people who handle food, and such illnesses can be easily prevented.

Treatment

Persons suffering from a food-borne illness should consult a physician if the following symptoms persist for more than two or three days: a fever of 102 degrees or higher, presence of blood in the stool, or **dehydration** (as indicated by dizziness upon standing). Medical help should also be sought if

Fight Disease: Wash Your Hands

Amid the technological marvels of the twenty-first century, health care specialists agree that the single most effective way to prevent the transmission of disease is by washing your hands. Unwashed hands are thought to be responsible for one-quarter of food-borne illnesses, including *E. coli* and salmonella, and are a major means of transmission for SARS, meningitis, hepatitis, and the common cold. Studies have shown that infection rates in schools and day-care centers plummet after the launch of hand-washing campaigns. The most important times to wash your hands are after using the toilet or handling a diaper, handling raw food such as chicken, sneezing or coughing into your hand, or being out in public. While anitbacterial soaps are considered no more effective than regular soaps, alcohol gels in "hand sanitizers" have received high praise for their ability to eliminate germs.

—Paula Kepos

mycotoxin: poison produced by a fungus

microorganisms: bacteria and protists; single-celled organisms

nausea: unpleasant sensation in the gut that precedes vomiting

diabetes: inability to regulate level of sugar in the blood

cancer: uncontrolled cell growth

incidence: number of new cases reported each year

hygiene: cleanliness

dehydration: loss of water

electrolyte: salt dissolved in fluid

botulism is suspected. Dehydration caused by diarrhea and vomiting should be treated promptly with increased fluid intake or oral rehydration solutions. Sports beverages with **electrolytes** may be helpful. Bed rest can speed recovery, and while ill, any food consumed should be clean, easy to digest, and consumed in small amounts.

The treating physician should notify the local health department, who will then notify the Centers for Disease Control and Prevention (CDC). To minimize risks for food poisoning to others, the local health department should be contacted if the food was consumed at a large gathering; if the food came from a restaurant, deli, vendor, or kitchen that serves a large number of people, or if the food was a commercial product. SEE ALSO FOOD SAFETY; ORGANISMS, FOOD-BORNE.

Tanya Sterling
Toni Martin

Bibliography

Mahan, L. Kathleen, and Escott-Stump, Sylvia (2000). *Krause's Food, Nutrition, and Diet Therapy*, 10th edition. Philadelphia, PA: W. B. Saunders.

Townsend, Carolyn E., and Roth, Ruth A. (2000). *Nutrition and Diet Therapy*, 7th edition. Albany, NY: Delmar.

Internet Resources

Clemson Extension, Home and Garden Information Center. "Foodborne Illness: Prevention Strategies." Available from <http://hgic.clemson.edu/factsheets/HGIC3620.htm>

HIVpositive.com. "Foodborne Illness." Available from <http://www.hivpositive.com/f-Nutrition/Foodborne/Foodill.html>

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

white blood cell: immune system cell that fights infection

mucosa: moist exchange surface within the body

bacteria: single-celled organisms without nuclei, some of which are infectious

enzyme: protein responsible for carrying out reactions in a cell

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

stress: heightened state of nervousness or unease

malnutrition: chronic lack of sufficient nutrients to maintain health

nutrition: the maintenance of health through proper eating, or the study of same

calorie: unit of food energy

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

Immune System

The **immune system** is made up of cells, tissues, organs, and processes that identify a substance as abnormal or foreign and prevent it from harming the body. Primary defenses include the **white blood cells**, but skin, **mucosa**, normal **bacteria**, **enzymes**, and **proteins** also provide protection. During times of **stress** and **malnutrition**, immune function may be decreased, meaning that susceptibility to illness is increased. Proper **nutrition**, including adequate protein, **calories**, and **antioxidants** (such as vitamin C, vitamin E, and beta-carotene, which are all found in fruits and vegetables) may help to improve immune response and reduce the risk of illness. SEE ALSO INFECTION.

Catherine Christie

Bibliography

Shils, Maurice, et al. (1999). *Modern Nutrition in Health and Disease*, 9th edition. Baltimore, MD: Williams & Wilkins.

Inborn Errors of Metabolism

Inborn errors of **metabolism** are inherited disorders in which the body cannot **metabolize** the components of food (**carbohydrates**, **proteins**, and

metabolism: the sum total of reactions in a cell or an organism

metabolize: processing of a nutrient

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

The Guthrie test, given to newborns, helps doctors diagnose some inborn errors of metabolism before they cause permanent damage. The test requires a small sample of blood, usually taken from the heel. *[Garo/Photo Researchers, Inc. Reproduced by permission.]*

fats). Metabolism is the **biochemical** process that changes food components into **energy** and other required **molecules**. These disorders may be caused by the altered activity of essential **enzymes**, deficiencies of the substances that activate the enzymes, or faulty transport compounds. **Metabolic** disorders can be devastating if appropriate treatment is not initiated promptly and monitored frequently.

Inborn errors of metabolism often require **diet** changes, with the type and extent of the changes dependant on the specific metabolic disorder. The particular enzyme absence or inactivity for each inborn error of metabolism dictates which components are restricted and which are supplemented. Registered dietitians and physicians can help an individual assess the diet changes needed for each disease. The goals of **nutrition** therapy are to correct the metabolic imbalance and promote growth and **development** by providing adequate nutrition, while also restricting (or supplementing) one or more **nutrients** or dietary components. Additional goals in some disorders include reducing the risk of brain damage, other organ damage, episodes of metabolic crisis and coma, and even death. These restrictions and supplementations are specific for each disorder, and they may include the restriction of total fats, simple sugars, or total carbohydrates.

Listed below are several of the metabolic disorders that respond to nutrition therapy. The appropriate dietary restrictions and modifications that are necessary for treatment are also listed.

biochemical: related to chemical processes within cells

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

molecule: combination of atoms that form stable particles

enzyme: protein responsible for carrying out reactions in a cell

metabolic: related to processing of nutrients and building of necessary molecules within the cell

diet: the total daily food intake, or the types of foods eaten

nutrition: the maintenance of health through proper eating, or the study of same

development: the process of change by which an organism becomes more complex

nutrient: dietary substance necessary for health

Disorders of Amino Acid Metabolism

Phenylketonuria (PKU) is the most common disorder of amino acid metabolism. In this disorder the body cannot use the amino acid phenylalanine normally, and excess amounts build up in the blood. If untreated, PKU can cause mental retardation, seizures, behavior problems, and **eczema**. With treatment, persons with PKU have normal development and intelligence. The treatment for PKU consists of a special phenylalanine-restricted diet

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

eczema: skin disease causing itching and flaking

designed to maintain blood phenylalanine levels within an acceptable range. Medical formulas and foods, which do not contain phenylalanine, are used to provide the necessary intake of protein and other nutrients. Foods containing natural protein are prescribed in limited amounts to meet the body's requirement for phenylalanine, without providing too much.

Maple syrup urine disease (MSUD) is a disorder in which the body is unable to use the amino acids isoleucine, leucine, and valine in a normal way. Excessive amounts of these amino acids and their **metabolites** will build up in the blood and spill into the urine and perspiration, giving them the odor of maple syrup (which is how this disorder got its name). An untreated infant with MSUD may have some or all of the following symptoms: difficulty breathing, sleepiness, vomiting, irregular muscle movement, seizures, or coma, and the disease can cause death. Basic treatment involves restricting foods and infant formula that contain leucine, isoleucine, and valine. Medical formulas and foods, which contain very small amounts of leucine, isoleucine, and valine, are used to provide the necessary intake of protein and other nutrients.

metabolite: the product of metabolism, or nutrient processing within the cell

Disorders of Carbohydrate Metabolism

Galactosemia is a disorder in which the body cannot break down the sugar called galactose. Galactose can be found in food, and the body can break down lactose (milk sugar) to galactose and **glucose**. The body uses glucose for energy. People with galactosemia lack the enzyme to break down galactose, so it builds up and becomes toxic. In reaction to this buildup of galactose the body makes some abnormal chemicals. The buildup of galactose and these chemicals can cause liver damage, kidney failure, stunted growth, mental retardation, and **cataracts** in the eyes.

glucose: a simple sugar; the most commonly used fuel in cells

cataract: clouding of the lens of the eye

If not treated, galactosemia can cause death. Over time, children and young adults with galactosemia can have problems with speech, language, hearing, stunted growth, and certain learning disabilities. Children who do not follow a strict diet have an increased risk of having one or more of the problems listed above. Even when a strict diet is followed, some children do not do as well as others. Most girls with galactosemia have ovarian failure. The treatment for galactosemia is to restrict galactose and lactose from the diet for life. Since galactose is a part of lactose, all milk and all foods that contain milk must be eliminated from the diet, including foods that contain small amounts of milk products such as whey and casein. In addition, organ meats should not be eaten because they contain stored galactose.

Glycogen storage diseases require different treatments depending on the specific enzyme alteration. The most common type of glycogen storage disease is classified as type 1A. In this disorder the body is missing the enzyme that coverts the storage form of sugar (glycogen) into energy (glucose). If food is not eaten for two to four hours, blood glucose levels drop to a low level, leading to serious health problems such as seizures, poor growth, enlarged liver, high levels of some fats circulating in the blood, and high levels of **uric** and lactic acids in the blood. Dietary management of GSD-1A eliminates table sugar (sucrose) and fruit sugar (fructose) and limits milk sugar (lactose), as the body cannot use some sugars in these foods. Frequent meals and snacks that are high in complex carbohydrates are recommended. In addition, often supplements of uncooked cornstarch are often eaten

uric: from urine

between meals to keep blood sugar levels stable. Eating a diet that prevents low blood sugar will promote normal growth, decrease liver enlargement, and the high blood levels of uric and lactic acids.

Disorders of fatty acid metabolism occur when the body is not able to break down **fat** to use as energy. The body's main source of energy is glucose, but when the body runs out of glucose, fats are used for energy. If untreated, these disorders can lead to serious complications affecting the liver, heart, eyes, and muscles. Treatment includes altering the kind and the amount of fat in the diet and frequent feedings of carbohydrate-containing foods.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Urea cycle disorders are inherited disorders of **nitrogen** metabolism. When protein is digested it breaks down into amino acids, and nitrogen is found in all the amino acids. Those who have these disorders cannot use nitrogen in a normal way. Dietary treatment for these disorders is to provide only the amount of protein that the body can safely use. The diet consists mostly of fruits, grains, and vegetables that contain low amounts of protein and, therefore, low amounts of nitrogen.

nitrogen: essential element for plant growth

There are more than nineteen metabolic disorders that respond to nutrition therapy. The role of proper nutrition in the treatment of these disorders is crucial. Because these disorders are rare and require careful monitoring, affected individuals are best served by clinics specializing in metabolic disorders. SEE ALSO PHENYLKETONURIA (PKU).

Patricia D. Thomas

Bibliography

Acosta, P. B., and Yannicelli, S. (1993). "Energy and Protein Requirements of Infants and Children with Inherited Metabolic Disorders." *Metabolic Currents* 6:1–8.

Acosta, P. B., and Yannicelli, S. (2001). *Ross Metabolic Formula System: Nutrition Support Protocols*, 4th edition. Columbus, OH: Ross Laboratories.

Scriver, C. R.; Beaudet, A. L.; Sly, W. S.; and Valle, D., eds. (2001). *The Metabolic and Molecular Bases of Inherited Disease*, 8th edition. New York: McGraw-Hill.

Infant Mortality Rate

The infant mortality rate is the number of infant deaths (during the first twelve months of life) per 1,000 live births. Before birth, a fetus faces major health risks from **undernutrition** during pregnancy, particularly from inadequate, absent, or delayed prenatal care. A mother's **nutritional deficiencies** may result in a premature birth, which substantially increases the likelihood of infant death.

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

nutritional deficiency: lack of adequate nutrients in the diet

A poor **diet** inhibits development at critical stages in an infant's life, sometimes causing irreversible effects. This can be the case when a mother stops breastfeeding her child too soon. **Calories**, **protein**, **calcium**, **iron**, and **zinc** are especially crucial for developing infants.

diet: the total daily food intake, or the types of foods eaten

calorie: unit of food energy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

High infant mortality rates are often associated with poverty and poor access to health care. Some international issues include extreme imbalances in the food–population ratio in different regions of a country, rapid depletion of natural resources, cultural attitudes towards certain foods, and AIDS (acquired immunodeficiency syndrome). SEE ALSO MATERNAL MORTALITY RATE; PREGNANCY.

Kim Schenck

Bibliography

Wardlaw, Gordon; Hampl, Jeffrey; and DiSilvestro, Robert (2004). *Perspectives in Nutrition.* New York: McGraw-Hill.

Infant Nutrition

The first year of life is a period of very rapid growth. An infant's birth weight doubles after about five months and triples by the first birthday, by which time the infant's length increases by half. Adequate and appropriate **nutrition** is essential during this period, for infants that do not receive sufficient **calories**, **vitamins**, and **minerals** will not reach their expected growth.

nutrition: the maintenance of health through proper eating, or the study of same

calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

metabolic: related to processing of nutrients and building of necessary molecules within the cell

diet: the total daily food intake, or the types of foods eaten

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fat: type of food molecule rich in carbon and hydrogen, with high energy content

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

iron: nutrient needed for red blood cell formation

fortified: altered by addition of vitamins or minerals

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

morbidity: illness or accident

antibody: immune system protein that protects against infection

incidence: number of new cases reported each year

gastrointestinal: related to the stomach and intestines

Nutrient Requirements

An infant's requirement for calories is determined by size, rate of growth, activity, and **energy** needed for **metabolic** activities. Calorie needs per pound of body weight are higher during the first year of life than at any other time. Since there is variation among infants, a range of recommended calorie intakes have been developed. For the first four to six months of life, breast or formula feeding can provide sufficient calories. Measuring weight and length, and plotting it on a standardized growth grid, can determine the adequacy of an infant's calorie intake.

The calories in an infant's **diet** are provided by **protein**, **fat**, and **carbohydrates**. Protein is a basic part of every cell. Of the protein requirement, 50 percent is used for growth in the first two months of life, a figure that declines to 11 percent by two to three years of age. Fat provides 40 to 50 percent of the calories supplied during infancy and is a source of **essential fatty acids**. Carbohydrates, primarily lactose, are the principal source of dietary energy. Water requirements for the first six months are met when adequate amounts of breast milk or infant formula are consumed.

Breast milk from a well-nourished mother will supply adequate amounts of most vitamins and minerals, as will an **iron-fortified** formula. **Vitamin D** is also recommended for the breastfed infant, particularly infants who live in northern urban areas who are dark-skinned, who are kept covered due to cultural practices, or whose mothers have an inadequate intake of vitamin D. In places where the water supply is severely low in fluoride (less than 3 parts per million), fluoride supplementation might be considered for breastfed infants over six months of age.

Breastfeeding

All professional and international health organizations are in agreement that breastfeeding is the recommended method of infant feeding. Although breastfeeding is clearly essential for infants born in less industrialized countries, benefits are substantial in industrialized countries as well. In less industrialized countries, breastfeeding reduces infant mortality and **morbidity**.

Breast milk is nutritionally superior to formula, and it contains **antibodies** that reduce the risk of infection for the newborn baby. Breastfed infants have a decreased **incidence** of respiratory, **gastrointestinal**, and ear infections. The cost of feeding the infant is reduced, and the very nature of

A proper diet can lower the risk of infant disease and mortality. Between four and six months of age, infants are ready for semi-solid foods. Such foods can be purchased, such as the Gerber's product advertised here, or made at home from simple ingredients such as rice, fresh vegetables and fruits, nuts, and juice. *[John H. Hartman Center for Sales, Advertising and Marketing History, Duke University. Reproduced by permission.]*

Image rights not available

breastfeeding supports the mother-infant bond. There is also evidence that breastfed infants develop fewer **allergies**, and when tested at eighteen months of age they score higher on intelligence tests.

allergy: immune system reaction against substances that are otherwise harmless

It is not advisable for an infant to receive whole cow's milk before one year of age. Feeding cow's milk before one year has been associated with the development of iron deficiency. If breastfeeding is discontinued before one year of age, an iron-fortified, commercially prepared infant formula is recommended.

Formula Feeding

The governments of most countries have developed nutrient standards for commercial infant formulas. These guidelines ensure that a formula has

nutrients similar to the breast milk from a well-nourished woman. Most infant formulas are made from either modified cow's milk or soy, and both types will meet an infant's **nutritional requirements**. Standard infant formula comes in both a low-iron and iron-fortified form. Iron-fortified formula is always recommended, except in very specific circumstances. A third category of formulas has been developed for children with severe allergies, gastrointestinal problems, or other medical complications. These are classified as **elemental** formulas, and are prescribed when an infant cannot tolerate any other type of formula.

nutritional requirements: the set of substances needed in the diet to maintain health

elemental: made from predigested nutrients

The newborn infant will feed between eight to twelve times a day. As weight is gained, the infant will take more at each feeding and the number of feedings per day will decrease. An infant who is receiving adequate feeds will have at least six wet diapers a day, will appear satisfied after a feeding, and will follow the established growth curve.

In less industrialized countries, or in situations where formula costs are too high, infant formulas made from evaporated milk have been used. This is not recommended, however, since an infant would require more vitamin and mineral supplementation, and there is also a risk of incorrectly prepared formula. When any type of formula is prepared, it is essential that the water, bottles, and all the equipment used are sanitized, that hands are washed during preparation, and that the formula is kept refrigerated.

Beikost (Solid Food)

An infant is physically ready for semi-solid foods between four to six months of age. Before this age the reflex that allows babies to suckle will push foods out of the mouth. At around six months infants begin to sit independently, draw in their lower lip as a spoon is removed from the mouth, and they can indicate hunger by opening the mouth—and refusal by closing the mouth and turning away. Some parents believe that solid foods help a baby sleep through the night. However, sleeping through the night is not related to food, but is a developmental milestone that occurs between one to three months of age. To eat solid foods at an early age might reduce an infant's intake of breast milk or formula, which could have a negative impact on nutritional status.

All solid foods should be offered by spoon, not put in a bottle. A new food might initially be rejected, but with repeated offerings acceptance increases. Baby rice cereal is often recommended as the first food for an infant, since it rarely provokes allergic reactions and is iron fortified. The cereal should be mixed with breast milk or formula until it has a semi-liquid consistency. The next foods offered can be single strained fruits, strained vegetables, and at seven to eight months, strained meats. New foods are added one at a time, for two to three days, while the infant is watched for a negative reaction. Reactions would include rashes, vomiting, or diarrhea. Commercially prepared baby foods are convenient, and the first-stage foods are prepared without added sugar and starches. Home-prepared baby foods can be more economical, however.

The American Dental Association recommends juice be given to an infant with a cup rather than a bottle. This decreases the risk of both baby bottle tooth decay and overfeeding. Baby bottle tooth decay, also known as

nursing bottle mouth syndrome, is a disorder of extreme dental decay of the upper teeth, caused by infants or toddlers falling asleep while sucking a bottle filled with juice, milk, or any other fermentable liquid.

Self-Feeding

Self-feeding begins when an infant is able to sit up straight, grasp food with the hands or fingertips, and move the food from the hands to the mouth. This usually develops between six to seven months of age. Suitable foods are arrowroot biscuits, teething biscuits, and small pieces of soft fruit or soft cooked vegetables. To prevent choking when an infant is self-feeding, an adult caretaker should always be present.

Between seven and eight months, infants are able to move their shoulders and arms while seated. A more mature up-and-down chewing pattern is developing at this time, making it an appropriate time to begin introducing soft, mashed table foods. Well-cooked vegetables and meats and soft mashed fruits are usually well tolerated. Between ten and twelve months of age infants are becoming more aware of what others are eating, and they will want to imitate other people's eating habits. At this age it is appropriate to offer soft, chopped table foods in a meal pattern similar to the rest of the family. The one year old begins to clumsily self-feed with a spoon and sip from a cup. All these self-feeding skills will be continually refined during the toddler years.

Infancy is a time of tremendous growth that can be best met through breastfeeding. If this is not possible, commercial, iron-fortified infant formulas will provide adequate nutrition. Semi-solid foods are added to prepare the infant for more mature chewing and feeding. Throughout the first year it is important for parents to learn to recognize and accept an infant's cues regarding their feelings of hunger and fullness. Responsiveness to an infant's appetite will prevent overfeeding. Observing an infant's readiness to chew, and providing appropriate foods, will help them develop self-feeding skills and independent eating. SEE ALSO BABY BOTTLE TOOTH DECAY; BEIKOST; BREASTFEEDING.

Sheah Rarback

Bibliography

American Dietetic Association (1997). "Promotion of Breastfeeding." Journal of the American Dietetic Association 97:662–666.

Duyff, Roberta L. (1996). *The American Dietetic Association's Complete Food and Nutrition Guide.* Minneapolis, MN: Chronimed.

Fomon, Samuel J. (2001). "Feeding Normal Infants: Rationale for Recommendations." *Journal of the American Dietetic Association* 101:1002–1005.

Mitchell, Mary K. (1997). *Nutrition across the Life Span.* New York: W. B. Saunders.

Pipes, Peggy L., and Trahms, Cristine M. (1993). *Nutrition in Infancy and Childhood.* St. Louis, MO: Mosby.

Queen Samour, Patricia M.; King Helm, Kathy; and Lang, Carol E. (1993). *Handbook of Pediatric Nutrition*, 2nd edition. Gaithersburg: MD: Aspen.

Roberts, Susan B.; Heyman, Dennis M.; and Tracy, Lisa (1999). *Feeding Your Child for Lifelong Health: Birth through Age Six.* New York: Bantam.

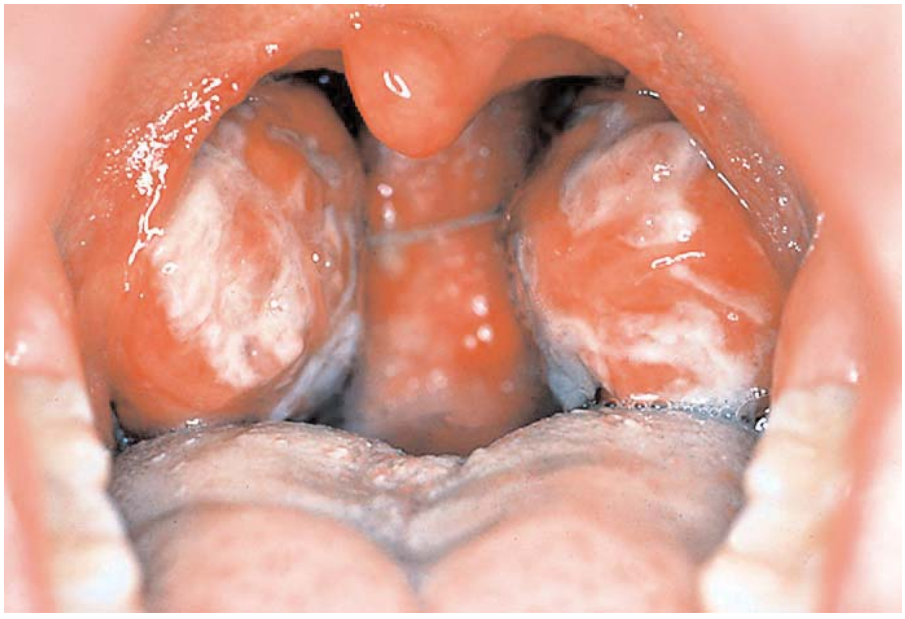
Satter, Ellyn (2000). *Child of Mine: Feeding with Love and Good Sense.* Palo Alto, CA: Bull Publishing.

Williamson, Carol P., ed. (1998). *Pediatric Manual of Clinical Dietetics.* Chicago: American Dietetic Association.

The Benefits of Breastfeeding

Mother's milk, designed as it is to nurture babies, contains the ideal amount and proportion of nutrients an infant needs, and the makeup of breast milk changes as the baby grows to satisfy its developing nutritional requirements. Breast milk contains antibodies that protect infants from many common diseases, including ear infections, diarrhea, and pneumonia, and helps develop the baby's immune system. Babies from families with allergies receive a particular benefit, as breast feeding has been shown to reduce allergies, asthma, and eczema. Unlike most formula, mother's milk contains docosohexaenoic acid and arachidonic acid, which contribute to brain and retinal development, and some studies have suggested that breastfed infants learn more effectively. In addition, they show a lower rate of obesity as adults. Mothers also benefit from breastfeeding in many ways. Of great psychological value, milk production burns 200 to 500 calories a day, speeding the mother's return to pre-pregnancy proportions.

—Paula Kepos



Glandular fever, or mononucleosis, is a viral infection that causes inflamed tonsils (shown here) and fever, and may cause an enlarged spleen. Symptoms most often appear in teens, but more than 80 percent of adults in the United States carry the virus and can transmit it. *[Science Photo Library/Photo Researchers, Inc. Reproduced by permission.]*

Internet Resources

Baby Center. "Baby Food Basics." Available from <http://www.babycenter.com>

Queens University. "A Guide to Infant Feeding—From Birth to 24 Months." Available from <http://www.queensu.ca/medicine>

Infection

microorganisms: bacteria and protists; single-celled organisms

bacteria: single-celled organisms without nuclei, some of which are infectious

respiratory system: the lungs, throat, and muscles of respiration, or breathing

gastrointestinal: related to the stomach and intestines

fatigue: tiredness

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

antibiotic: substance that kills or prevents the growth of microorganisms

An infections is an illness caused by **microorganisms** or **bacteria** that invade the body. The body's defenses against infections begin with blocking the entry of microorganisms into the system. Hand washing is an effective strategy in preventing the entry of microorganisms into the body through the skin, the **respiratory system**, or the GI (**gastrointestinal**) tract.

Local infections may produce redness, tenderness, and swelling, but systemic infections produce more serious symptoms such as fever, chills, sweats, and **fatigue**. Many infections will go away on their own, however, as the body's **immune system** can successfully fight off many infections. Others, however, require treatment, such as the use of **antibiotic** medications. SEE ALSO IMMUNE SYSTEM.

Catherine Christie

Insulin

insulin: hormone released by the pancreas to regulate level of sugar in the blood

hormone: molecules produced by one set of cells that influence the function of another set of cells

glucose: a simple sugar; the most commonly used fuel in cells

diabetes: inability to regulate level of sugar in the blood

Insulin is a **hormone** produced by specialized cells in the pancreas. Secreted into the bloodstream at each meal, insulin helps the body use and store **glucose** (sugar) produced during the digestion of food. In people with **diabetes**, the pancreas either does not produce enough insulin or the body cannot use the insulin that is produced in an efficient manner.

Treatment for diabetes requires the delivery of insulin into the bloodstream by either an insulin pen, needle and syringe, or pump. An insulin

pen is a device that looks like a pen but contains an insulin cartridge. Both the syringe and pen methods require injection of the insulin into the arm, thigh, or abdomen. Pump therapy, however, continuously administers insulin according to a programmed plan unique to the pump wearer. Several types of insulin exist, and they differ in when the insulin begins working after it is injected, when the insulin is working hardest, and how long the insulin lasts in the body.

Insulin release and glucose **absorption** depend on a number of factors, including the glycemic index of food and the co-ingestion of **fat** and **protein**. Consumption of high-glycemic foods causes **hyperglycemia** which results in the release of too much insulin. On the other hand, low-glycemic foods or the ingestion of fat and protein in a meal provide steady glucose absorption and release of insulin.

Exercise lowers blood glucose levels and increases the amount of insulin in the bloodstream, along with improving the body's use of insulin. A balance must exist between the sugar used for **energy**, the sugar available from food, and the insulin used in lowering blood sugar. Consequently, changes may have to be made to insulin, or food intake, or both, prior to and after exercise. SEE ALSO DIABETES MELLITUS; GLYCEMIC INDEX; HYPERGLYCEMIA; HYPOGLYCEMIA.

absorption: uptake by the digestive tract

fat: type of food molecule rich in carbon and hydrogen, with high energy content

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

hyperglycemia: high level of sugar in the blood

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Julie Lager

Bibliography

Bode, Bruce W.; Sabbah, Hassan T.; Gross, Todd M.; Fredrickson, Linda P.; and Davidson, Paul C. (2002). "Diabetes Management in the New Millennium Using Insulin Pump Therapy." *Diabetes/Metabolism Research and Reviews* 18 (Suppl. 1):S14–S20.

DeWitt, Dawn E. and Hirsch, Irl B. (2003). "Outpatient Insulin Therapy in Type 1 and Type 2 Diabetes Mellitus: A Scientific Review." *Journal of the American Medical Association* 289(17):2254–2264.

Parmet, Sharon; Cassio, Lynm; and Glass, Richard M. (2003). "Insulin." *Journal of the American Medical Association* 289(17):2314.

Internet Resources

American Diabetes Association. "About Insulin." Available from <http://www.diabetes.org/>

National Library of Medicine. "Diabetes." Updated July 2, 2003. Available from <http://medlineplus.gov/>

Irradiation

Irradiation, or "electronic **pasteurization**," exposes food to a radiant source of energy, such as **gamma rays** or electron beams, for a brief period of time. Irradiation is a "cold" process that produces little heat, so food can remain packaged throughout the process—and until opened by the consumer. Irradiation decreases or eliminates harmful **bacteria**, insects, and **parasites**. It does not make a food radioactive, and it is allowed in nearly forty countries (including the United States, France, Israel, Russia, and China). It is also endorsed by many agencies, including the World Health Organization. Food Irradiation is not without controversy, however, and many consumer groups and organic farming organizations oppose it, believing that it can alter the cellular structure of foods and cause the production of **free radicals**. Other

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

gamma rays: very high energy radiation, more powerful than x rays

bacteria: single-celled organisms without nuclei, some of which are infectious

parasite: organism that feeds off of other organisms

free radical: highly reactive molecular fragment, which can damage cells

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

hazards cited by critics include the partial destruction of **vitamins** in irradiated foods, the destruction of beneficial bacteria as well as harmful bacteria, and the environmental hazard of nuclear irradiation facilities.

A logo called the "radura" is used internationally to indicate that the food has been irradiated, though some have suggested that this symbol is too benign to accurately represent the irradiation process, and that it is too similar to the symbol of the U.S. Environmental Protection Agency. SEE ALSO BIOTECHNOLOGY; FOOD SAFETY.

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Institute of Food Technologists' Expert Panel on Food Safety and Nutrition (1998). *Scientific Status Summary: Irradiation of Food.* Chicago, IL: Author.

Satin, Morton (1996). *Food Irradiation: A Guidebook*, 2nd edition. Lancaster, PA: Technomic Publishing.

Internet Resources

U.S. Department of Agriculture Food Safety and Inspection Service. Available from <http://www.fsis.usda.gov>

isoflavones: estrogen-like compounds in plants

phytochemical: chemical produced by plants

biological: related to living organisms

physiological: related to the biochemical processes of the body

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

estrogen: hormone that helps control female development and menstruation

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

tofu: soybean curd, similar in consistency to cottage cheese

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Isoflavones

Isoflavones are **phytochemicals**, which are naturally occurring compounds found in plants that potentially have strong **biological** activity (and, therefore, a **physiological** effect) in the body. They may help lower the risk for various diseases, including **cancer**, **heart disease**, and **diabetes**. Similar in chemical structure to **estrogen**, isoflavones are, in fact, weak estrogens, and may have an effect similar to estrogens on the body. Nonestrogenic effects of isoflavones include reduction of **cholesterol** levels and inhibition of cancer-cell growth. Food sources include soy products such as soy milk, **tofu**, tempeh, and miso, but not soy sauce or soybean oil. Isoflavones may or may not be found in soy **protein**, depending on the processing method. SEE ALSO ANTIOXIDANTS; FUNCTIONAL FOODS; PHYTOCHEMICALS; SOY.

Susan Mitchel

Johnson, Howard

American businessman
1885–1972

Howard Deering Johnson had very humble beginnings in the food service business. Although he is mostly known for his motel, hotel, and restaurant chains, it was his branded ice cream that gave him a spectacular start in the business.

Howard Johnson was born in Boston, Massachusetts, in 1885. He quit school in the eighth grade to work in his father's cigar store and export business as a salesman. Johnson served in World War I as a part of the American Expeditionary Force. Soon after Johnson's return, his father died, leaving him the business and its heavy debt. He sold the business to pay off the

In the 1950s, Howard Johnson's restaurants dotted the American landscape, and travelers came to depend on the restaurants' consistency. This new way of doing business, called *franchising,* was perfected by the chain's founder, Howard Dearing Johnson.
[© Bettmann/Corbis. Reproduced by permission.]

debts in 1924. Johnson then borrowed $2,000 to buy a small corner drugstore and soda fountain in Wollaston, Massachusetts. He sold candy, newspapers, cigars, and medicine—and he was very successful.

The popularity of the soda fountain convinced him that having better-tasting ice cream would boost his business. At first, he used his mother's recipe. Not satisfied with this, he invested $300 in an ice cream recipe from an elderly German immigrant who was retiring. This premium ice cream recipe utilized natural flavors and twice the normal level of butterfat. Johnson began with three flavors, eventually increasing this to twenty-eight flavors. He also sold his ice cream at local beaches to boost business.

A local restaurant owner who purchased ice cream from the drug store asked to use the Howard Johnson name on his restaurant. Johnson agreed, which made him the exclusive source of supplies. The restaurant combined a lunch counter, **fast-food** takeout, an ice cream stand, and a sit-down restaurant—all in one location. Johnson soon began selling franchises of his restaurants. The white buildings trimmed with orange and sea blue became the Howard Johnson trademarks.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Johnson was very effective in maintaining quality control. At a Howard Johnson establishment, one could expect cleanliness and hospitality. The waitresses were hired for their courtesy, and high chairs were available for children at all restaurants, along with meal portions especially for children. By 1940, Johnson had about 135 restaurants.

During World War II, 90 percent of the restaurants closed due to gas rationing. The industrious Johnson contracted to manufacture candy and other goods for the armed forces. After the war, he began expanding his chains nationwide. More Americans were beginning to travel, and Johnson saw a need for better quality motels and hotels to meet the needs of these

travelers and their families. Johnson created motor hotels, offering good services and cleanliness. By 1965, the Howard Johnson name was to be found on 770 restaurants and 265 motor hotels.

Howard Johnson retired in 1959, leaving the company to his son. However, he continued to monitor his restaurants for cleanliness and proper food preparation, often performing unannounced inspections.

Howard Johnson's Restaurant's Smart Meals are based on the federal government's Dietary Guidelines for Americans. They rank lower in fat, **calories**, **cholesterol**, and sodium than traditional fast-food meals. The **nutrition** information is always clearly visible on the menu, so that diners are aware of what they are eating.

calorie: unit of food energy

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

nutrition: the maintenance of health through proper eating, or the study of same

As of 2002, only fifteen Howard Johnson restaurants and two ice cream shops remain in the United States and Puerto Rico, mainly due to increased competition from fast-food restaurants and their low prices. Menu items and the original-recipe ice cream can still be purchased in various supermarkets and in all Howard Johnson restaurants. There are nearly five hundred hotels in fourteen countries. In the 1980s, the restaurant chain separated from the franchised hotels when the Howard Johnson Corporation was sold to other corporations. In addition, the contract that had allowed Howard Johnson to be the "King of the Road" expired and was not renewed. This allowed fast-food chains to claim space on the nation's highways and turnpikes. Nevertheless, Howard Johnson made it possible for travelers and families on the go to eat nutritiously and enjoy a higher standard in all aspects of hospitality than was previously available. SEE ALSO DIETARY TRENDS, AMERICAN; FAST FOODS.

Slande Celeste

Bibliography

"Hitting the Road Healthfully." (1994). *Tufts University Diet and Nutrition Letter.* 12(5):7.

Lavine, S. A. (1965). *Famous Merchants.* New York: Dodd Mead.

Internet Resources

HoJo Land. "HoJo History." Available from <http://hojoland.homestead.com>

K

Kellogg, John Harvey

American physician
1852–1943

John Harvey Kellogg was an influential spokesman for vegetarianism, a leader in the invention of nut- and soy-based meat substitutes, a surgeon, and, for over fifty years, the director of the Battle Creek Sanitarium. In partnership with his brother Will, he made the Kellogg name famous. By studying food chemistry, Kellogg learned that an early step in **indigestion** is the conversion of starch to dextrin, or sugar. Cereal grains have a high starch content, and Kellogg discovered that prolonged baking almost completely dextrinized the starch in multigrain biscuits. He ground these up and served them to his patients, calling the creation "granola." In 1889, Kellogg invented the first flaked breakfast cereal, which was made from wheat. He later devised a method of producing corn flakes.

indigestion: reduced ability to digest food

Many **entrepreneurs**, including C. W. Post, the man most responsible for instigating Battle Creek's food "gold rush," came to make riches from breakfast cereal.

entrepreneur: founders of new businesses

Born and raised near Battle Creek, the birthplace of the Seventh-day Adventist Church, Kellogg became intimately involved with the religious-medical-health doctrine of the Seventh-day Adventists. Yet, tragically, before his death he and his brother had split their business, he had given up the rights to use the Kellogg name, and he spent the final third of his life outside the Seventh-day Adventist Church, which expelled him in 1907 due to his divergent views on the Bible and his belief in pantheism, the belief that there is a divine presence in all living things.

Born to John Preston Kellogg and his second wife, Anne, on February 26, 1852, John Harvey Kellogg's family lived on a 160-acre farm in rural Tyrone Township in Livingston County, Michigan. When he was four years old, his family moved to Battle Creek. John Preston Kellogg invested money toward the building of the Battle Creek Sanitarium. However, it was the early church leaders, James and Ellen White, who encouraged Kellogg's ambition and steered him toward a career in medicine. He graduated in February 25, 1875, from Bellevue Hospital Medical School with an M.D. degree, after first spending twenty weeks in Florence Heights, New Jersey, at Dr. Russell Trall's Hygeio-Therapeutic College. Trall was a founding member and officer of the American Vegetarian Society and the author of *The Scientific Basis of Vegetarianism* (1860). He was also a leading figure in American hydropathy, an alternative system of medical practice that treated medical conditions with applications of water.

As a young man, Kellogg would often sit in on meetings concerning the Battle Creek Sanitarium during his visits home from school, and it soon became evident that he should work there. Four major Seventh-day Adventist leaders were situated in Battle Creek, James and Ellen White, Uriah Smith, and Professor Sidney Brownsberger, president of Battle Creek College. At the age of twenty-four, Kellogg agreed to be medical director of the Battle Creek Sanitarium for one year starting in 1876. At that time the institution had twenty patients.

By force of personality and hard work, Kellogg put Battle Creek Sanitarium on the map as the place for the wealthy to recuperate and rejuvenate. And he remained at the Battle Creek Sanitarium long after corn flakes had made Battle Creek the cereal center of the world. The sanitarium burned to the ground in 1902, and the boom in cereals helped to finance its rebuilding.

Image rights not available

After initiating the production of granola in 1877, Dr. Kellogg organized the Sanitarium Food Company as a subsidiary of the Battle Creek Sanitarium in 1901. This company marketed a variety of oatmeal, graham and fruit crackers, and whole grain cereals and breads. In 1908 it became the Kellogg Food Company. After a long contentious dialogue, Kellogg and his brother parted ways, and in 1920 the rights to manufacture cereal went to Will along with the commercial use of the Kellogg name.

John Harvey Kellogg helped to invent Cornflakes cereal; but it was his brother, Will Keith Kellogg, who recognized the cereal's marketability. John Harvey preferred to focus on reforming the health of the nation, and to that end he promoted a vegetarian diet and abstinence from alcohol and tobacco. *[Courtesy of Mark LaFlaur. Reproduced by permission.]*

Unable to have children, Kellogg and his wife, Ella (née Eaton) were active in aiding children, many of whom were raised in their home. Together, they established the Haskell Home for Orphans in 1894, and at one time

they together helped as many as thirty individuals in one year. They assumed responsibility for forty-two children, legally adopting four or five of them. They hired private tutors for the children and provided them with jobs. Their efforts were not completely successful, however, as one of the children later became a drifter and blackmailed Kellogg with threats of embarrassment. At the age of seventy-eight, Kellogg moved to Florida and renovated the Country Club Hotel—which was donated by a previous patron, the pioneer aircraft manufacturer Glenn Curtiss—and opened the Miami–Battle Creek Sanitarium, a 100-bed establishment, which ran at capacity for his remaining thirteen years of life. SEE ALSO BATTLE CREEK SANITARIUM, EARLY HEALTH SPA; WHITE, ELLEN G.

Louise E. Schneider

Bibliography

Graybill, Ron (1992). "The Whites Come to Battle Creek: A Turning Point in Adventist History." Adventist Heritage. Loma Linda, CA: Department of Archives and Special Collections with the Department of History and the School of Religion.

Sabate, Joan (2001). *Vegetarian Nutrition.* Boca Raton, FL: CRC Press.

Schwartz, Richard W. (1970). *John Harvey Kellogg, M.D.* Nashville, TN: Southern Publishing Association.

Stoltz, Garth (1992). "A Taste of Cereal." Adventist Heritage. Loma Linda, CA: Department of Archives and Special Collections with the Department of History and the School of Religion.

Kroc, Ray

American businessman
1902–1984

Raymond Albert Kroc was born in Oak Park, Illinois, to Luis and Rose Kroc. He had two younger siblings, Robert and Lorraine. As a child, his mother called Ray "Danny Dreamer" because he would daydream all the time. Rose Kroc was a piano teacher, and she taught young Ray to play.

Kroc's first job was with his uncle, Earl Edmund Sweet, in a soda fountain the summer before he started high school. The next summer Ray dropped out of school, and he used the money he made the previous summer to rent a building with two friends. They sold sheet music and small instruments, but after a few months the business failed.

During World War I, Kroc lied about his age and became an ambulance driver for the Red Cross. He returned to Chicago after the war and held various jobs, including work as a jazz pianist and as a real-estate salesman. In the summer of 1919, Ray played in a band at Paw-Paw Lake, Michigan, where he met his future wife, Ethel Flemming. Ray and Ethel married in 1922, but only after he satisfied his father's requirement of getting a steady job—selling paper cups for the Lily Tulip Cup Company, where he worked for seventeen years.

In the early 1940s, Kroc became the exclusive distributor of a multimixer that could mix five milk shakes simultaneously. Two of his best customers were the McDonald brothers, Richard and Maurice (Mac), who bought eight of the mixers for their **fast-food** restaurants. The McDonalds had started with a group of hot-dog carts, and now had a chain of restau-

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Customers line up at the very first McDonald's restaurant, which in 1954 inspired Ray A. Kroc to build a fast-food empire. Today there are more than 30,000 McDonald's restaurants worldwide. *[AP/Wide World Photos. Reproduced by permission.]*

rants—for which Richard McDonald designed the "golden arches" logo and the "number-of-hamburgers-sold" sign.

In 1954, Kroc went to San Bernardino, California, to see the McDonald brothers' restaurant, which used an assembly-line format to prepare foods. Kroc decided to set up a chain of drive-in restaurants based on the McDonalds' format and convinced the brothers to sell him the rights to franchise McDonald's restaurants nationwide. His first restaurant opened on April 15, 1955, in Des Plaines, Illinois. Kroc also began selling franchises on the condition that the owners managed their restaurants. Kroc was known for his obsessive cleanliness, and he wanted the restaurants kept very clean. In 1961, Kroc bought out the McDonald brothers for $2,700,000. At this time he had established 228 restaurants, and sales had reached $37,000,000. By 1963 more than 1 billion hamburgers had been sold.

Kroc served as the company's president from 1955 to 1968, as chairman of the board from 1968 to 1977, and as a senior chairman from 1977 until his death. He also was the owner of the San Diego Padres professional baseball team. Kroc died on January 14, 1984, in San Diego, California. He

McDonald's Worldwide

By 2004, McDonalds had become a $40 billion global enterprise with more than 30,000 restaurants in 120 countries and more than half its sales outside the United States. International outlets are adapted to local cultures. In Saudi Arabia, for example, single men are seated separately from women and children. Indian McDonald's restaurants serve no beef or pork, but feature instead such menu items as a Chicken Maharaja Mac, a Paneer Salsa Wrap, and a McAloo Tikki Burger. In Japan, where the "r" sound is difficult, Ronald McDonald goes by the name Donald McDonald. As the chain faces slowing sales in a mature domestic market, the pace of its international expansion has increased. In China, where there are already 500 McDonald's, the chain plans to open more than 100 new branches a year. The company has become a major employer worldwide, with more than 1 million employees. However, despite (or because of) its international success, McDonald's has frequently come under attack as a symbol of American cultural imperialism. In 2000, anti-globalization protesters in a French farm town smashed windows in a half-built McDonald's franchise, highlighting the struggle between small farmers and big business in the global agriculture market. And after the United States began bombing Afghanistan in 2001, McDonald's outlets in Pakistan and Indonesia were vandalized. Attacks on McDonald's have been recorded in more than 50 countries.

—Paula Kepos

is remembered as a pioneer in the fast-food industry, and was named as one of *Time* magazine's "Builders and Titans" of the twentieth century. SEE ALSO DIETARY TRENDS, AMERICAN; FAST FOODS.

Delores C. S. James

Bibliography

Kroc, Raymond, A. (1977). *Grinding It Out.* Chicago, IL: Contemporary Books.

Schlosser, Eric (2001). *Fast Food Nation: The Dark Side of the All-American Meal.* New York: Houghton Mifflin.

Internet Resources

Britannica.com (2001). "Kroc, Ray." Available from <http://www.britannica.com>

Pepin, Jacques. (2000). "Ray Kroc." Available from <http://www.time.com/time>

Kwashiorkor

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

malnutrition: chronic lack of sufficient nutrients to maintain health

macronutrient: nutrient needed in large quantities

famine: extended period of food shortage

nutrient: dietary substance necessary for health

absorption: uptake by the digestive tract

The term **kwashiorkor**, meaning "the disease of the displaced child" in the language of Ga, was first defined in the 1930s in Ghana. Kwashiorkor is one of the more severe forms of **protein malnutrition** and is caused by inadequate protein intake. It is, therefore, a **macronutrient** deficiency.

Kwashiorkor is largely a problem in the developing world, although it can be found in geriatric and hospitalized patients in Western nations. Generally, kwashiorkor occurs when drought, **famine**, or societal unrest leads to an inadequate food supply. Protein-depleted diets in such areas are mostly based on starches and vegetables, with little meat and animal products. A lack of maternal understanding regarding balanced diets further contributes to the problem. Finally, infections and other disease states negatively impact **nutrient** intake, digestion, and **absorption**.

Children are most at risk due to their increased dietary needs. Inadequate caloric and protein intake manifests itself with certain physical characteristics. Symptoms may include any of the following: failure to gain weight, stunted linear growth, generalized **edema**, protuberant (swollen) abdomen, diarrhea, skin desquamation (peeling) and vitiligo (white spots on the skin), reddish pigmentation of hair, and decreased muscle mass. Mental changes include lethargy, apathy, and irritability. Physiologic changes include a fatty liver, **renal failure**, and **anemia**. During the final stages of kwashiorkor, patients can experience, **shock**, coma, and, finally, death.

edema: accumulation of fluid in the tissues

renal failure: inability of the kidneys to cleanse the blood

anemia: low level of red blood cells in the blood

shock: state of dangerously low blood pressure and loss of blood delivered to the tissues

Treatment of kwashiorkor begins with rehydration. Subsequent increase in food intake must proceed slowly, beginning with **carbohydrates** followed by protein supplementation. If treatment is initiated early, there can be a regression of symptoms, though full height and weight potential will likely never be reached. SEE ALSO MALNUTRITION; MARASMUS; NUTRITIONAL DEFICIENCY; PROTEIN.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

Seema P. Kumar

Bibliography

Latham, Michael (1997). *Human Nutrition in the Developing World.* Rome: Food and Agricultural Organization of the United Nations.

Trowell, H. C.; Davis, J. N. P.; and Dean, R. F. A. (1982). *Kwashiorkor.* New York: Academic Press.

Internet Resources

World Health Organization (1996). *WHO Global Database on Child Growth and Malnutrition.* Available from <http://www.who.int/nutgrowthdb>

Lactose Intolerance

Lactose intolerance is the inability to digest significant amounts of lactose, the primary sugar in milk. This inability results from a shortage of the **enzyme** lactase, which is normally produced by the cells that line the small intestine. Lactase breaks down lactose into simpler forms that can then be absorbed into the bloodstream during the digestive process. Common symptoms of lactose intolerance include **nausea**, cramps, bloating, gas, and diarrhea.

lactose intolerance: inability to digest lactose, or milk sugar

enzyme: protein responsible for carrying out reactions in a cell

nausea: unpleasant sensation in the gut that precedes vomiting

Structure and Functions of Lactose

Lactose is a **disaccharide carbohydrate**, composed of the two monosaccharides, **glucose** and galactose. When lactose reaches the digestive system, the lactase enzyme breaks down lactose into glucose and galactose. The liver then changes the galactose into glucose. If this process occurs normally, the glucose enters the bloodstream and raises the blood glucose level.

disaccharide carbohydrate: molecule composed of two linked sugars

glucose: a simple sugar; the most commonly used fuel in cells

Prevalence

As many as 75 percent of all adults worldwide are lactose intolerant, and between 30 million and 50 million Americans are lactose intolerant. Certain racial or ethnic groups are more widely affected than others. As many as 75 percent of all African-American, Jewish, Native American, and Mexican-American adults, and 90 percent of Asian-American adults are lactose

Between 30 and 50 million Americans are lactose intolerant, meaning they are deficient in the enzyme lactase. The majority of lactose-intolerant people can consume small amounts of lactose, or lactose in certain foods, but may experience symptoms of intestinal upset if they consume too much. *[Photograph by Leonard Lessin. Peter Arnold, Inc. Reproduced by permission.]*

congenital: present from birth

absorption: uptake by the digestive tract

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

bacteria: single-celled organisms without nuclei, some of which are infectious

intestines: the two long tubes that carry out the bulk of the processes of digestion

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

fatty acids: molecules rich in carbon and hydrogen; a component of fats

calcium: mineral essential for bones and teeth

intolerant. The condition is least common among persons of northern European descent.

Types of Lactose Intolerance

There are three basic types of lactose intolerance: primary, secondary, and **congenital**. In primary lactose intolerance, the body begins to produce less lactase after about the age of two, depending on an individual's racial or ethnic background. This type is genetically determined and is a permanent condition.

Secondary lactose intolerance, on the other hand, is temporary and results from a disease or medications that damage the lining of the small intestine where lactase is normally active. Secondary lactose intolerance gradually disappears when the illness passes.

Congenital lactose intolerance is an extremely rare condition in which the lactase enzyme is completely absent at birth. Unlike other types of lactose intolerance, this type requires complete avoidance of lactose.

Clinical Diagnosis

The most common tests used to measure the **absorption** of lactose in the digestive system are the lactose tolerance test, the hydrogen breath test, and the stool **acidity** test.

The lactose tolerance test involves an individual drinking a liquid that contains lactose. The individual must fast before this test, in which several blood samples are taken over a two-hour period to measure the blood glucose level, which indicates how well the body is able to digest lactose. If lactose is incompletely absorbed, then the blood glucose level will not rise, confirming a diagnosis of lactose intolerance.

The hydrogen breath test measures the amount of hydrogen in the breath. Normally, no hydrogen is detectable in the breath. However, undigested lactose in the colon is fermented by **bacteria**, and various gases, including hydrogen, are produced. The hydrogen is absorbed from the **intestines**, carried through the bloodstream to the lungs, and exhaled. As with the previous test, a lactose-loaded beverage is consumed, and the individual then breathes into a machine that measures the amount of hydrogen in the breath.

The stool acidity test measures the amount of acid in a person's stool. Undigested lactose fermented by bacteria in the colon creates **lactic acid** and other short-chain **fatty acids** that can be detected in a stool sample. In addition, glucose may be present in the sample as a result of unabsorbed lactose in the colon.

Nutrition for People with Lactose Intolerance

There are degrees of intolerance for lactose. Studies have shown that many true lactose intolerants can consume moderate amounts of milk and dairy products without symptoms, particularly if milk is part of a meal.

Milk and other dairy products are a major source of **calcium**. Many people with lactose intolerance may be able to tolerate yogurt with active cultures, which is very high in calcium, even though it is fairly high in lactose. Evidence shows that the bacterial cultures used in making yogurt

produce some of the lactase enzyme required for proper digestion. Lactose-intolerant individuals should also be able to tolerate cheese, as most of the lactose is removed, along with the whey, when the cheese is made.

However, people with lactose intolerance who do not drink milk or eat diary products can still get the calcium they need from dark-green, leafy vegetables such as broccoli, turnip or collard greens, and kale. Certain fish with soft, edible bones, such as herring, salmon, or sardines, are also good calcium sources.

Although milk and foods made from milk are the only natural sources, lactose is often added to **processed foods**, such as bread, cereal, and salad dressing. This is because dairy products can contribute to the required or desired flavor, color, and texture of many foods, in addition to increasing the nutritional value of processed foods. Some products that are labeled "nondairy," such as powdered coffee creamer and whipped toppings, may include ingredients that are derived from milk, and therefore contain lactose. It is important to carefully read food labels, looking not only for milk and lactose among the contents, but also for such terms as *whey*, *curds*, *milk by-products*, *dry milk solids*, and *nonfat dry milk powder*, all of which contain lactose. SEE ALSO AFRICAN AMERICANS, DIET OF; AFRICANS, DIETS OF; ASIANS, DIET OF; CARBOHYDRATES.

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Gita C. Gidwani

Bibliography

National Digestive Diseases Information Clearinghouse (2002). "Lactose Intolerance." NIH Publication No. 02-2751. Available from <http://www.niddk.nih.gov>

Lay Health Advisor

One model utilized to counter public health budget cuts is the use of lay health advisors (LHAs). Potential LHAs are individuals in the community who have a reputation as a "natural helper" and are trusted by their friends, family, and neighbors. One of the primary objectives of an LHA is to bring together professionals and consumers to mobilize the resources of a community to foster support for preventive health actions. LHAs can facilitate behavior change, especially in underserved populations, by bringing notice to particular health issues that may be of detriment to that community.

Beth Hensleigh

Bibliography

Thomas, James; Eng, Eugenia; and Clark, Michele (1998). "Lay Health Advisors: Sexually Transmitted Disease Prevention through Community Involvement." *American Journal of Public Health* 88(8):1252.

Internet Resources

North Carolina Breast Cancer Screening Program. "NC-BCSP Lay Health Advisors." Available from <http://bcsp.med.unc.edu/pages/LHAs.htm>

Lead Poisoning

Lead is an indestructible **heavy metal** that can accumulate and linger in the body. Although the problem of lead exposure has been reduced in the United

heavy metal: lead, chromium, and other metals found in the middle section of the periodic table of the elements

States, minorities and disadvantaged individuals remain chronically exposed. In developing countries, occupational and environmental exposures still exist and are a serious public health problem.

Definition of Lead Poisoning

Lead poisoning, or plumbism, is defined as a toxic condition caused by the ingestion or inhalation of the metallic element lead, which is found in many places, including the air, soil, water, houses, ceramic cookware, and solder used in metal cans and pipes. Lead poisoning occurs when blood lead levels are equal to or greater than 10 µg/dl (micrograms per deciliter).

Symptoms of Lead Poisoning

Lead exposure results from either inhaling or ingesting lead. Low levels of exposure (up to 10 µg/dl) are associated with **anemia**, headaches, general weakness, **fatigue**, learning disabilities, impaired **development** of the **nervous system**, and delayed growth, while greater levels of exposure (70 µg/dl) include symptoms such as decreased appetite, vomiting, abdominal pain, **constipation**, and drowsiness. If blood lead levels exceed 70 µg/dl, coma, seizures, bizarre behavior, impaired muscular coordination, and even death can occur.

anemia: low level of red blood cells in the blood

fatigue: tiredness

development: the process of change by which an organism becomes more complex

nervous system: the brain, spinal cord, and nerves that extend throughout the body

constipation: difficulty passing feces

Populations at Risk

Lead poisoning is one of the greatest environmental threats to children. Lead **absorption** is five to eight times greater in children than in adults. Approximately 11 percent of ingested lead will reach the adult digestive tract, as compared to 30 to 70 percent in children. In addition, children absorb up to 50 percent of inhaled lead. Children that are at greatest risk are those living near highways and interstates, in urban and inner-city areas, or in low-income housing. While the United States government banned leaded gasoline in 1986, residual lead is still present in the soil around highways and interstates. Children that live in homes or play in playgrounds near those areas can ingest lead through dust on their hands. In developing countries where leaded gasoline is still used, children living near highways are exposed to lead through automobile and truck exhaust.

absorption: uptake by the digestive tract

Children living in inner-city and urban areas are exposed to lead through leaded paint used in older homes (prior to 1978), as well as through the presence of pipes soldered with lead solder. Lead can leach into the water in the pipes, contributing to the blood lead levels of children (and adults) ingesting the water. The major sources of lead exposure today are household dust from paint and exterior soil. In addition, children of low **socioeconomic status** are at a nutritional disadavantage, for they often do not consume enough food to keep their stomachs full enough to slow absorption, and because they usually do not have enough **iron** and **calcium** in their diets.

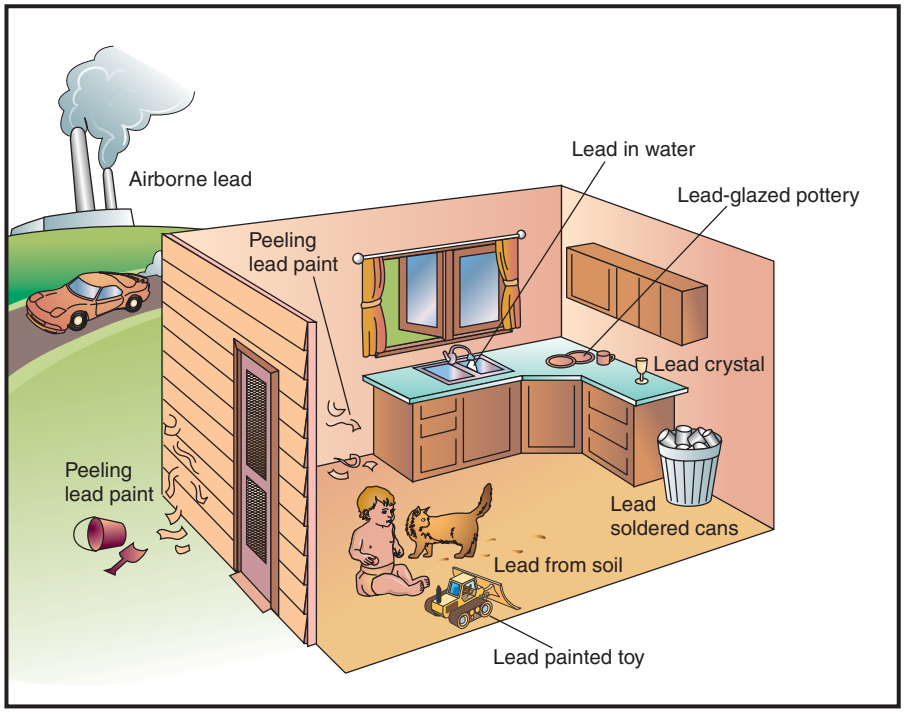
socioeconomic status: level of income and social class

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

In developing countries, both adults and children face a risk of lead poisoning due to exposure sources such as leaded gasoline, lead-based cosmetics, lead solder in food containers, ceramic cookware, folk remedies, and lead-based paint. Since adverse effects of lead poisoning are magnified in **malnourished** populations, it is critical that developing countries recognize the threat of unintentional lead exposure.

malnourished: lack of adequate nutrients in the diet



Lead is commonly found in and around the home, especially in older homes. Children are especially susceptible to lead poisoning, since they absorb lead more readily than adults. Even minor exposure to lead can severely affect a child's development. *[Electronic Illustrators Group. Reproduced by permission.]*

Sources of Lead

During the 1970s, Americans discontinued the use of leaded gasoline, and other sources of environmental lead exposure have gradually been reduced. While exposure to lead has diminished, residual amounts still remain in contaminated soil, dust, lakes, and streams.

A major source of environmental exposure for children is lead-based paint. While this type of paint is no longer manufactured in the United States, buildings constructed prior to 1978 may contain residual lead. Lead exposure occurs when lead-contaminated dust is inhaled or ingested. In addition, young children may eat contaminated paint chips or ingest contaminated paint dust while sucking their hands or fingers.

Other sources of lead exposure include ceramic cookware and lead solder. Lead contained in the glaze on ceramic cookware can leach out and enter food during the cooking process. In lead-soldered pipes, lead enters the water as it passes through or collects in the pipe. People living in older homes with lead-soldered pipes should drink bottled water or make certain that the water is allowed to run several minutes before it is ingested. Water that has sat in the pipes longer than six hours should not be consumed.

While lead solder is no longer used to seal cans in the United States, imported food remains a source of exposure. Once again, lead from the solder leaches into the food. Acidic foods and drinks, such as pickles or fruit juice, enhance the leaching process. Other exposure sources include a food coloring (*lozeena*) from Iraq that is sometimes used to color rice and meat, and to which lead is sometimes added; prune juice concentrate from France and raisins from Turkey (lead-containing preservatives and pesticides are used on foods such as prunes and raisins), and duck eggs from Taiwan (lead is used in the traditional method of preserving duck eggs). In addition, a

Prevalence of Lead Poisoning

As a result of public health initiatives, lead levels in children's blood have dropped steadily since the 1970s, but approximately 434,000 U.S. children between one and five years of age still have elevated lead levels. Lead poisoning remains a particular threat among certain racial and ethnic groups that are disproportionately affected. For example, 6 percent of white children living in older housing have elevated lead levels, while the numbers for African-American and Mexican-American children in similar housing are 22 percent and 13 percent, respectively. In developing countries, which commonly use unleaded gasoline, lead poisoning is the most significant environmental disease among children. According to the World Health Organization, fifteen to eighteen million children in the developing world have suffered permanent brain damage as a result of lead poisoning.

—Paula Kepos

nutritional deficiency: lack of adequate nutrients in the diet

mucosa: moist exchange surface within the body

fortified: altered by addition of vitamins or minerals

environment: surroundings

number of folk remedies from around the world, as well as imported leaded crystal, can be sources of lead exposure. Folk remedies of concern include: *koo sar* pills, used as a remedy for menstrual cramps in Asia; *azarcon*, an orange powder used for intestinal illness in Mexico; *ghasard*, an Indian folk remedy for babies; *kandu*, a red powder used to treat stomachache; *farouk*, a Middle Eastern teething remedy; and *hai gen fen*, a clamshell powder added to tea.

Nutritional Interventions

Nutritional deficiencies allow lead to accumulate in body tissues and organs. The absorption of lead is greatest when the stomach is empty; therefore, consuming regular meals is important. Unfortunately, the ability to afford three meals a day is sometimes a problem for populations at risk for lead poisoning.

In the body, calcium binds to lead and inhibits its absorption; therefore, dietary calcium interferes with the absorption of lead through the intestinal **mucosa**. Among high-risk populations, calcium supplements or the addition of milk and yogurt to meals and snacks is recommended.

Research has also demonstrated a link between iron deficiency and lead poisoning. Recognition of this link is important, since iron deficiency is the most common childhood nutritional problem worldwide. Iron supplementation, or consuming foods rich in iron, such as **fortified** cereals, prunes, beef, and calves liver, can interfere with lead accumulating in the body.

Educational Interventions

In many developed nations, information programs are available to advise homeowners of lead hazards in older homes. Programs offering proper methods of exposure reduction are important, since homeowners attempting to rid their homes of lead paint and pipes with lead solder can inadvertently increase their exposure through sanding and other activities. International groups, such as the World Health Organization, are working to increase international awareness of lead exposure issues and abatement programs. In 1998, the U.S. National Center for Environmental Health identified childhood lead poisoning as one of its five global priorities.

The most effective intervention for lead poisoning is removing all sources of lead from the **environment**. Since this is not possible for many high-risk populations, health care providers can provide parents and child-care workers with information on how to care for children's nails and on proper hand-washing techniques, as well as information on the dangers of consuming paint chips and/or paint dust.

Consumer-awareness campaigns relating to the potential hazards of imported cookware and dishes can also help adults and children avoid unintentional ingestion of lead. Individuals need to be aware of the potential presence of lead in products and food items from other countries, particularly those that lack environmental controls relating to lead, such as Mexico, Turkey, Pakistan, India, Indonesia, Nepal, Thailand, and many countries in the Middle East and Asia.

Medical Treatment

Typically, persons diagnosed with blood lead levels greater than 45 µg/dl will receive chelation therapy, which uses chemical agents that bind to lead

in the body and cause it to be excreted in the urine or feces. High blood lead levels are considered a medical emergency requiring immediate attention, since the chances of serious complications rise as lead accumulates in the blood.

Virginia Jones Noland

Bibliography

Alters, S., and Schiff, W. (2001). *Essential Concepts for Healthy Living*, 2nd ed. Boston: Jones and Bartlett.

Binns, H.; Kim, D.; and Campbell, C. (2001). "Targeted Screening for Elevated Blood Lead Levels: Populations at High Risk." *Pediatrics* 108:1364–1366.

Chisolm, J. J. (2001). "The Road to Primary Prevention of Lead Toxicity in Children." *Pediatrics* 107:581–583.

Edlin, G.; Golanty, E.; and Brown, K. M. (1999). *Health and Wellness*, 6th ed. Boston: Jones and Bartlett.

Ellis, M., and Kane, K. (2000). "Lightening the Lead Load in Children." *American Family Physician* 62:545–565.

Lynch, R.; Boatright, D.; and Moss, S. (2000). "Lead-Contaminated Imported Tamarind Candy and Children's Blood Lead Levels." *Public Health Reports* 115:537–543.

Nadakavukaren, A. (1990). *Man and Environment: A Health Perspective*, 3rd ed. Prospect Heights, IL: Waveland Press.

Sargent, J. D. (1994). "The Role of Nutrition in the Prevention of Lead Poisoning in Children." *Pediatric Annals* 23:636–642.

Satcher, D. (2000). "The Surgeon General on the Continuing Tragedy of Childhood Lead Poisoning." *Public Health Reports* 115:579–580.

Simon, J., and Hudes, E. (1999). "Relationship of Ascorbic Acid to Blood Lead Levels." *Journal of the American Medical Association* 281:2289–2293.

Telljohann, S.; Symons, C.; and Miller, D. (2001). *Health Education: Elementary and Middle School Applications*, 3rd ed. Boston: McGraw Hill.

Tong, S.; Schirnding, Y; and Prapamontol, T. (2000). "Environmental Lead Exposure: A Public Health Problem of Global Dimensions." *Bulletin of the World Health Organization* 78:1068–1077.

Warren, C. (2000). *Brush with Death: A Social History of Lead Poisoning.* Baltimore, MD: Johns Hopkins University Press.

Whitney, E., and Nunnelley, E. (1987). *Understanding Nutrition*, 4th ed. New York: West Publishing.

Wright, R.; Shannon, M.; Wright, R.; and Hu, H. (1999). "Association between Iron Deficiency and Low-Level Lead Poisoning in an Urban Primary-Care Clinic." *American Journal of Public Health* 89(7):1049–1053.

Legumes

Legumes are the edible seeds of plants. They provide a good source of **protein**, thiamine, folic acid, vitamin E, and **fiber**. The **insoluble** fiber in legumes helps to lower blood **cholesterol**. Examples of legumes are: dried beans, peas, and seeds (including navy, broad, butter, northern, pinto, red, and black beans, as well as chick peas, soybeans, and peanuts).

Legumes are an important source of protein for vegetarians, especially **vegans**. The protein in legumes is considered incomplete, however, and needs to be eaten in combination with whole grains to make a complete (high-quality) protein (e.g., green beans, lentils, and rice; navy beans and barley; soybeans and sesame seeds; red beans and rice). Such combinations

legumes: beans, peas, and related plants

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fiber: indigestible plant material which aids digestion by providing bulk

insoluble: not able to be dissolved in

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

vegan: person who consumes no animal products, including milk and honey

Legumes include many varieties of beans, including the popular green bean shown here. Legumes provide more fiber per serving than any other vegetable, and also provide plenty of protein. *[JLM Visuals. Reproduced with permission.]*

have been used for centuries in the diets of people practicing vegetarianism. SEE ALSO PLANT-BASED DIETS; SOY; VEGETARIANISM.

Simin B. Vaghefi

Life Expectancy

The term *life expectancy* is used to describe the average life span of an individual. Life expectancy can vary considerably in different areas of the world. Compared to other advanced countries, for example, people in the United States "die earlier and spend more time disabled" (WHO, 2000). Factors that affect life expectancy in the United States include: (1) the HIV epidemic, (2) cancers relating to tobacco, (3) high rates of **coronary heart disease**, (4) poor health among minority groups living in rural areas, and (5) high levels of violence.

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

According to the World Health Organization (WHO) the Japanese have the longest healthy life expectancy (74.5) among 191 countries the organization examined in 2000. In contrast, the shortest life expectancy (26 years) exists among the people of Sierra Leone. These figures were based on a new method of calculating *healthy* life expectancy called Disability Adjusted Life Expectancy (DALE), which was developed by the WHO. DALE summarizes the expected number of years to be lived in adequate health, rather than just the expected number of years lived.

According to DALE the United States ranks twenty-fourth, with an average life expectancy of 70.0 years for babies born in 1999. (Examined by gender, U.S. female babies in 1999 could expect 72.6 years of life, while male babies could expect only 67.5 years.) Life expectancy based on DALE for other countries are: Australia, 73.2 years; France, 73.1; Sweden, 73.0; Spain, 72.8; Italy, 72.7; Greece, 72.5; Switzerland, 72.5; Monaco, 72.4; and Andorra, 72.3.

The world's average life expectancy at birth rose to 67 years in 1998 (from 61 years in 1980). Although individual countries vary in average life-span years, the average number of years has increased due to increases in intake of nutritious food, primary health care (including safe water, sanitation, and immunizations), and education. SEE ALSO INFANT MORTALITY RATE; MATERNAL MORTALITY RATE.

Daphne C. Watkins

Internet Resources

World Bank. "Life Expectancy." Available from <http://www.worldbank.org/depweb/english/modules>

World Health Organization (2000). "Japan Number One in New 'Healthy Life' System." Available from <http://www.int/inf-pr-2000/en/pr2000-life.html>

cardiovascular: related to the heart and circulatory system

atherosclerosis: build-up of deposits within the blood vessels

artery: blood vessel that carries blood away from the heart toward the body tissues

lipid: fats, waxes and steroids; important components of cell membranes

Lipid Profile

Cardiovascular disease (CVD) is a major cause of death in the world and is mainly due to **atherosclerosis** (hardening of the **arteries**). Abnormal blood **lipids** are risk factors for CVD.

OPTIMAL, BORDERLINE, AND HIGH LEVELS FOR EACH COMPONENT

Element	Optimal	Borderline	High risk
LDL Cholesterol	<100	130–159	160+
HDL Cholesterol	>60	35–45	<35
Triglycerides	<150	150–199	>200
Total Cholesterol	<200	200–239	>240
Cholesterol to HDL Ratio	<4	5	>6

SOURCE: National Heart, Lung, and Blood Institute.

Blood Lipids and Lipid Transport

Lipids are **insoluble** (does not dissolve) in water but are soluble (dissolves) in alcohol and other solvents. When dietary fats are digested and absorbed into the small intestine, they eventually re-form into **triglycerides**, which are then packaged into **lipoproteins**.

Dietary fats, including **cholesterol**, are absorbed from the small **intestines** and transported into the liver by lipoproteins called *chylomicrons*. Chylomicrons are large droplets of lipids with a thin shell of **phospholipids**, cholesterol, and **protein**. Once chylomicrons enter the bloodstream, an **enzyme** called *lipoprotein lipase* breaks down the triglycerides into fatty acid and **glycerol**. After a 12- to 14-hour fast, chylomicrons are absent from the bloodstream. Thus, individuals who are having a lipid profile done should fast overnight to ensure that chylomicrons have been cleared.

The liver removes the chylomicron fragments, and the cholesterol is repackaged for transport in the blood in *very low-density lipoproteins* (VLDLs), which eventually turn into *low-density lipoproteins* (LDL). LDL cholesterol (LDL-C)—the "bad cholesterol"—consists mainly of cholesterol. Most LDL particles are absorbed from the bloodstream by receptor cells in the liver. Cholesterol is then transported throughout the cells. Diets high in saturated fats and cholesterol decrease the uptake of LDL particles by the liver. LDL particles are also removed from the bloodstream by scavenger cells, or macrophages, which are **white blood cells** that bury themselves in blood vessels such as arteries. Scavenger cells prevent cholesterol from reentering the bloodstream, but they deposit the cholesterol in the inner walls of blood vessels, eventually leading to the **development** of plaque.

High-density lipoproteins (HDLs) are a separate group of lipoproteins that contain more protein and less cholesterol than LDL. **HDL** cholesterol (HDL-C) is also called "good cholesterol." HDL is produced primarily in the liver and intestine, and it travels in the bloodstream, picks up cholesterol, and gives the cholesterol to other lipoproteins for transport back to the liver.

insoluble: not able to be dissolved in

triglyceride: a type of fat

lipoprotein: blood protein that carry fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

intestines: the two long tubes that carry out the bulk of the processes of digestion

phospholipid: a type of fat used to build cell membranes

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

enzyme: protein responsible for carrying out reactions in a cell

glycerol: simple molecule that forms a portion of fats

white blood cell: immune system cell that fights infection

development: the process of change by which an organism becomes more complex

HDL: high density lipoprotein, a blood protein that carries cholesterol

Lipid Profile

A lipid profile measures total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides. A physician may order a lipid profile as part of an annual exam or if there is specific concern about CVD, especially coronary artery disease. The National Cholesterol Education Program recommends that individuals age twenty and over have a fasting lipoprotein profile every

HDL/LDL RATIO VALUES

Risk level	Men	Women
Very Low Risk	3.4	3.3
Low Risk	4.0	3.8
Average Risk	5.0	4.5
Moderate Risk	9.5	7.0
High Risk	>23	>11

SOURCE: National Heart, Lung, and Blood Institute.

five years. A lipid profile should be done after a nine- to twelve-hour fast without food, liquids, or medication. If fasting is not possible, the values for total cholesterol and HDL-C may still be useful. If total cholesterol is 200 milligrams per deciliter (mg/dl) or higher, or HDL-C is less than 40 mg/dl, the individual will need to have a follow-up lipoprotein profile done to determine LDL-C and triglyceride levels.

Depending on the physician's request, the lipid profile may include the ratio of cholesterol to HDL. This ratio is sometimes used in place of total blood cholesterol. The ratio is obtained by dividing the HDL cholesterol level by the total cholesterol. For example, if a person has total cholesterol of 200 mg/dl and an HDL cholesterol level of 50 mg/dl, the ratio is 4:1. The goal is to keep the ratio below 5:1, and optimally at 3.5:1. There are several **over-the-counter** cholesterol measuring devices on the market, but none has been endorsed by any medical organizations.

over-the-counter: available without a prescription

Treating Abnormal Blood Lipids

The National Cholesterol Education Program, the American College of Cardiology, and the American Heart Association recommend **diet** and lifestyle modification as the first line of defense against abnormal blood lipids. These recommendations include a diet low in total **fat**, **saturated fat**, and cholesterol; a diet high in **fiber**; weight loss or weight management; increased physical activity; smoking cessation; increased intake of plant **sterols** (e.g., margarines and salad dressings made with soybean sterols); and daily use of a low-dose aspirin. Drug therapy may be required for high-risk individuals. Cholesterol-lowering **drugs** works to lower LDL by reducing cholesterol synthesis and by binding **bile** acids in the small intestines. However, there are possible side effects to these drugs that patients should be aware of. SEE ALSO ARTERIOSCLEROSIS; ATHEROSCLEROSIS; CARDIOVASCULAR DISEASES; FATS.

Delores C. S. James

diet: the total daily food intake, or the types of foods eaten

fat: type of food molecule rich in carbon and hydrogen, with high energy content

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

fiber: indigestible plant material which aids digestion by providing bulk

sterol: building blocks of steroid hormones; a type of lipid

drugs: substances whose administration causes a significant change in the body's function

bile: substance produced in the liver which suspends fats for absorption

Bibliography

Birtcher, Kim K., et al. (February 2000). "Strategies for Implementing Lipid-Lowering Therapy: Pharmacy-Based Approach." *American Journal of Cardiology* 85(3):30–35.

National Cholesterol Education Program (2001). *Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), Executive Summary.* NIH Publication No. 01-3670. Washington, DC: National Institutes of Health.

Wardlaw, G.; Hampl, J.; and DiSilvestro, R. (2004). *Perspectives in Nutrition*, 6th edition. Boston, MA: McGraw-Hill.

Internet Resources

American Heart Association. "Cholesterol, Home Testing Devices." Available from <http:/www.americanheart.org>

Lab Tests OnLine. "Lipid Profile." Available from <http://www.labtestsonline.org>

National Heart Lung and Blood Institute. "Recommendations for Lipoprotein Measurement." Available from <http://www.nhlbi.nih.gov/prof/heart>

Low Birth Weight Infant

An infant born with a weight of less than five pounds (2,500 grams) at birth is classified as a low birth weight infant. Babies with low birth weight were either born prematurely or are small for their age because their growth was restricted in the womb. Poor maternal health and **nutrition** may cause low birth weight. Risk factors include inadequate prenatal nutrition, smoking during pregnancy, and infection during pregnancy. Low birth weight infants face a higher risk of death within the first year of life and have higher rates of disability and disease than other infants. Low birth weight is a leading cause of infant mortality throughout world.

Amy N. Marlow

nutrition: the maintenance of health through proper eating, or the study of same

Macrobiotic Diet

George Ohsawa (1893–1966) coined the term ***macrobiotic*** to describe a philosophy towards life, health, and healing. Macrobiotic means "way of long life." Macrobiotics is best described as a way of living according to the principles of yin and yang. Ohsawa, in his book, *Zen Macrobiotics*, describes twelve principles of yin and yang. On the simplest level, it means that individuals eat foods that keep them in balance with their **environment** (i.e., in a hot (yang) climate, more cooling (yin) foods are eaten, and vice versa). Oshawa outlined a ten-stage "Zen" macrobiotic **diet** in which each stage gets more restrictive. The diet is alleged to overcome all forms of illness. At the "highest level," the diet is nutritionally inadequate and has resulted in several deaths. Oshawa devoted much of his time trying to understand the "Order of the Universe," and eventually succumbed to the efforts of his experimentation.

macrobiotic: related to a specific dietary regimen based on balancing of vital principles

environment: surroundings

diet: the total daily food intake, or the types of foods eaten

More recently, macrobiotics has come to mean a dietary regimen used to prevent and treat many diseases. The macrobiotic diet is actually several diets ranging in restrictions from severe to moderate. The severe diet consists exclusively of whole cereal grains, while the moderate diet consists of whole cereal grains and certain types of vegetables, fruits, and soups. Today's leading proponent is Michio Kushi, who reformulated and popularized macrobiotics in the United States.

The standard macrobiotic diet avoids many foods including meat, poultry, animal fats, eggs, dairy products, refined sugar, and foods containing artificial sweeteners or other chemical additives. All recommended foods are preferably organically grown and minimally processed. Consumption of genetically modified, irradiated, processed, canned, and frozen foods is discouraged. The diet consists of five categories of foods (with a recommended weight percentage of total food consumed):

- Whole cereal grains (40%–60%).
- Vegetables, including smaller amounts of raw or pickled vegetables (20%–30%).

People who follow a macrobiotic diet limit their food intake to specific foods, especially whole grains, vegetables, and beans. Though certain aspects of the macrobiotic diet are nutritious, scientists dispute claims that it can cure cancer and other diseases. *[Thierry Orban/Corbis Sygma. Reproduced by permission.]*

- Beans and sea vegetables (5%–10%).
- Soups (which may be made with vegetables, sea vegetables, grains, or beans).
- Beverages including any traditional tea that does not have an aromatic fragrance or a stimulating effect and spring water or good-quality well water, without ice. Not recommended are tropical or semitropical fruits and fruit juices, soda, artificial drinks and beverages, coffee, and colored tea.
- Occasional foods include fruit, white fish, seeds, and nuts.

- Foods to eliminate from the diet include meat, animal **fat**, eggs, poultry, dairy products, refined sugars, chocolate, molasses, honey, vanilla, hot spices, artificial vinegar, and strong alcoholic beverages.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Although the range of intakes varies, macrobiotic diets are generally low in **energy**, **protein**, and fat. They are also likely to be inadequate in **vitamin D**, folic acid, vitamin B_{12}, riboflavin, **calcium**, and **iron**. **Clinical** cases of **malnutrition** and growth failure in children have been reported.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

clinical: related to hospitals, clinics, and patient care

malnutrition: chronic lack of sufficient nutrients to maintain health

Proponents of the macrobiotic diet recommend it for **cancer** patients. It is alleged to slow progression of cancer by starving the rapidly reproducing cells responsible for the disease. Many patients with HIV/AIDS also turn to a macrobiotic diet to help combat the disease. However, these patients and others with immune-suppressed diseases are already losing alarming amounts of weight, and they also have other medical and nutritional complications. The macrobiotic diet may only exacerbate their problem and cause more **nutritional deficiencies**.

cancer: uncontrolled cell growth

nutritional deficiency: lack of adequate nutrients in the diet

Delores C. S. James

Bibliography

Bowman, B. B.; Kushner, R. F.; Dawson, S. C.; Levin, B. (1984). "Macrobiotic Diets for Cancer Treatment and Prevention." *Journal of Clinical Oncology* 2(6):702–711.

Kushi M. (1987). *The Book of Macrobiotics: The Universal Way of Health and Happiness.* Tokyo: Japan Publications.

Internet Resources

Horowitz, J., and Tomita, M. (2002). "The Macrobiotic Diet as Treatment for Cancer: Review of the Evidence." *The Permanente Journal* 6(4). Available from <http://www.kaiserpermanente.org/medicine/permjournal>

Kushi Institute. "What is macrobiotics?" Available from <http://www.kushiinstitute.org/whatismacro.html>

Malnutrition

The **nutritional requirements** of the human body reflect the nutritional intake necessary to maintain optimal body function and to meet the body's daily **energy** needs. **Malnutrition** (literally, "bad **nutrition**") is defined as "inadequate nutrition," and while most people interpret this as **undernutrition**, falling short of daily nutritional requirements, it can also mean overnutrition, meaning intake in excess of what the body uses. However, undernutrition affects more than one-third of the world's children, and nearly 30 percent of people of all ages in the developing world, making this the most damaging form of malnutrition worldwide.

nutritional requirements: the set of substances needed in the diet to maintain health

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

malnutrition: chronic lack of sufficient nutrients to maintain health

nutrition: the maintenance of health through proper eating, or the study of same

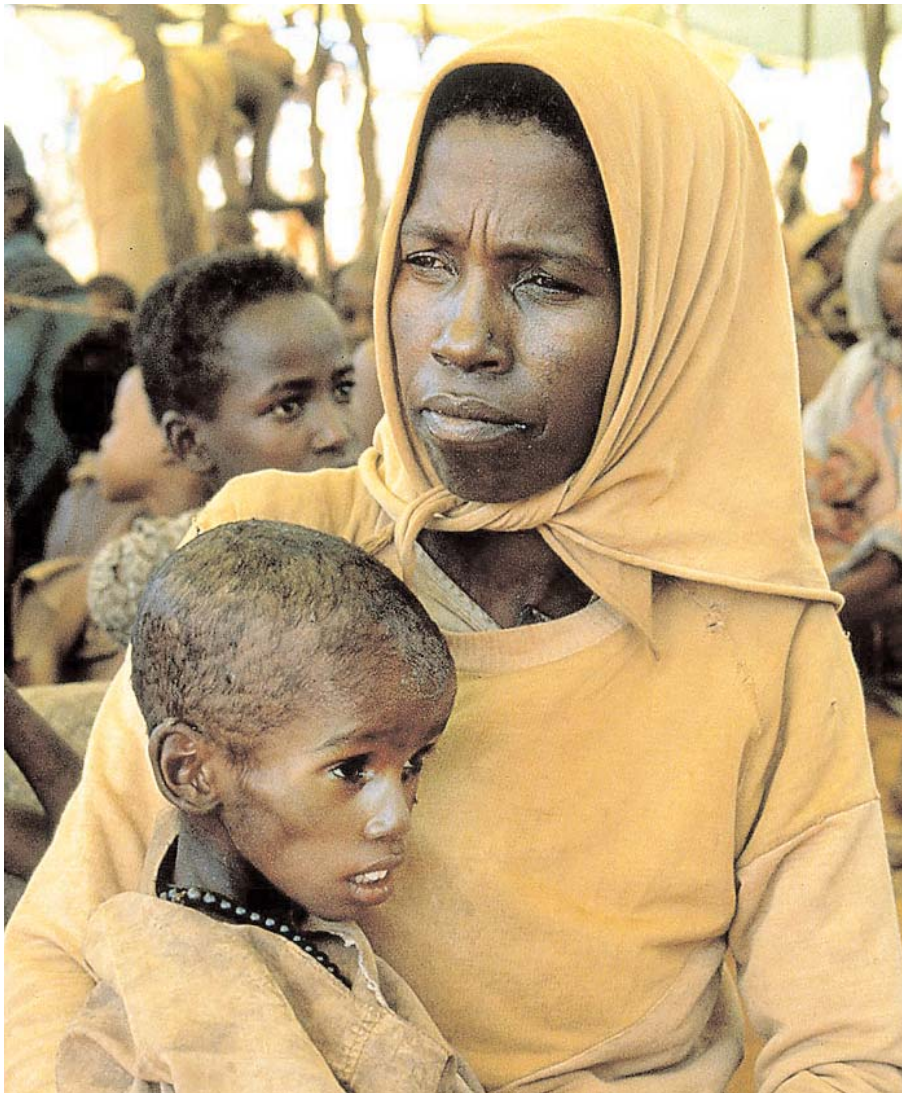
The **etiology** of malnutrition includes factors such as poor food availability and preparation, recurrent infections, and lack of nutritional education. Each of these factors is also impacted by political instability and war, lack of sanitation, poor food distribution, economic downturns, erratic health care provision, and by factors at the community/regional level.

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

etiology: origin and development of a disease

People at Risk

Certain people are more susceptible to malnutrition than others. For example, individuals in rapid periods of growth, such as infants, adolescents,



In developing nations, more than half of all deaths among children under five years old are due to malnutrition. Malnourished children who survive may experience stunted growth, illness, and lifelong malnourishment. *[Photograph by Bruce Brander. National Audubon Society Collection/Photo Researchers, Inc. Reproduced by permission.]*

and pregnant women, have higher nutritional needs than others, and are therefore more susceptible to the effects of poor nutrition. Those living in deprived socioeconomic circumstances or that lack adequate sanitation, education, or the means to procure food are also at risk. Most importantly, individuals at risk for systemic infections (particularly **gastrointestinal**) and those who suffer with a **chronic** disease are at greatly increased risk because they require additional energy to support their **immune system** and often have decreased **absorption** of **nutrients**.

In fact, the relationship between malnutrition and infection is cyclical—infection predisposes one to malnutrition, and malnutrition, which impairs all immune defenses, predisposes one to infection. The World Health Organization (WHO) identifies malnutrition as "the single most important risk factor for disease" (WHO). Some research has identified **malnourished** children as being more likely to suffer episodes of infectious disease, as well as episodes of longer duration and greater severity, than other children. In particular, **hookworm**, **malaria**, and chronic diarrhea have been linked with malnutrition. These conditions are more prevalent in the developing world than in the industrialized world, though malnutrition exists worldwide, par-

gastrointestinal: related to the stomach and intestines

chronic: over a long period

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

absorption: uptake by the digestive tract

nutrient: dietary substance necessary for health

malnourished: lack of adequate nutrients in the diet

hookworm: parasitic nematode that attaches to the intestinal wall

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

ticularly in areas of poverty and among patients with chronic disease or who are hospitalized and on **enteric** feeding.

enteric: pertaining to the intestine; delivered via a tube into the intestine

Necessary Nutrients

The WHO's Department of Nutrition for Health and Development is responsible for formulating dietary and nutritional guidelines for international use. Adequate total nutrition includes the following nutrients: **protein**, energy (**calories**), vitamin A and carotene, **vitamin D**, vitamin E, vitamin K, thiamine, riboflavin, **niacin**, vitamin B6, pantothenic acid, **biotin**, **folate**, vitamin C, **antioxidants**, **calcium**, **iron**, **zinc**, selenium, magnesium, and iodine. Most important are protein and the caloric/energy requirement needed to utilize protein. If these elements are inadequate, the result is a protein-energy malnutrition (PEM), or protein-calorie malnutrition (PCM), which affects one in every four children worldwide, with the highest concentration in Asia. Chronic deficiencies of protein and calories result in a condition called **marasmus**, while a **diet** high in **carbohydrates** but low in protein causes a condition called **kwashiorkor**.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calorie: unit of food energy

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

niacin: one of the B vitamins, required for energy production in the cell

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

folate: one of the B vitamins, also called folic acid

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

diet: the total daily food intake, or the types of foods eaten

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

Malnutrition and Growth

Malnutrition from any cause retards normal growth. Growth assessments are therefore the best way to monitor a person's nutritional status. While there are a variety of methods used to measure growth, the most common are known as **anthropometric** indices, which compare an individual's age, height, and weight, each of which is measured against the others. The values are expressed as percentages, or percentiles, of the normal distribution of these measurements. So, for example, a child with a given height and age might rank in the 90th percentile for height based on all children of that particular age, meaning that 90 percent of children that age are shorter than this particular child. Through anthropometric studies, researchers have found that particular measurements correlate with specific growth trends, based on how the body normally changes over time. Abnormal height-for-age (stunting) usually measures long-term growth faltering. Low weight-for-height (**wasting**) correlates with an **acute** growth disturbance.

anthropometric: related to measurement of characteristics of the human body

wasting: loss of body tissue often as a result of cancer or other disease

acute: rapid-onset and short-lived

Malnutrition can have severe long-term consequences. Children who suffer from malnutrition are more likely to have slowed growth, delayed development, difficulty in school, and high rates of illness, and they may remain malnourished into adulthood.

Limited growth patterns are distributed unevenly across the globe. Eighty percent of children affected by stunting or wasting live in Asia, with 15 percent in Africa and 5 percent in Latin America. Low weight-for-age (underweight) is usually used as an overall measurement of growth status. More than 35 percent of all preschool-age children in developing countries are underweight. There are differences, however, across regions. "The risk of being underweight is 1.5 times higher in Asia than in Africa, and 2.3 times higher in Africa than Latin America" (Onis, p. 10). In some ways, these indices also enable an indirect understanding of the societal factors in these regions that contribute to malnutrition as mentioned above.

The Universal Declaration of Human Rights, established by the United Nations (UN) in 1948, identifies nutrition as a fundamental human right.

An acutely malnourished Liberian boy is weighed at a therapeutic feeding center. Such centers, operated by international relief organizations, provide intensive care and a specialized diet to rehabilitate severely malnourished children. *[AP/Wide World Photos. Reproduced by permission.]*

Malnutrition remains one of the world's highest priority health issues, not only because its effects are so widespread and long lasting, but also because it can be eradicated. Given the multifactorial causes of malnutrition, interventions must be focused on both acute and broad goals. Current efforts are targeted at high-risk groups, particularly infants and pregnant women, for it is "in these populations and during these ages that nutritional interventions have the greatest potential for benefit" (Schroeder, p. 46). Even the simple supplementation of vitamin A or beta-carotene supplements during pregnancy can decrease maternal mortality by 40 percent. Interventions include direct food supplementation, food access, agricultural **enrichment**, nutritional education, and improved infrastructure related to **hygiene**, sanitation, and health care delivery. Each of these programs "must be tailored to the particular problems, cultural conditions, and resource constraints of the local context" (Schroeder, p. 417). Strategies for reducing the **prevalence** of malnutrition must effectively address its many causes. SEE ALSO KWASHIORKOR; MARASMUS; NUTRIENTS; NUTRITION.

Seema P. Kumar

Bibliography

Gillespie, Stuart, and Lawrence Haddad (2001). *Attacking the Double Burden of Malnutrition in Asia and the Pacific.* Washington, DC: International Food Policy Research Institute.

Onis, M.; Monteiro, C.; Akre, J.; and Clugston, G. (1993). "The Worldwide Magnitude of Protein-Energy Malnutrition." In *Bulletin of the World Health Organization* 71(6).

Schroeder, Dirk G. (2001). "Malnutrition." In *Nutrition and Health in Developing Countries*, ed. Richard Semba and Martin Bloem. Totowa, NJ: Humana Press.

Shannon, Joyce Brennflck (2001). *Worldwide Health Sourcebook.* Detroit, MI: Omnigraphics.

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

hygiene: cleanliness

prevalence: describing the number of cases in a population at any one time

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

malnutrition: chronic lack of sufficient nutrients to maintain health

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

calorie: unit of food energy

wasting: loss of body tissue often as a result of cancer or other disease

acute: rapid-onset and short-lived

gastrointestinal: related to the stomach and intestines

Marasmus

Marasmus is one component of **protein-energy malnutrition** (PEM), the other being **kwashiorkor**. It is a severe form of malnutrition caused by inadequate intake of protein and **calories**, and it usually occurs in the first year of life, resulting in **wasting** and growth retardation. Marasmus accounts for a large burden on global health. The World Health Organization (WHO) estimates that deaths attributable to marasmus approach 50 percent of the more than ten million deaths of children under age five with PEM.

The major factors that cause a deficit of caloric and protein intake include the following: the transition from breastfeeding to nutrition-poor foods in infancy, **acute** infections of the **gastrointestinal** tract, and **chronic** infections such as HIV or **tuberculosis**. The imbalance between decreased energy intake and increased energy demands result in a negative energy balance.

The physiologic response to a negative energy balance is to reduce energy consumption. Children who suffer from marasmus display decreased activity, lethargy, **behavioral** changes, slowed growth, and weight loss. The subsequent effects on the body are wasting and a loss of **subcutaneous fat** and muscle, resulting in growth retardation. The majority of children who suffer from marasmus never return to age-appropriate growth standards.

The cornerstone of therapy for marasmus is to supply the body with the necessary **nutritional requirements**. The nutritional needs of children in the rehabilitation stage require at least 150 kilocalories per kilogram per day. **Dehydration** must be addressed with oral rehydration therapy, while **micronutrient** deficiencies, such as vitamin A deficiency, require supplementation. Immunizations must be reviewed and given as necessary to reduce the burden of **infectious diseases** on children's bodies. Finally, family education must be ongoing to improve behavioral responses to such conditions. Some ready-to-use formulas and foods have also been developed. Such a broad approach must be taken to help reduce the **morbidity** and mortality caused by this condition. SEE ALSO CALORIE; INFANT MORTALITY RATE; KWASHIORKOR; MALNUTRITION; PROTEIN.

Seema Pania Kunar

chronic: over a long period

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

behavioral: related to behavior, in contrast to medical or other types of interventions

subcutaneous: beneath the skin

fat: type of food molecule rich in carbon and hydrogen, with high energy content

nutritional requirements: the set of substances needed in the diet to maintain health

dehydration: loss of water

micronutrient: nutrient needed in very small quantities

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

morbidity: illness or accident

Marketing Strategies

The American Marketing Association defines marketing as "the process of planning and executing the conception, pricing, promotion, and distribution of ideas, goods, and services to create exchanges that satisfy individual and organizational objectives." Marketers use an assortment of strategies to guide how, when, and where product information is presented to consumers. Their goal is to persuade consumers to buy a particular brand or product.

Successful marketing strategies create a desire for a product. A marketer, therefore, needs to understand consumer likes and dislikes. In addition, marketers must know what information will convince consumers to buy their product, and whom consumers perceive as a credible source of information. Some marketing strategies use fictional characters, celebrities, or experts (such as doctors) to sell products, while other strategies use specific statements or "health claims" that state the benefits of using a particular product or eating a particular food.

Impact and Influence

Marketing strategies directly impact food purchasing and eating habits. For example, in the late 1970s scientists announced a possible link between eating a high-fiber **diet** and a reduced risk of **cancer**. However, consumers did not immediately increase their consumption of high-fiber cereals. But in 1984 advertisements claiming a relationship between high-fiber diets and protection against cancer appeared, and by 1987 approximately 2 million households had begun eating high-fiber cereal. Since then, other health claims, supported by scientific studies, have influenced consumers to decrease consumption of foods high in **saturated fat** and to increase consumption of fruits, vegetables, skim milk, poultry, and fish.

diet: the total daily food intake, or the types of foods eaten

cancer: uncontrolled cell growth

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

Of course, not all marketing campaigns are based on scientific studies, and not all health claims are truthful. In July 2000 a panel of experts from the U.S. Department of Agriculture supported complaints made by the Physicians Committee for Responsible Medicine that the "Got Milk" advertisements contained untruthful health claims that suggested that milk consumption improved sports performance, since these claims lacked scientific

Companies often use characters to appeal to young consumers. Ronald McDonald first appeared on T.V. in 1963, portrayed by Willard Scott. The clown is known worldwide, and according to McDonald's, is the most recognizable figure next to Santa Claus. *[Photograph by Tim Clary. AP/Wide World Photos. Reproduced by permission.]*

support. In addition, the panel agreed with the physicians' claim that whole milk consumption may actually increase the risk of **heart disease** and **prostate** cancer, and recommended that this information be included in advertisements.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

prostate: male gland surrounding the urethra that contributes fluid to the semen

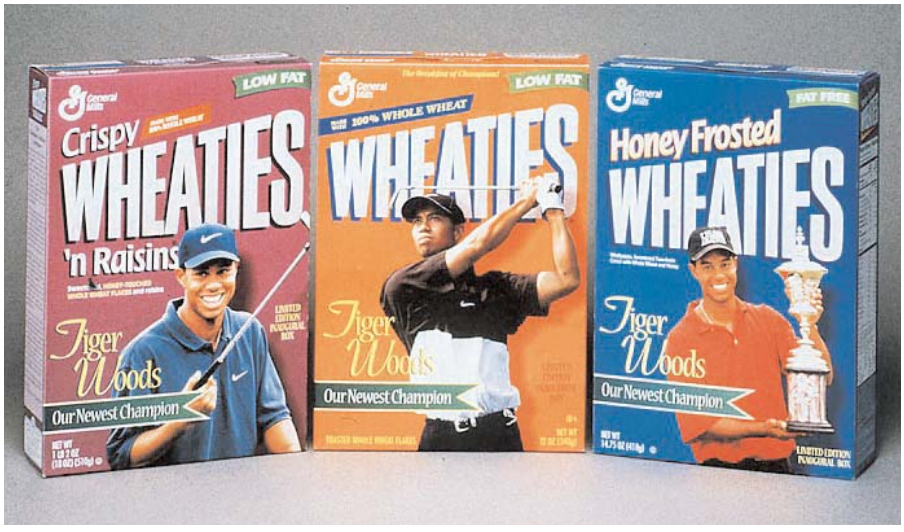
The tremendous spending power and influence of children on parental purchases has attracted marketers, and, as a result, marketing strategies aimed at children and adolescents have increased. Currently, about one-fourth of all television commercials are related to food, and approximately one-half of these are selling snacks and other foods low in nutritional value. Many of the commercials aimed at children and adolescents use catchy music, jingles, humor, and well-known characters to promote products. The impact of these strategies is illustrated by studies showing that when a majority of television commercials that children view are for high-sugar foods, they are more likely to choose unhealthful foods over nutritious alternatives, and vice versa.

Inappropriate Advertisements

Attempts to sell large quantities of products sometimes cause advertisers to make claims that are not entirely factual. For instance, an advertisement for a particular brand of bread claimed the bread had fewer **calories** per slice than its competitors. What the advertisement did not say was that the bread was sliced much thinner than other brands.

calorie: unit of food energy

Deceptive advertising has also been employed to persuade women to change their infant feeding practices. Advertisers commonly urge mothers to use infant formula to supplement breast milk. Marketing strategies include



One strategy used by advertisers is to feature a celebrity in their advertisements or on their packaging. The implicit message is that the celebrity endorses the product, uses the product, and may even depend on the product for success. *[AP/Wide World Photos. Reproduced by permission.]*

giving women trial packs or coupons for several months of free formula. Often, women are not aware that supplementing breast milk with formula will reduce or stop their milk supply. When the samples and coupons are no longer available, women may try to "stretch" the formula by mixing it with water, unaware that diluting the formula places their infant at risk for **malnutrition**. Many groups have objected to the use of marketing strategies that include free formula and coupons, and infant-formula manufacturing companies have been forced to modify their marketing practices.

malnutrition: chronic lack of sufficient nutrients to maintain health

Other marketing strategies involve labeling foods as "light," meaning that one serving contains about 50 percent less **fat** than the original version (or one-third fewer calories). For example, a serving of light ice cream contains 50 percent less fat than a serving of regular ice cream. As a result, consumers mistakenly believe that eating light food means eating healthful food. However, they fail to realize that a serving of the light version of a food such as ice cream can still contain more fat and sugar than is desirable.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Food labels with conflicting information often confront consumers. For example, labels claiming "no fat" do not necessarily mean zero grams of fat. Food labeling standards define low-fat foods as those containing less than 0.5 gram of fat per serving. Therefore, consuming several servings may mean consuming one or two grams of fat, and people are often unaware of what amount of a food constitutes a "serving." In addition, foods low in fat may be high in sugar, adding additional calories to one's daily caloric intake. Too often, consumers mistakenly translate a claim of "no fat" into one of "no calories."

Other examples of conflicting claims include labels advertising foods as "high in fiber," without specifically indicating the presence of high levels of salt, sugar, or other **nutrients**. Also, labels advertising dairy products as high in **calcium**, and thus offering protection from **osteoporosis**, are often missing information relating to the high fat content and its possible contribution to the risk of heart disease.

nutrient: dietary substance necessary for health

calcium: mineral essential for bones and teeth

osteoporosis: weakening of the bone structure

Consumers are also misled by food comparisons. For example, one fruit drink may be advertised as containing more vitamin C than another, when in reality neither of the drinks are a good source of the vitamin. In addition,

labels on some fruit drinks claim that the product "contains real fruit juice" when, in reality, the fine print reveals that one serving contains "less than 10% fruit juice."

Recommendations for Responsible Food Marketing

Consumers rely on product advertisements and food labels for nutritional education. The American Association of Advertising Agencies states that responsible food marketing strategies should: (1) avoid vague, false, misleading, or exaggerated statements; (2) avoid incomplete or distorted interpretations of claims made by professional or scientific authorities; and (3) avoid unfair product comparisons. Advertisers must also consider the long-term consequences or potential for harm stemming from their claims. While these recommendations are important in developed countries, they become even more critical in international marketing campaigns.

It is also important for consumers to recognize their role in evaluating health claims and product comparisons. While advertisers are aware of the need for truth in advertising, sometimes their desire to sell products overshadows an accurate disclosure of product attributes. Advertisers should bear in mind that inaccurate or vague health claims have the potential to cause economic hardship, illness, and even death. Lastly, marketing strategies used in developing nations should be subjected to the highest standards of truth in advertising. SEE ALSO EATING HABITS; HEALTH CLAIMS.

Virginia Jones Noland

Bibliography

Belch, George E., and Belch, Michael A. (1995). *Introduction to Advertising and Promotion: An Integrated Marketing Communications Perspective*. Boston: Irwin.

Boyle, Marie A., and Morris, Diane H. (1994). *Community Nutrition in Action*. St. Paul, MN: West Publishing.

Chetley, Andrew (1986). *The Politics of Baby Foods: Successful Challenges to an International Marketing Strategy*. New York: St. Martin's.

Connor, John M., et al. (1985). *The Food Manufacturing Industries: Structure, Strategies, Performance, and Policies*. Lexington, KY: D.C. Heath.

Elder, John P. (2001). *Behavior Change and Public Health in the Developing World*. Thousand Oaks, CA: Sage.

EPM Communications (1998). "TV Is the Most-Often-Used Source of Health Information." *Research Alert* 16:7.

Goldberg, Jeanne P., and Hellwig, Jennifer P. (1997). "Nutrition Scientists in the Media: The Challenge Facing Scientists." *Journal of the American College of Nutrition* 16:544–550.

Jeffrey, D. B.; McLellarn, R. W.; and Fox, D. T. (1982). "The Development of Children's Eating Habits: The Role of Television Commercials." *Health Education Quarterly* 9:174–189.

Mathios, Alan D., and Ippolito, Pauline M. (1998). "Food Companies Spread Nutrition Information through Advertising and Labels." *Food Review* 21(2):38–44.

Nestle, Marion. (2000). "Soft Drink 'Pouring Rights': Marketing Empty Calories to Children." *Public Health Reports* 115:308–319.

Sutton, Sharon M.; Balch, George I.; and Lefebvre, Craig (1995). "Strategic Questions for Consumer-Based Health Communications." *Public Health Reports* 110:725–733.

Taras, H. L., et al. (1998). "Television's Influence on Children's Diet and Physical Activity." *Journal of Developmental and Behavioral Pediatrics* 10:176–180.

Taylor, Anna (1998). "Violations of the International Code of Marketing Breast Milk Substitutes: Prevalence in Four Countries." *British Medical Journal* 316:1117–1122.

Internet Resources

Baker, Linda (2000). "Breast-Feeding vs. Formula Feeding: Message in a Bottle." Available from <http://www.zipmall.com/bab-bott.html>

Center for a New American Dream. "Just the Facts About Advertising and Marketing to Children." Available from <http://www.newdream.org/campaign/kids/facts.html>

Infant Feeding Action Coalition (INFACT) Canada (2002). "Infant Foods and Health Claims." Available from <http://www.infactcanada.ca/claimsfall1998.htm>

Medical College of Wisconsin. "Health Claims on Food Labels: What Do They Really Mean?" Available from <http://healthlink.mcw.edu/article/974663611.html>

Optimal Wellness Center (2002). "USDA Confirms Milk Ads Make False Health Claims." Available from <http://www.mercola.com/2001/oct/3/milk_ads.htm>

Mastitis

Mastitis is a common infection among breastfeeding women. The infection causes the breast to become tender, red, and hot. The woman also experiences flu-like symptoms, such as fever, tiredness, and sometimes **nausea** and vomiting. Breast infections can occur when the milk ducts become plugged or when the nipples become cracked. In rare cases, the connective tissues of the breast may become infected.

nausea: unpleasant sensation in the gut that precedes vomiting

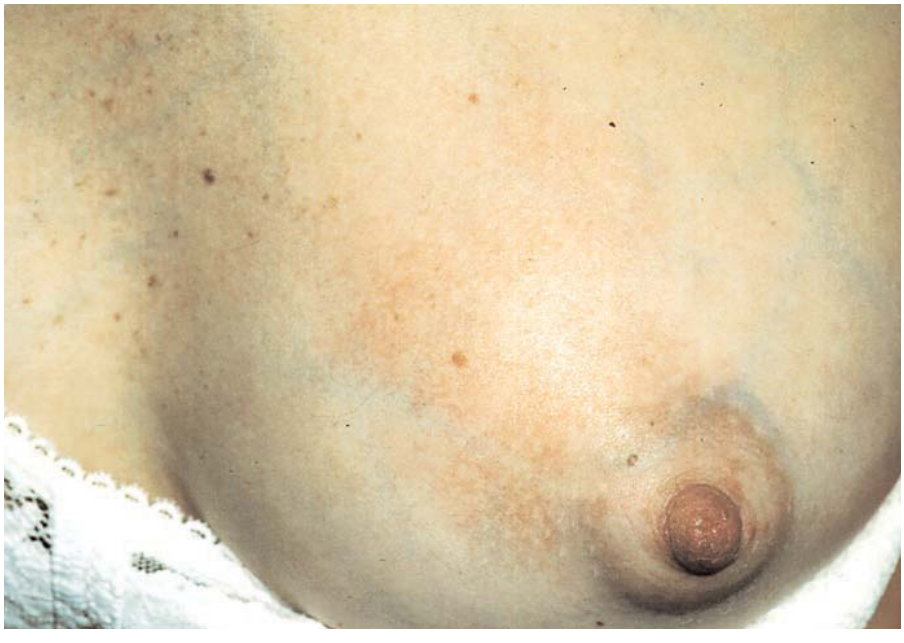
Mastitis usually affects only one breast, and is treatable with **antibiotics**. Women with mastitis are encouraged to continue to breastfeed, or to pump the milk from both breasts, to prevent the breasts from becoming abscessed. Mastitis is not dangerous to the infant, since the milk is not infected. SEE ALSO BREASTFEEDING.

antibiotic: substance that kills or prevents the growth of microorganisms

Delores C. S. James

Bibliography

Worthington-Roberts, Bonnie, S., and Rodwell Williams, Sue (1993). *Nutrition in Pregnancy and Lactation*, 6th edition. Madison, WI: Brown & Benchmark.



An inflamed, painfully tender breast combined with flu-like symptoms may indicate that a nursing mother has mastitis. Frequent feeding or pumping from the affected breast can help, as can rest and drinking lots of fluids. *[Photograph by Dr. P. Marazzi. Photo Researchers, Inc. Reproduced by permission.]*

Internet Resources

Tilson, Bonnie. "Mastitis." Available from <http://www.lalecheleague.org>

Maternal Mortality Rate

The maternal mortality rate reflects the number of maternal deaths in a population due to both direct obstetric causes and to conditions aggravated by pregnancy or childbirth. The maternal mortality rate in the United States is approximately 7.7 deaths per 100,000 pregnancies.

Research indicates that 88 to 98 percent of all maternal deaths can be prevented. Socioeconomic factors such as poverty, education level, and **malnutrition** have proven to be the underlying causes of most maternal deaths. Maternal mortality rates are substantially less in developed countries (1 in 1,800) than in developing countries (1 in 48), illustrating the impact of **socioeconomic status**. To keep the rates as low as possible, health officials in all nations must advocate for quality health services for all women during pregnancy and childbirth. SEE ALSO INFANT MORTALITY RATE.

malnutrition: chronic lack of sufficient nutrients to maintain health

socioeconomic status: level of income and social class

Beth Hensleigh

Internet Resources

Centers for Disease Control and Prevention. "Maternal Mortality: United States, 1982–1996." Available from <http://www.cdc.gov/epo/mmwr>

World Health Organization. "Reduction of Maternal Mortality. A Joint WHO/UNFPA/UNICEF/World Bank Statement." Available from <http://www.who.int/reproductive-health/publications>

Meals On Wheels

Meals On Wheels is a federal food assistance program aimed at improving the diets and nutritional status of homebound older adults. It is funded under Title III-C of the Older Americans Act (OAA) of 1965. The program provides one hot meal at noon five days a week. Each meal must supply approximately one-third of the recommended **nutrient** intakes. The meal pattern includes three ounces of meat or a meat alternate, two one-half cup portions of fruits and vegetables, one serving of bread, one teaspoon of butter or margarine, eight ounces of milk or a **calcium** equivalent, and one serving of dessert. SEE ALSO AGING AND NUTRITION; NUTRITION PROGRAMS IN THE COMMUNITY.

nutrient: dietary substance necessary for health

calcium: mineral essential for bones and teeth

Beth Fontenot

Meat Analogs

A meat analog is a manufactured food product that looks and tastes like meat. Vegetarians and other health-conscious individuals eat meat analogs because they are relatively high in **protein**. They are also very versatile and can be broiled, baked, or roasted. Soy, wheat **gluten**, beans, and/or nuts are used as the main protein source, with other ingredients used to provide texture and a meat-like taste. Meat analogs can be purchased to replace

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

gluten: a protein found in wheat

hamburger, steak, chicken, hot dogs, sausage, and many other meat products. SEE ALSO PROTEIN; SOY; VEGETARIANISM.

Lenore S. Hodges
Cheryl Flynt

Internet Resources

American Dietetic Association, Vegetarian Nutrition Practice Group. "Making the Change to a Vegetarian Diet." Available from <http://www.vegetariannutrition.net/articles.htm>

Seventh-day Adventist Dietetic Association. "Meatless Meats." Available from <http://www.sdada.org/meatlessmeats.htm>

Medical Nutrition Therapy

Medical **nutrition** therapy (MNT) is the development and provision of a nutritional treatment or therapy based on a detailed assessment of a person's medical history, psychosocial history, physical examination, and dietary history. It is used to treat an illness or condition, or as a means to prevent or delay disease or complications from diseases such as **diabetes**. The purpose of the assessment is to:

nutrition: the maintenance of health through proper eating, or the study of same

diabetes: inability to regulate level of sugar in the blood

1. Determine the persons' need for therapy
2. Set parameters to plan a therapy
3. Develop a therapy plan
4. Determine the best method to initiate the therapy
5. Evaluate the effectiveness of the therapy

Assessment Components

A medical history includes the assessment of **acute** or **chronic** diseases or conditions, as well as any surgeries a person may have had. Medication and drug or alcohol use should also be determined. The evaluation of interactions between food and medications is included because medications may interfere with **nutrient absorption** or increase the excretion of nutrients. Vitamin, mineral, and **herbal** supplementation can affect nutritional balance, and interactions with medications are also possible. Knowing the types and amounts of any supplements being taken is important both to determine if the supplementation is needed and to determine if too much of a particular nutrient is being used, which might result in an overdose.

acute: rapid-onset and short-lived

chronic: over a long period

nutrient: dietary substance necessary for health

absorption: uptake by the digestive tract

herbal: related to plants

A physical examination includes an assessment of sex, age, and **anthropometric** data (measurement of height, weight, **body mass index**, and arm or wrist circumference). The physical appearance of the hair, skin, and nails can assist in identifying **nutritional deficiencies**. For example, spoon-shaped, pale, and brittle fingernails may indicate an **iron** deficiency. **Paralysis** or amputation can affect a persons' ability to eat and increase their risk of certain complications, such as bed sores, which require good nutrition to heal. A person's weight history, such as recent weight changes or rapid weight loss, can be an indicator of a nutritional problem. Knowing if any weight changes were voluntary can affect the direction of a medical nutrition therapy plan.

anthropometric: related to measurement of characteristics of the human body

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

nutritional deficiency: lack of adequate nutrients in the diet

iron: nutrient needed for red blood cell formation

paralysis: inability to move

A psychosocial assessment includes reviewing a person's economic status, ethnic and cultural background, living situation, education level, occupation, mental status, and access to adequate food sources to maintain good health. Each of these components plays a role in determining a person's ability to follow through on specific therapy plans. Handicaps such as mental retardation or blindness may affect a person's ability to prepare meals. The number of people in a household may limit food access or selection if they are on a limited income. In some situations, a recommendation for a change in the person's living situation may be made in order to improve their nutritional health. For example, an elderly person living alone may only eat one meal a day due to limited mobility and low income. Such a person would be a candidate for an **assisted-living** facility, where meals would be provided.

assisted-living: facility that provides aid in meal preparation, cleaning, and other activities to help maintain independent living

A **diet** history includes an assessment of a person's usual dietary intake. This can be done by using any of the following methods: (1) a food frequency questionnaire, (2) a twenty-four-hour recall of food eaten, or (3) a three- to five-day food diary. Reviewing food preparation methods is helpful in determining the amount of sodium and **fat** in the diet. The frequency of meals eaten out is an important indicator of whether a person enjoys cooking, has access to cooking, or just prefers to eat out instead of cooking. These factors play a role in determining the details of a therapy plan. Other information that is obtained in a diet history includes:

diet: the total daily food intake, or the types of foods eaten

fat: type of food molecule rich in carbon and hydrogen, with high energy content

1. Is the appetite level good or poor, and has it changed recently?
2. Have there been any taste alterations? If so, why?
3. Are there any chewing or swallowing difficulties?
4. What are the person's bowel habits and have they changed recently?
5. Are there any religious restrictions on the diet?
6. Are there any food **allergies** or intolerances?

allergy: immune system reaction against substances that are otherwise harmless

Therapy Provision

Medical nutrition therapy is provided by registered dietitians (RDs), who are the only health care professionals with nutrition-specific training. Education includes a bachelor's, master's, or doctoral degree from an accredited university. Required course work is approved by the Commission on Accreditation for Dietetics Education of the American Dietetic Association. After obtaining a degree focused on nutrition and dietetics and completion of a dietetic **internship**, a national credentialing exam is required. The Commission on Dietetic Registration administers the national examination. Registered dietitians must complete continuing education requirements to maintain their registration status. Advanced certifications can also be obtained through additional training and/or experience. The American Dietetic Association, the American Association of Diabetes Educators, and other nutrition-related organizations recognized within the dietetics profession award these certifications. Dietitians are also commonly referred to as nutritionists. Qualified nutritionists should also have the registered dietitian credentials, and many states require registered dietitians and nutritionist to be licensed.

internship: training program

Registered dietitians are employed in many settings, including: hospitals, health clinics, extended-care facilities, physician offices, home-care compa-

Registered dietitians who apply their expertise to treat illness practice medical nutrition therapy. The therapy may be designed to cure disease or to ensure that a patient's diet does not complicate recovery. In this picture, an RD helps a wheelchair-bound patient prepare a meal. *[Royalty-Free/Corbis. Reproduced by permission.]*

nies, private practice, community and public health programs, colleges and universities, school food service, state and federal health and nutrition programs, research organizations, and food or pharmaceutical organizations.

Insurance Coverage

Insurance coverage for the cost of MNT is inconsistent across the United States. Some private insurance companies have policies that pay the cost for a person to receive medical nutrition therapy based on protocols developed by the American Dietetic Association. Other companies leave the coverage to the discretion of a case manager or physician, while some refuse to provide reimbursement for any nutrition therapy.

Some U.S. states have laws that mandate that insurance companies provide coverage for MNT. Some of these states limit coverage to diabetes, while others include a wider range of diseases. In January 2002, the Medicare program began providing MNT coverage for persons with diabetes and **pre-renal** disease. (Medicare is a federal health insurance program for those over the age of sixty-five, those under sixty-five with certain disabilities, and for people with permanent kidney failure.) Congress is considering inclusion of other diagnoses, such as **cardiovascular** disease. This would expand the provision of MNT to those persons with coronary **artery** disease, congestive heart failure, and **hypertension**. Diabetes self-management training is a Medicare-covered benefit that includes MNT and education on issues such as blood **glucose** monitoring, disease complications, and prevention. Internationally, the cost of nutrition therapy is sometimes covered by a national health care system, or by a private system similar to that in the United States.

pre-renal: kidney disease caused by change in the blood supply to the kidney

cardiovascular: related to the heart and circulatory system

artery: blood vessel that carry blood away from the heart toward the body tissues

hypertension: high blood pressure

glucose: a simple sugar; the most commonly used fuel in cells

Medical Nutrition Therapy is physician directed. This means a person's primary care physician makes a referral to a registered dietitian for therapy. Many insurance carriers and state licensure laws require this referral to document the medical necessity of the therapy.

The expansion of insurance coverage for MNT by Medicare and private providers is vital to improving access to this type of care. Rising health

care costs and limited incomes often force choices between food and health care. Medical nutrition therapy has been shown to reduce health care cost for individuals, employers, hospitals, and insurance carriers. SEE ALSO DIETITIAN; NUTRITIONAL ASSESSMENT.

Mindy Benedict

Bibliography

American Dietetic Association (2000). *Manual of Clinical Dietetics*, 6th ed. Chicago, IL: Author.

Florida Dietetic Association (2002). *The Florida Dietetic Association Handbook of Medical Nutrition Therapy: The Florida Diet Manual*. Tallahassee, FL: Author.

Internet Resources

American Dietetic Association. "Medicare MNT Benefit Provider Information." Available from <http://www.eatright.org>

Mellanby, Edward

British physician
1884–1955

The British physician and pharmacologist Sir Edward Mellanby was born in West Hartlepool, England, the youngest son of John Mellanby, a shipyard owner, and his wife Mary Isabella Lawson. Mellanby attended Barnard Castle School and Emmanuel College in Cambridge, England, where he studied **physiology**. After working as a research student from 1905 to 1907, Mellanby studied medicine at St. Thomas's Hospital in London, and he held a fellowship for medical research from 1910 through 1912. He was married in 1914 to May Tweedy, of London, who was also a researcher in physiology. The following year Mellanby became a medical doctor.

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

From 1913 to 1920, Mellanby served as a lecturer at King's College for Women in London, where he later became a professor in physiology. In 1914, the Medical Research Committee of the college asked Mellanby to investigate the cause of **rickets**, a bone disease characterized by bone pain, skeletal deformity, impaired growth, and weakness.

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

Searching for a dietary deficiency that caused rickets, Mellanby decided to test porridge, the staple food of Scotland, by feeding a group of dogs a **diet** consisting exclusively of oats. Inadvertently, the dogs were kept indoors, without exposure to sunlight, during the experiment. In 1919, Mellanby reported that he produced rickets in the dogs through the restrictive diet. He then cured the dogs of rickets by adding cod-liver oil to their diet. Mellanby concluded that a component of cod-liver oil that the oats did not contain was essential in preventing rickets.

diet: the total daily food intake, or the types of foods eaten

As a result, Mellanby proposed that rickets was caused by the absence of a dietary factor.

Scientists would later discover that rickets is prevented by **vitamin D**, which can either be consumed as a dietary factor or produced naturally by the body when exposed to sunlight. Mellanby's work laid the foundation for this conclusion, since the cod-liver oil fed to the dogs was a good source of vitamin D and the dogs were raised without exposure to sunlight.

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

In 1920, Mellanby was appointed chair of the pharmacology department at the University of Sheffield in England, and as an honorary physician to the Royal Infirmary. He held these positions until 1933, when he became secretary of the Medical Research Council, which had been established by the British government in 1913. He was closely involved with the planning of the new Institute of Medical Research, which opened in 1950 in London.

During World War II, Mellanby was involved with programs to create a wartime diet as well as programs to promote the welfare of both military and civilian personnel. After retiring from the Medical Research Council in 1949, he traveled to India, Australia, and New Zealand to serve as an advisor. After his return to England, he gave several public lectures. Mellanby died on January 30, 1955, while working in his London laboratory. SEE ALSO RICKETS.

Karen Bryla

Bibliography

Oxbury, Harold (1985). *Great Britons: Twentieth-Century Lives.* Oxford, England: Oxford University Press.

Internet Resources

National Academy of Sciences. "Unraveling the Enigma of Vitamin D: Closing in on Rickets." Available from <http://beyonddiscovery.org>

University of California, Riverside. "History of Vitamin D." Available from <http://vitamind.ucr.edu/history.html>

Research conducted by Sir Edward Mellanby led to the discovery that rickets is a disease of malnutrition, curable with regular doses of cod-liver oil. Scientists later determined that the condition is a result of vitamin D deficiency.
[Bettmann/Corbis. Reproduced by permission.]

Menopause

Young girls start menstruating between the ages of eleven and thirteen, when their reproductive systems reach maturity. Women have regular **menstrual cycles** every twenty-eight days until about the age of fifty, at which time menstruation becomes irregular. This irregularity signals the start of **menopause**. The natural cessation of menstruation occurs due to reduced production of the female **hormones estrogen** and progesterone, which generally occurs between the ages of forty and fifty-five. The age at which a woman enters menopause is affected by **genetics**, race, and environmental factors. Women can also go into premature menopause, either naturally or due to oophorectomy (the surgical removal of the ovaries).

menstrual cycles: the build-up and sloughing off of the lining of the uterus in women commencing at puberty and proceeding until menopause

menopause: phase in a woman's life during which ovulation and menstruation end

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

genetics: inheritance through genes

Stages of Menopause

Women go through different phases of menopause, including perimenopausal, **menopausal**, and postmenopausal periods. During the perimenopausal period, the regular cyclical occurrence of menstruation is disrupted and menstruation becomes irregular. This phase may last anywhere from six months to a year. During the perimenopausal period, production of estrogen is reduced, and eventually stops. Menopause is defined as the cessation of the menstrual period. Women are described as postmenopausal when they have gone one year without a menstrual period.

menopausal: related to menopause, the period during which women cease to ovulate and menstruate

Physiological Changes

The lack of estrogen and progesterone causes many changes in women's **physiology** that affect their health and well-being. These changes include:

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

calcium: mineral essential for bones and teeth

osteoporosis: weakening of the bone structure

basal metabolism: level of body energy consumption and chemical processes in the absence of exertion

cardiovascular: related to the heart and circulatory system

- Elevated levels of total **cholesterol** and LDL-cholesterol, which increases the risk of **coronary heart disease** (CHD) in women. During the reproductive years, estrogen prevents increased levels of blood cholesterol and maintains the activity of estrogen receptors in women, thus preventing the risk of CHD.
- **Calcium** loss from the bones is increased in the first five years after the onset of menopause, resulting in a loss of bone density. This bone loss then tapers off until about the age of seventy-five, when calcium loss accelerates again. This predisposes women to the risk of **osteoporosis** and bone fractures.
- The body composition of menopausal women also changes, with the percentage of body fat increasing and muscle mass decreasing. The increase in body-fat percentage is believed to be partly due to decreased physical activity.
- Decreased muscle mass reduces the rate of **basal metabolism**, which may be responsible for weight gain at this period of a woman's life.
- The abdominal-fat storage that occurs in women at this stage increases the risk for **cardiovascular** disease.
- The tissues in the urinary tract and reproductive organs atrophy.

fatigue: tiredness

anxiety: nervousness

Some other transient but unpleasant symptoms of menopause include hot flashes, **fatigue**, **anxiety**, sleep disturbance, and memory loss.

Treatments and Remedies: Benefits and Disadvantages of Each

Menopausal women are faced with many choices in terms of treatment or remedies for these problems. Some of the treatment choices are experimentally proven to be effective and relatively harmless, while other options such as herbs, teas, and dietary supplements have not been subjected to scientific experimentation and have not been proven to be without harm.

cancer: uncontrolled cell growth

Estrogen replacement therapy (ERT) is the often-used medically prescribed treatment for menopausal and postmenopausal women. Although some studies have indicated a decreased risk of CHD and osteoporosis with ERT use, others have indicated it may increase the risk of breast **cancer**. The Women's Health Initiative, which was designed to study the effects of ERT on the health of elderly women, stopped the ERT part of the research in July 2002. The preliminary result of that study showed the risk of CHD was, in fact, increased in women on ERT.

aerobic: designed to maintain adequate oxygen in the bloodstream

Scientific investigations have shown that physical activity, including **aerobic** and muscular strengthening exercises, not only prevent bone mineral loss, they also help alleviate many menopausal symptoms, including the increased percentage of body fat, abdominal-fat storage, hot flashes, fatigue, and sleep disturbances.

phytoestrogen: plant-derived estrogen compound

legumes: beans, peas, and related plants

Phytoestrogens, which are present in foods such as soy, red clover, flaxseed, and other beans and **legumes**, are natural plant estrogen-type chemicals that can help replace human estrogen without some of the risk factors of ERT. Epidemiological observations indicate that in some cultures where soy is a staple food, women do not suffer from hot flashes during and

Hormone replacement pills are used by some women to reduce the symptoms of menopause. According to the Women's Health Initiative, women who use a combination of estrogen and the synthetic hormone progestin increase their risk of developing breast cancer and heart disease. *[Stephen Chernin/Getty Images. Reproduced by permission.]*

after menopause. The results of human experiments designed to study the effect of soy products on alleviating symptoms during menopause are new and inconsistent, but promising. In addition, the **isoflavones** in soy products are strong **antioxidants** and may be effective in reducing the risk of CHD in women of menopausal age.

Herbal supplements promoted by the supplement industry to prevent hot flashes, anxiety, sleep disturbances, and other symptoms of menopause have not been scientifically studied, and since the chemical composition of these supplements is not always known, they may contain harmful substances. Thus, these kinds of supplements are not generally recommended for menopausal women.

isoflavones: estrogen-like compounds in plants

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

herbal: related to plants

Dietary and Lifestyle Changes

Recommendations for dietary and lifestyle changes for women during menopause are a little different from that for women in general. Menopausal women need to eat less of foods that are high in **iron**. Because they are not menstruating, their requirement for iron is reduced, and is thus the same as for men, about 10 milligrams per day. This means that they need to cut down on red meat, organ meats such as liver and kidney, and other foods high in iron. If they are taking multivitamin and mineral supplements, ones with a low iron content are recommended.

iron: nutrient needed for red blood cell formation

Water intake is emphasized in older women and men, since the thirst sensation becomes dulled as people age. Six to eight glasses of fluid per day are recommended for this age group. Water, fruit juices, other nonalcoholic beverages, and fresh fruits can help provide variety in fluid intake. In addition, an increased consumption of legumes (e.g., dried chick peas, varieties of beans, lentils, soy and soy products) is recommended to provide phytoestrogens and isoflavones. There are other alternatives that are used by people around the world to reduce hot flashes and other symptoms of menopause, including herbs such as ginseng, black cohash, kava, and wild yam. However, there has been little scientific data to determine the effectiveness and safety of these supplements.

Menopausal women need to decrease their intake of total fat, **saturated fat**, and total **calories** to balance their **energy** expenditure and prevent weight gain, which is sometimes associated with this period in a women's life. It is believed that, on average, women gain about 1.2 pounds a year, with most of the weight gain in the form of abdominal fat. A study done in the 1990s found that a modest weight reduction program in premenopausal women, including **diet** and exercise, produced modest weight loss and favorable blood lipid changes that lasted five years through the women's menopausal period. This study (Simkin-Silverman et al.) proved that weight gain during menopause is not only related to hormonal changes, but also to decreased level of physical activity.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

calorie: unit of food energy

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

diet: the total daily food intake, or the types of foods eaten

A woman's intake of dietary **fiber** must be increased during menopause to prevent **constipation**. This objective can be accomplished by following the Dietary Guidelines for Americans, which recommend consuming six servings of whole grains and cereals, three to five servings of vegetables, and two to four servings of fruit per day. Exercise is also very important for all older individuals. Thirty minutes of moderate daily exercise, such as speed walking, is recommended. Other exercises, such as flexibility and strength training to maintain lean muscle mass and bone density, can be very helpful if done two to three times a week. SEE ALSO WOMEN'S NUTRITIONAL ISSUES.

fiber: indigestible plant material which aids digestion by providing bulk

constipation: difficulty passing feces

Simin Vaghefi

Bibliography

Nelson, M. E.; Fiatrone, M. A.; Morganti, C. N. M.; et al. (1994). "Effects of High-Intensity Strength Training on Multiple Risk Factors for Osteoporotic Fractures." *Journal of the American Medical Association* 272:1909–1914.

Simkin-Silverman, L.; Wing, R. R.; Hansen, D. H.; et al. (1995). "Prevention of Cardiovascular Risk Factor Elevations in Healthy Premenopausal Women." *Preventive Medicine* 24:509–517.

Internet Resources

Women's Health Initiative. "Findings from the Women's Health Initiative." Available from <http://www.nhlbi.nih.gov/whi>

Men's Nutritional Issues

While many diseases and health care issues affect both men and women, certain diseases and conditions exhibited in men may require distinct approaches regarding diagnosis and management. Some of the major issues associated with men's health are related to **cancer**, **diabetes**, **heart disease**, **hypertension**, impotence, and **prostate** health. This entry highlights definitions, **etiology**, treatment, and **lifestyle** factors of men's health, as well as nutritional implications.

Cancer

Cancer is characterized as aberrant and uncontrolled cell growth. Cells divide more rapidly than normal, and these growths may metastasize (spread to other organs). It affects people of all ages and can attack any organ or tissue of the body. Some cancers are more responsive to treatment and lend themselves to a cure, while others seem to appear suddenly and resist treatment.

Much of what we know from nutritional epidemiology supports the role of **diet** as a means of staving off cancer. Particularly, a mostly plant-based diet—one high in fruits, vegetables, and whole grains—is the key. Men should aim for five to nine servings of fruits and vegetables daily and eat breads, cereals, and grains that are high in **fiber**, such as whole wheat bread, bran flakes, brown rice, and quinoa.

Apart from diet, the most important thing a man can do to reduce his cancer risk is stop smoking and cease using all tobacco products. Smoking is the number one preventable cause of death in the United States, claiming 400,000 lives per year, and it increases the risk for developing cancer. **Genetics** and environmental sources (e.g., ultraviolet light) are also linked with cancer.

Diabetes Mellitus

Carbohydrate intolerance—the inability to properly **metabolize** sugars—is known as diabetes mellitus, often just shortened to diabetes. The pancreas makes **insulin**, a **hormone** responsible for a cell's uptake of **glucose** (sugar) from blood for **energy**. People who have diabetes do not make enough insulin, or else the body cannot use what is made. Treatment includes achieving a healthy weight, engaging in exercise, and prescription medication. Sometimes people are able to cure their diabetes with diet and weight loss.

A proper diet for people with diabetes is comparable to what the average healthy person should already be eating. Basic tenets include: eat three meals daily, incorporate healthful snacks, focus on foods high in fiber, combine **protein** and carbohydrates with moderate amounts of unsaturated fat, and avoid sugar-sweetened beverages to reduce overall caloric intake.

Heart Disease

Heart disease, or coronary **artery** disease, is a result of improper function of the heart and blood vessels. There are many forms of heart disease. **Atherosclerosis** (hardening of the arteries) and hypertension (**high blood pressure**) are two of the most common. Fat deposits disrupt the flow of blood to the heart muscle, increasing the risk of myocardial infarction (**heart attack**).

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

prostate: male gland surrounding the urethra that contributes fluid to the semen

etiology: origin and development of a disease

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

diet: the total daily food intake, or the types of foods eaten

fiber: indigestible plant material which aids digestion by providing bulk

genetics: inheritance through genes

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

metabolize: processing of a nutrient

insulin: hormone released by the pancreas to regulate level of sugar in the blood

hormone: molecules produced by one set of cells that influence the function of another set of cells

glucose: a simple sugar; the most commonly used fuel in cells

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

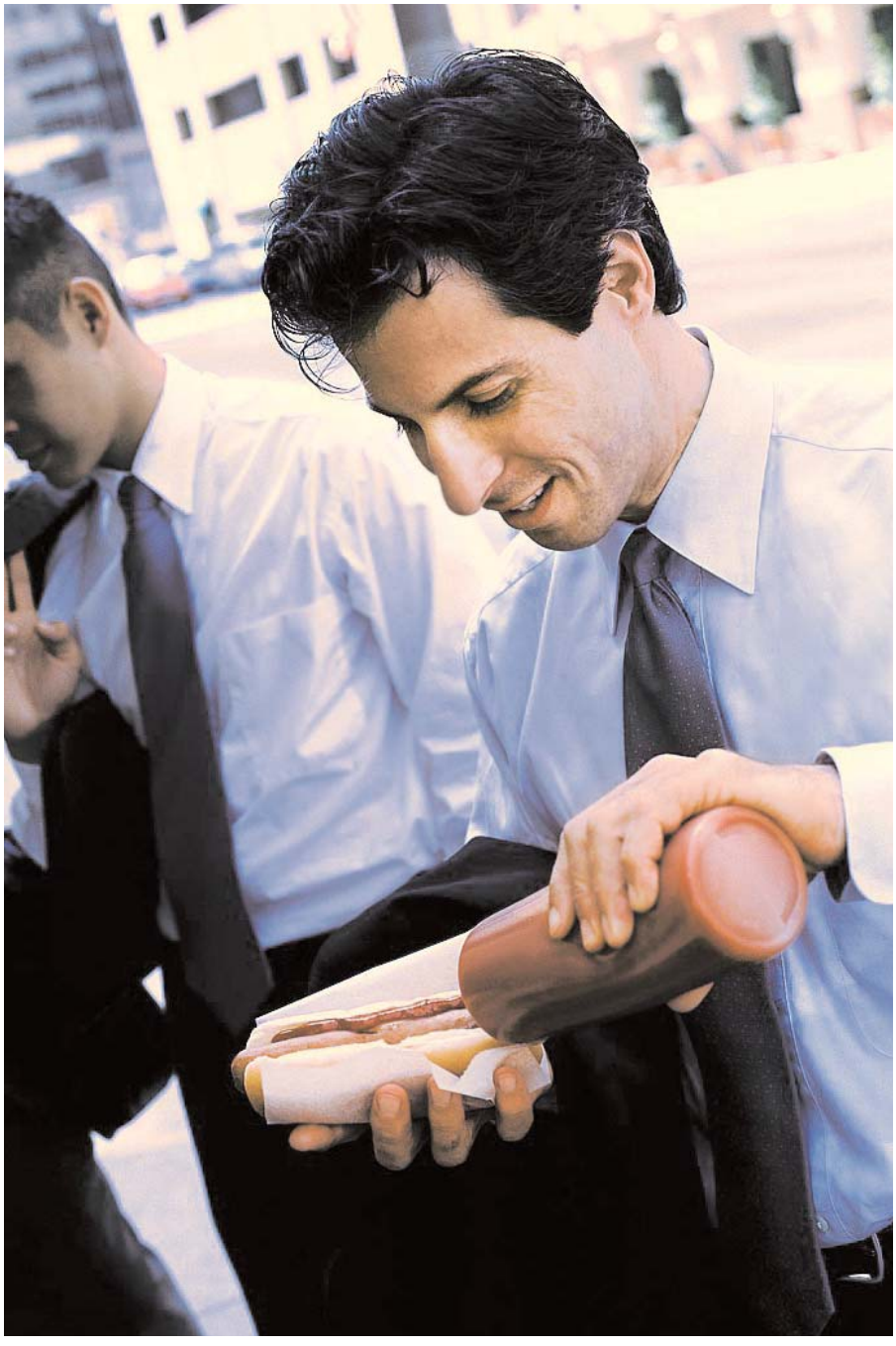
protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

artery: blood vessel that carries blood away from the heart toward the body tissues

atherosclerosis: build-up of deposits within the blood vessels

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle



According to the National Cancer Institute, men are approximately 1.5 times as likely as women to develop colorectal cancer or heart disease. Both diseases may be prevented by eating well. The convenience and economic appeal of fast foods, such as hot dogs, can lead to poor dietary habits. *[Royalty-Free/Corbis. Reproduced by permission.]*

Heart disease is the number one cause of death for men. According to the American Heart Association, 440,175 men died of heart disease in 2000. Apart from just being male, other risk factors are being forty-five years of age and older, low levels of high-density lipoprotein (**HDL**—the "good" **cholesterol**), high levels of low-density lipoprotein (LDL—the "bad" cholesterol), hypertension, smoking, excess body fat, diabetes, and a family history of heart disease.

HDL: high density lipoprotein, a blood protein that carries cholesterol

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

The most important thing men should do to prevent heart disease is stop smoking and manage their weight. In terms of diet, dietitians recommend that men include more lean and healthier protein foods in their diets—such

as white meat chicken and turkey, and sirloin instead of filet mignon. Additionally, eating fatty fish (e.g., salmon or mackerel) twice a week may have a cardioprotective effect. Baking and broiling are preferred over deep fat frying.

Hypertension

The Centers for Disease Control and Prevention (CDC) reports that 64 percent of men seventy-five and older have hypertension (high blood pressure), and African Americans are at a greater risk. Termed the "silent killer," hypertension often has no physical symptoms. Men often feel well enough to function normally in their day-to-day lives, and they do not view the risk as a serious one.

Being **obese** is associated with hypertension. Losing weight helps to control **blood pressure**, and sometimes men are able to decrease or discontinue their medication if their physicians determine it is no longer needed. Getting men to move away from large portions of fatty meat and potatoes and more toward three ounces of meat on a plate of overflowing vegetables is one sure method to help prevent **overweight** and manage hypertension. Additionally, some men are sensitive to dietary salt (sodium chloride). Eating too much salt can cause the body to retain water, resulting in increased blood pressure. **Processed foods** tend to be high in salt.

obese: above accepted standards of weight for sex, height, and age

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

overweight: weight above the accepted norm based on height, sex, and age

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Impotence

Impotence, also known as erectile dysfunction, occurs when a man cannot maintain an erection to achieve orgasm in sexual intercourse. The National Institutes of Health report that 15 to 30 million American men have erectile dysfunction. Many things can prevent normal erection, including **psychological** interference, **neurological** problems, abnormal blood flow, and prescription medications. Certain health conditions, such as diabetes and heart disease, cause men to experience impotence as well. Treatment may consist of psychotherapy, prescription medication, and surgery.

psychological: related to thoughts, feelings, and personal experiences

neurological: related to the nervous system

Prostate Health

A small gland surrounding the urethra, the prostate supplies fluid that transports semen. The CDC reports that 31,078 men died of prostate cancer in 2000. Signs of prostate trouble are hesitant urination, weak urine flow and dribbling, and incontinence (inability to control urinary bladder). **Nutrition** may play a role in prostate health. Besides eating a varied diet focused on overall moderation, researchers have shown benefits from lycopene, a **phytochemical** (plant chemical) that gives plants a red color. Foods containing lycopene include processed tomato products, watermelon, and pink or red grapefruit.

nutrition: the maintenance of health through proper eating, or the study of same

phytochemical: chemical produced by plants

Conclusion

Nutrition impacts health. Eating a good diet promotes **wellness** and disease prevention for healthy men, and sound nutrition helps manage **chronic** diseases as well. Men often fall short of achieving a healthful diet due to busy work schedules, fear of or disinterest in cooking, and the stresses of daily living. Simple steps to improve time management and a willingness for experimentation in the kitchen are both reasonable suggestions to help men eat more healthful meals.

wellness: related to health promotion

chronic: over a long period

Apart from nutritious meals, men should visit their physicians regularly, both for checkups and to discuss the health implications of nutritional supplements (protein powder, vitamin E, etc.). Routine physical exams, including blood tests for cholesterol, blood pressure measurements, and cancer screenings, help identify problems early, which can dramatically improve outcomes. In addition, sixty minutes of exercise daily helps weight management. SEE ALSO ADULT NUTRITION; CANCER; DIABETES MELLITUS; HEART DISEASE; HYPERTENSION.

D. Milton Stokes

Bibliography

American Heart Association (2002). *Heart Disease and Stroke Statistics: 2003 Update.* Dallas, TX.: Author.

Perry, Angela, and Schacht, Marck, eds. (2001). *American Medical Association Complete Guide to Men's Health.* New York: Wiley.

Reichler, Gayle (1998). *Active Wellness.* New York: Time-Life Books.

Internet Resources

American Dietetic Association. <http://www.eatright.org>

Centers for Disease Control and Prevention, National Center for Health Statistics. "Fast Stats A to Z: Heart Disease." Available from <http://www.cdc.gov/nchs/fastats>

Centers for Disease Control and Prevention, National Center for Health Statistics. "Fast Stats A to Z: Prostate Disease." Available from <http://www.cdc.gov/nchs/fastats>

National Institute of Diabetes and Digestive and Kidney Diseases. "Erectile Dysfunction." Available from <http://www.niddk.nih.gov/health/>

Metabolism

Metabolism refers to the physical and chemical processes that occur inside the cells of the body and that maintain life. Metabolism consists of anabolism (the constructive phase) and **catabolism** (the destructive phase, in which complex materials are broken down). The transformation of the macronutrients **carbohydrates**, fats, and **proteins** in food to **energy**, and other **physiological** processes are parts of the **metabolic** process. ATP (adinosene triphosphate) is the major form of energy used for cellular metabolism.

metabolism: the sum total of reactions in a cell or an organism

catabolism: breakdown of complex molecules

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

physiological: related to the biochemical processes of the body

metabolic: related to processing of nutrients and building of necessary molecules within the cell

oxygen: O_2, atmospheric gas required by all animals

atoms: fundamental particles of matter

glucose: a simple sugar; the most commonly used fuel in cells

mucosa: moist exchange surface within the body

glycogen: storage form of sugar

fat: type of food molecule rich in carbon and hydrogen, with high energy content

amino acid: building block of proteins, necessary dietary nutrient

biological: related to living organisms

diabetes: inability to regulate level of sugar in the blood

adipose tissue: tissue containing fat deposits

hormone: molecules produced by one set of cells that influence the function of another set of cells

insulin: hormone released by the pancreas to regulate level of sugar in the blood

Carbohydrate Metabolism

Carbohydrates made up of carbon, hydrogen, and **oxygen atoms** are classified as mono-, di-, and polysaccharides, depending on the number of sugar units they contain. The monosaccharides—**glucose**, galactose, and fructose—obtained from the digestion of food are transported from the intestinal **mucosa** via the portal vein to the liver. They may be utilized directly for energy by all tissues; temporarily stored as **glycogen** in the liver or in muscle; or converted to **fat**, **amino acids**, and other **biological** compounds.

Carbohydrate metabolism plays an important role in both types of **diabetes** mellitus. The entry of glucose into most tissues—including heart, muscle, and **adipose tissue**—is dependent upon the presence of the **hormone insulin**. Insulin controls the uptake and metabolism of glucose in these cells and plays a major role in regulating the blood glucose concentration. The reactions of carbohydrate metabolism cannot take place with-

out the presence of the **B vitamins**, which function as coenzymes. Phosphorous, magnesium, **iron**, copper, manganese, **zinc** and chromium are also necessary as cofactors.

B vitamins: a group of vitamins important in cell energy processes

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

Carbohydrate metabolism begins with ***glycolysis***, which releases energy from glucose or glycogen to form two **molecules** of pyruvate, which enter the **Krebs cycle** (or citric acid cycle), an oxygen-requiring process, through which they are completely oxidized. Before the Krebs cycle can begin, pyruvate loses a carbon dioxide group to form acetyl coenzyme A (acetyl-CoA). This reaction is irreversible and has important metabolic consequences. The conversion of pyruvate to acetyl-CoA requires the B vitamins.

glycolysis: cellular reaction that begins the breakdown of sugars

molecule: combination of atoms that form stable particles

Krebs cycle: cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules

The hydrogen in carbohydrate is carried to the electron transport chain, where the energy is conserved in ATP molecules. Metabolism of one molecule of glucose yields thirty-one molecules of ATP. The energy released from ATP through hydrolysis (a chemical reaction with water) can then be used for biological work.

Only a few cells, such as liver and kidney cells, can produce their own glucose from amino acids, and only liver and muscle cells store glucose in the form of glycogen. Other body cells must obtain glucose from the bloodstream.

Under **anaerobic** conditions, lactate is formed from pyruvate. This reaction is important in the muscle when energy demands exceed oxygen supply. Glycolysis occurs in the cytosol (fluid portion) of a cell and has a dual role. It degrades monosaccharides to generate energy, and it provides **glycerol** for **triglyceride** synthesis. The Krebs cycle and the electron transport chain occur in the **mitochondria**. Most of the energy derived from carbohydrate, protein, and fat is produced via the Krebs cycle and the electron transport system.

anaerobic: without air, or oxygen

glycerol: simple molecule that forms a portion of fats

triglyceride: a type of fat

mitochondria: small bodies within a cell that harvest energy for use by the cell

Glycogenesis is the conversion of excess glucose to glycogen. *Glycogenolysis* is the conversion of glycogen to glucose (which could occur several hours after a meal or overnight) in the liver or, in the absence of glucose-6-phosphate in the muscle, to lactate. *Gluconeogenesis* is the formation of glucose from noncarbohydrate sources, such as certain amino acids and the glycerol fraction of fats when carbohydrate intake is limited. Liver is the main site for gluconeogenesis, except during starvation, when the kidney becomes important in the process. Disorders of carbohydrate metabolism include diabetes mellitus, **lactose intolerance**, and **galactosemia**.

lactose intolerance: inability to digest lactose, or milk sugar

galactosemia: inherited disorder preventing digestion of milk sugar, galactose

Protein Metabolism

Proteins contain carbon, hydrogen, oxygen, **nitrogen**, and sometimes other atoms. They form the cellular structural elements, are **biochemical** catalysts, and are important regulators of **gene expression**. Nitrogen is essential to the formation of twenty different amino acids, the building blocks of all body cells. Amino acids are characterized by the presence of a terminal carboxyl group and an amino group in the alpha position, and they are connected by peptide bonds.

nitrogen: essential element for plant growth

biochemical: related to chemical processes within cells

gene expression: use of a gene to make the protein it encodes

Digestion breaks protein down to amino acids. If amino acids are in excess of the body's biological requirements, they are metabolized to glycogen or fat and subsequently used for energy metabolism. If amino acids are to be used for energy their carbon skeletons are converted to acetyl CoA,

which enters the Krebs cycle for oxidation, producing ATP. The final products of protein catabolism include carbon dioxide, water, ATP, urea, and ammonia.

Vitamin B_6 is involved in the metabolism (especially catabolism) of amino acids, as a cofactor in transamination reactions that transfer the nitrogen from one keto acid (an acid containing a keto group [-CO-] in addition to the acid group) to another. This is the last step in the synthesis of nonessential amino acids and the first step in amino acid catabolism. Transamination converts amino acids to L-glutamate, which undergoes **oxidative deamination** to form ammonia, used for the synthesis of urea. Urea is transferred through the blood to the kidneys and excreted in the urine.

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

deamination: removal of an NH2 group from a molecule

The glucose-alanine cycle is the main pathway by which amino groups from muscle amino acids are transported to the liver for conversion to glucose. The liver is the main site of catabolism for all essential amino acids, except the branched-chain amino acids, which are catabolized mainly by muscle and the kidneys. **Plasma** amino-acid levels are affected by dietary carbohydrate through the action of insulin, which lowers plasma amino-acid levels (particularly the branched-chain amino acids) by promoting their entry into the muscle.

plasma: the fluid portion of the blood, distinct from the cellular portion

Body proteins are broken down when dietary supply of energy is inadequate during illness or prolonged starvation. The proteins in the liver are utilized in preference to those of other tissues such as the brain. The gluconeogenesis pathway is present only in liver cells and in certain kidney cells.

Disorders of amino acid metabolism include **phenylketonuria**, albinism, alkaptonuria, type 1 tyrosinaemia, nonketotic hyperglycinaemia, histidinaemia, homocystinuria, and maple syrup urine disease.

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

Fat (Lipid) Metabolism

Fats contain mostly carbon and hydrogen, some oxygen, and sometimes other atoms. The three main forms of fat found in food are glycerides (principally triacylglycerol [triglyceride], the form in which fat is stored for fuel), the **phospholipids**, and the **sterols** (principally **cholesterol**). Fats provide 9 kilocalories per gram (kcal/g), compared with 4 kcal/g for carbohydrate and protein. Triacylglycerol, whether in the form of chylomicrons (microscopic lipid particles) or other **lipoproteins**, is not taken up directly by any tissue, but must be hydrolyzed outside the cell to **fatty acids** and glycerol, which can then enter the cell.

phospholipid: a type of fat used to build cell membranes

sterol: building blocks of steroid hormones; a type of lipid

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

lipoprotein: blood protein that carry fats

fatty acids: molecules rich in carbon and hydrogen; a component of fats

Fatty acids come from the **diet**, adipocytes (fat cells), carbohydrate, and some amino acids. After digestion, most of the fats are carried in the blood as chylomicrons. The main pathways of lipid metabolism are lipolysis, beta-oxidation, **ketosis**, and lipogenesis.

diet: the total daily food intake, or the types of foods eaten

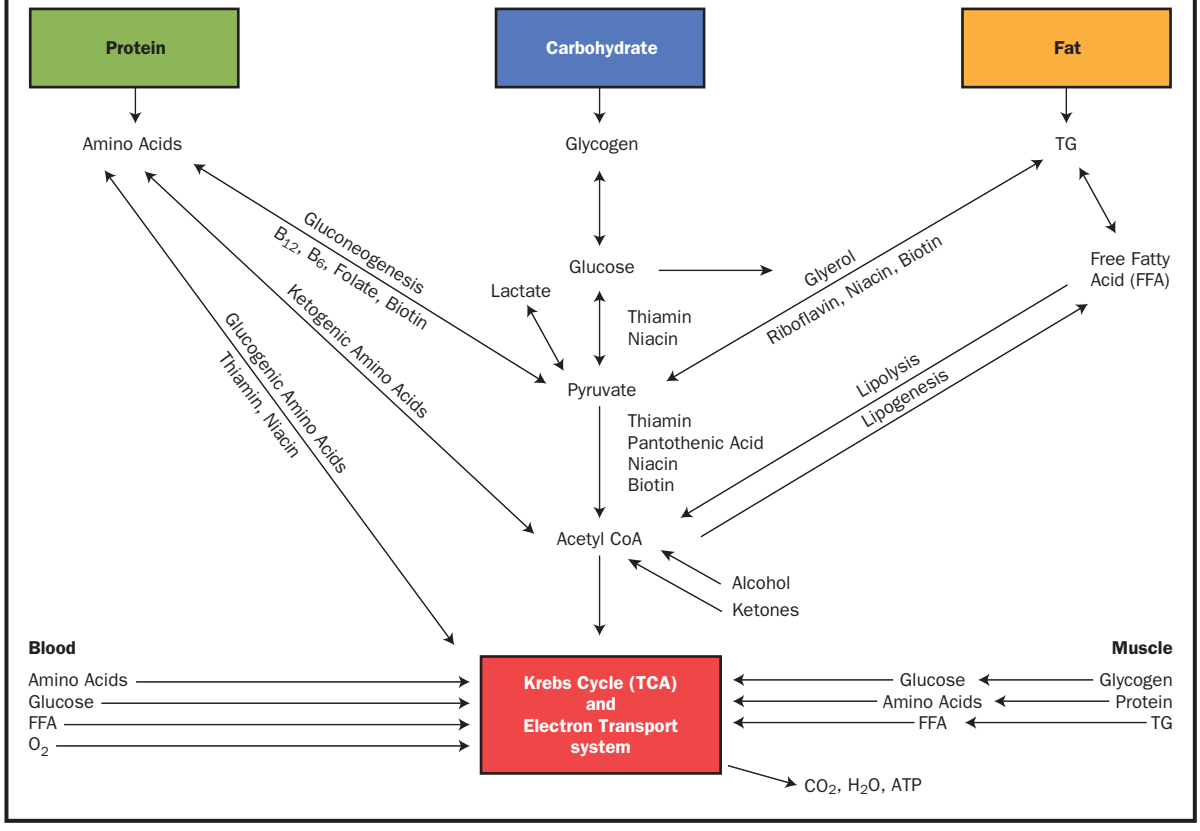
ketosis: build-up of ketone bodies in the blood, due to fat breakdown

Lipolysis (fat breakdown) and beta-oxidation occurs in the mitochondria. It is a cyclical process in which two carbons are removed from the fatty acid per cycle in the form of acetyl CoA, which proceeds through the Krebs cycle to produce ATP, CO_2, and water.

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

Ketosis occurs when the rate of formation of **ketones** by the liver is greater than the ability of tissues to oxidize them. It occurs during prolonged starvation and when large amounts of fat are eaten in the absence of carbohydrate.

INTERRELATIONSHIPS AMONG CARBOHYDRATE, PROTEIN, AND FAT IN HUMAN METABOLISM



Lipogenesis occurs in the cytosol. The main sites of triglyceride synthesis are the liver, adipose tissue, and intestinal mucosa. The fatty acids are derived from the hydrolysis of fats, as well as from the synthesis of acetyl CoA through the oxidation of fats, glucose, and some amino acids. Lipogenesis from acetyl CoA also occurs in steps of two carbon atoms. NADPH produced by the pentose-phosphate shunt is required for this process. Phospholipids form the interior and exterior cell membranes and are essential for cell regulatory signals.

Cholesterol Metabolism

Cholesterol is either obtained from the diet or synthesized in a variety of tissues, including the liver, adrenal cortex, skin, intestine, testes, and aorta. High dietary cholesterol suppresses synthesis in the liver but not in other tissues.

Carbohydrate is converted to triglyceride utilizing glycerol phosphate and acetyl CoA obtained from glycolysis. Ketogenic amino acids, which are metabolized to acetyl CoA, may be used for synthesis of triglycerides. The fatty acids cannot fully prevent protein breakdown, because only the glycerol portion of the triglycerides can contribute to gluconeogenesis. Glycerol is only 5 percent of the triglyceride carbon.

Most of the major tissues (e.g., muscle, liver, kidney) are able to convert glucose, fatty acids, and amino acids to acetyl-CoA. However, brain and

nervous tissue—in the fed state and in the early stages of starvation—depend almost exclusively on glucose. Not all tissues obtain the major part of their ATP requirements from the Krebs cycle. Red blood cells, tissues of the eye, and the kidney medulla gain most of their energy from the anaerobic conversion of glucose to lactate. SEE ALSO CARBOHYDRATES; FATS; NUTRIENTS; PROTEIN.

Gita Patel

Bibliography

Bland, Jeffrey S.; Costarella, L.; Levin, B.; Liska, DeAnn; Lukaczer, D.; Schiltz, B.; and Schmidt, M. A. (1999). *Clinical Nutrition: A Functional Approach*. Gig Harbor, WA: Institute of Functional Medicine.

Linder, Maria (1991). *Nutritional Biochemistry and Metabolism, with Clinical Applications*, 2nd edition. New York: Elsevier.

Newsholme E. A., and Leech, A. R. (1994). *Biochemistry for the Medical Sciences*. New York: Wiley.

Salway, J. G. 1999. *Metabolism at a Glance*, 2nd edition. Malden, MA: Blackwell Science.

Shils, M. E.; Olson, J. A.; Shike, M.; and Ross C. A.; eds. (1999). *Modern Nutrition in Health and Disease*, 9th edition. Baltimore, MD: Wilkins & Wilkins.

Wardlaw, Gordon M., and Kessel Margaret (2002). *Perspectives in Nutrition*, 5th edition. Boston: McGraw-Hill.

Williams, M. H. (1999). *Nutrition for Health, Fitness, and Sport*, 6th edition. Boston: McGraw-Hill.

Yeung, D. L., ed. (1995). *Heinz Handbook of Nutrition*, 8th edition. Pittsburgh, PA: Heinz Corporate Research Center.

Ziegler, Ekhard E., and Filer, L. J. (1996). *Present Knowledge in Nutrition*, 7th edition. Washington, DC: International Life Sciences Institute Press.

Zubay, Geoffrey L.; Parson, William W.; and Vance, Dennis E. (1995). *Principles of Biochemistry*. Dubuque, IA: William C. Brown.

Minerals

mineral: an inorganic (non-carbon-containing) element, ion, or compound

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

metabolic: related to processing of nutrients and building of necessary molecules within the cell

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

trace: very small amount

calcium: mineral essential for bones and teeth

phosphorus: element essential in forming the mineral portion of bone

Minerals are inorganic elements that originate in the earth and cannot be made in the body. They play important roles in various bodily functions and are necessary to sustain life and maintain optimal health, and thus are essential **nutrients**. Most of the minerals in the human **diet** come directly from plants and water, or indirectly from animal foods. However, the mineral content of water and plant foods varies geographically because of variations in the mineral content of soil from region to region.

The amount of minerals present in the body, and their **metabolic** roles, varies considerably. Minerals provide structure to bones and teeth and participate in **energy** production, the building of **protein**, blood formation, and several other metabolic processes. Minerals are categorized into major and **trace** minerals, depending on the amount needed per day. Major minerals are those that are required in the amounts of 100 mg (milligrams) or more, while trace minerals are required in amounts less than 100 mg per day. The terms *major* and *trace*, however, do not reflect the importance of a mineral in maintaining health, as a deficiency of either can be harmful.

Some body processes require several minerals to work together. For example, **calcium**, magnesium, and **phosphorus** are all important for the formation and maintenance of healthy bones. Some minerals compete with

each other for **absorption**, and they interact with other nutrients as well, which can affect their **bioavailability**.

absorption: uptake by the digestive tract

bioavailability: availability to living organisms, based on chemical form

Mineral Bioavailability

The degree to which the amount of an ingested nutrient is absorbed and available to the body is called bioavailability. Mineral bioavailability depends on several factors. Higher absorption occurs among individuals who are deficient in a mineral, while some elements in the diet (e.g., oxalic acid or oxalate in spinach) can decrease mineral availability by chemically binding to the mineral. In addition, excess intake of one mineral can influence the absorption and **metabolism** of other minerals. For example, the presence of a large amount of **zinc** in the diet decreases the absorption of **iron** and copper. On the other hand, the presence of **vitamins** in a meal enhances the absorption of minerals in the meal. For example, vitamin C improves iron absorption, and **vitamin D** aids in the absorption of calcium, phosphorous, and magnesium.

metabolism: the sum total of reactions in a cell or an organism

zinc: mineral necessary for many enzyme processes

iron: nutrient needed for red blood cell formation

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

In general, minerals from animal sources are absorbed better than those from plant sources as minerals are present in forms that are readily absorbed and binders that inhibit absorption, such as **phytates**, are absent. **Vegans** (those who restrict their diets to plant foods) need to be aware of the factors affecting mineral bioavailability. Careful meal planning is necessary to include foods rich in minerals and absorption-enhancing factors.

phytate: plant compound that binds minerals, reducing their ability to be absorbed

vegan: person who consume no animal products, including milk and honey

Supplementation

It is generally recommended that people eat a well-balanced diet to meet their mineral requirements, while avoiding deficiencies and chemical excesses or imbalances. However, supplements may be useful to meet dietary requirements for some minerals when dietary patterns fall short of **Recommended Dietary Allowances** (RDAs) or **Adequate Intakes** (AIs) for normal healthy people.

Recommended Dietary Allowances: nutrient intake recommended to promote health

adequate intake: nutrient intake that appears to maintain the state of health

The Food and Nutrition Board currently recommends that supplements or **fortified** foods be used to obtain desirable amounts of some nutrients, such as calcium and iron. The recommendations for calcium are higher than the average intake in the United States. Women, who generally consume lower energy diets than men, and individuals who do not consume dairy products can particularly benefit from calcium supplements. Because of the increased need for iron in women of childbearing age, as well as the many negative consequences of iron-deficiency **anemia**, iron supplementation is recommended for vulnerable groups in the United States, as well as in developing countries.

fortified: altered by addition of vitamins or minerals

anemia: low level of red blood cells in the blood

Mineral supplementation may also be appropriate for people with prolonged illnesses or extensive injuries, for those undergoing surgery, or for those being treated for alcoholism. However, extra caution must be taken to avoid intakes greater than the RDA or AI for specific nutrients because of problems related to nutrient excesses, imbalances, or adverse interactions with medical treatments. Although toxic symptoms or adverse effects from excess supplementation have been reported for various minerals (e.g., calcium, magnesium, iron, zinc, copper, and selenium) and tolerable upper limits set, the amounts of nutrients in supplements are not regulated by the

Excesses of certain minerals can prevent the absorption of others, which is one reason that eating a balanced diet is superior to depending on mineral supplements. With the possible exception of iron and calcium, mineral deficiences are rare among healthy people in developed nations. *[AP/Wide World Photos. Reproduced by permission.]*

Food and Drug Administration (FDA). Therefore, supplement users must be aware of the potential adverse effects and choose supplements with moderate amounts of nutrients.

Major Minerals

The major minerals present in the body include sodium, potassium, chloride, calcium, magnesium, phosphorus, and sulfur.

Functions.

The fluid balance in the body, vital for all life processes, is maintained largely by sodium, potassium, and chloride. Fluid balance is regulated by charged sodium and chloride ions in the extracellular fluid (outside the cell) and potassium in the intracellular fluid (inside the cell), and by some other **electrolytes** across cell membranes. Tight control is critical for normal muscle contraction, nerve impulse transmission, heart function, and **blood pressure**. Sodium plays an important role in the absorption of other nutrients, such as **glucose**, **amino acids**, and water. Chloride is a component of hydrochloric acid, an important part of **gastric** juice (an acidic liquid secreted by glands in the stomach lining) and aids in food digestion. Potassium and sodium act as cofactors for certain **enzymes**.

Calcium, magnesium, and phosphorus are known for their structural roles, as they are essential for the development and maintenance of bones and teeth. They are also needed for maintaining cell membranes and connective tissue. Several enzymes, **hormones**, and proteins that regulate energy and **fat** metabolism require calcium, magnesium and/or phosphorus to become active. Calcium also aids in **blood clotting**. Sulfur is a key component of various proteins and vitamins and participates in drug-detoxifying pathways in the body.

Disease prevention and treatment.

Sodium, chloride, and potassium are linked to **high blood pressure** (**hypertension**) due to their role in the body's fluid balance. High salt or sodium chloride intake has been linked to **cardiovascular** disease as well. High potassium intakes, on the other hand, have been associated with a lower risk of **stroke**, particularly in people with

electrolyte: salt dissolved in fluid

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

glucose: a simple sugar; the most commonly used fuel in cells

amino acid: building block of proteins, necessary dietary nutrient

gastric: related to the stomach

enzyme: protein responsible for carrying out reactions in a cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

fat: type of food molecule rich in carbon and hydrogen, with high energy content

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

hypertension: high blood pressure

cardiovascular: related to the heart and circulatory system

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

hypertension. Research also suggests a preventive role for magnesium in hypertension and cardiovascular disease, as well as a beneficial effect in the treatment of **diabetes**, **osteoporosis**, and migraine headaches.

diabetes: inability to regulate level of sugar in the blood

osteoporosis: weakening of the bone structure

Osteoporosis is a bone disorder in which bone strength is compromised, leading to an increased risk of fracture. Along with other lifestyle factors, intake of calcium and vitamin D plays an important role in the maintenance of bone health and the prevention and treatment of osteoporosis. Good calcium nutrition, along with low salt and high potassium intake, has been linked to prevention of hypertension and **kidney stones**.

kidney stones: deposits of solid material in kidney

Deficiency. Dietary deficiency is unlikely for most major minerals, except in starving people or those with protein-energy **malnutrition** in developing countries, or people on poor diets for an extended period, such as those suffering from alcoholism, **anorexia nervosa**, or **bulimia**. Most people in the world consume a lot of salt, and it is recommended that they moderate their intake to prevent **chronic** diseases (high salt intake has been associated with an increased risk of death from stroke and cardiovascular disease). However, certain conditions, such as severe or prolonged vomiting or diarrhea, the use of **diuretics**, and some forms of kidney disease, lead to an increased loss of minerals, particularly sodium, chloride, potassium, and magnesium. Calcium intakes tend to be lower in women and vegans who do not consume dairy products. Elderly people with suboptimal diets are also at risk of mineral deficiencies because of decreased absorption and increased excretion of minerals in the urine.

malnutrition: chronic lack of sufficient nutrients to maintain health

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

chronic: over a long period

diuretic: substance that depletes the body of water

Toxicity. Toxicity from excessive dietary intake of major minerals rarely occurs in healthy individuals. Kidneys that are functioning normally can regulate mineral concentrations in the body by excreting the excess amounts in urine. Toxicity symptoms from excess intakes are more likely to appear with **acute** or chronic kidney failure.

acute: rapid-onset and short-lived

Sodium and chloride toxicity can develop due to low intake or excess loss of water. Accumulation of excess potassium in **plasma** may result from the use of potassium-sparing diuretics (medications used to treat high blood pressure, which increase urine production, excreting sodium but not potassium), insufficient aldosterone secretion (a hormone that acts on the kidney to decrease sodium secretion and increase potassium secretion), or tissue damage (e.g., from severe burns). Magnesium intake from foods has no adverse effects, but a high intake from supplements when kidney function is limited increases the risk of toxicity. The most serious complication of potassium or magnesium toxicity is cardiac arrest. Adverse effects from excess calcium have been reported only with consumption of large quantities of supplements. Phosphate toxicity can occur due to absorption from phosphate salts taken by mouth or in **enemas**.

plasma: the fluid portion of the blood, distinct from the cellular portion

enema: substance delivered via the rectum

Trace Minerals

Trace minerals are present (and required) in very small amounts in the body. An understanding of the important roles and requirements of trace minerals in the human body is fairly recent, and research is still ongoing. The most important trace minerals are iron, zinc, copper, chromium, fluoride, iodine, selenium, manganese, and molybdenum. Some others, such as arsenic, boron, cobalt, nickel, silicon, and vanadium, are recognized as essential for

some animals, while others, such as barium, bromine, cadmium, gold, silver, and aluminum, are found in the body, though little is known about their role in health.

biological: related to living organisms

Functions. Trace minerals have specific **biological** functions. They are essential in the absorption and utilization of many nutrients and aid enzymes and hormones in activities that are vital to life. Iron plays a major role in **oxygen** transport and storage and is a component of **hemoglobin** in red blood cells and **myoglobin** in muscle cells. Cellular energy production requires many trace minerals, including iron, copper, and zinc, which act as enzyme cofactors in the synthesis of many proteins, hormones, **neurotransmitters**, and **genetic** material.

oxygen: O_2, atmospheric gas required by all animals

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

myoglobin: oxygen storage protein in muscle

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

genetic: inherited or related to the genes

Iron and zinc support immune function, while chromium and zinc aid **insulin** action. Zinc is also essential for many other bodily functions, such as growth, development of sexual organs, and reproduction. Zinc, copper and selenium prevent **oxidative** damage to cells. Fluoride stabilizes bone mineral and hardens tooth enamel, thus increasing resistance to tooth decay. Iodine is essential for normal thyroid function, which is critical for many aspects of growth and development, particularly brain development. Thus, trace minerals contribute to physical growth and mental development.

insulin: hormone released by the pancreas to regulate level of sugar in the blood

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

Role in disease prevention and treatment. In addition to clinical deficiency diseases such as anemia and goiter, research indicates that trace minerals play a role in the development, prevention, and treatment of chronic diseases. A marginal status of several trace minerals has been found to be associated with **infectious diseases**, disorders of the stomach, intestine, bone, heart, and liver, and **cancer**, although further research is necessary in many cases to understand the effect of supplementation. Iron, zinc, copper, and selenium have been associated with immune response conditions. Copper, chromium and selenium have been linked to the prevention of cardiovascular disease. Excess iron in the body, on the other hand, can increase the risk of cardiovascular disease, liver and colorectal cancer, and neurodegenerative diseases such as Alzheimer's disease. Chromium supplementation has been found to be beneficial in many studies of impaired glucose tolerance, a metabolic state between normal glucose regulation and diabetes. Fluoride has been known to prevent dental **caries** and osteoporosis, while potassium iodide supplements taken immediately before or after exposure to radiation can decrease the risk of radiation-induced thyroid cancer.

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

cancer: uncontrolled cell growth

caries: cavities in the teeth

Deficiency. With the exception of iron, dietary deficiencies are rare in the United States and other developed nations. However, malnutrition in developing countries increases the risk for trace-mineral deficiencies among children and other vulnerable groups. In overzealous supplement users, interactions among nutrients can inhibit absorption of some minerals leading to deficiencies. Patients on **intravenous** feedings without mineral supplements are at risk of developing deficiencies as well.

intravenous: into the veins

Although severe deficiencies of better-understood trace minerals are easy to recognize, diagnosis is difficult for less-understood minerals and for mild deficiencies. Even mild deficiencies of trace minerals however, can result in poor growth and development in children.

Iron deficiency is the most common nutrient deficiency worldwide, including in the United States. Iron-deficiency anemia affects hundreds of mil-

lions of people, with highest **prevalence** in developing countries. Infants, young children, adolescents, and pregnant and lactating women are especially vulnerable due to their high demand for iron. Menstruating women are also vulnerable due to blood loss. Vegetarians are another vulnerable group, as iron from plant foods is less bioavailable than that from animal sources.

prevalence: describing the number of cases in a population at any one time

Zinc deficiency, marked by severe growth retardation and arrested sexual development, was first reported in children and adolescent boys in Egypt, Iran, and Turkey. Diets in Middle Eastern countries are typically high in **fiber** and phytates, which inhibit zinc absorption. Mild zinc deficiency has been found in vulnerable groups in the United States. Copper deficiency is rare, but can be caused by excess zinc from supplementation.

fiber: indigestible plant material which aids digestion by providing bulk

Deficiencies of fluoride, iodine, and selenium mainly occur due to a low mineral content in either the water or soil in some areas of the world. Fluoride deficiency is marked by a high prevalence of dental caries and is common in geographic regions with low water-fluoride concentration, which has led to the fluoridation of water in the United States and many other parts of the world. Goiter and **cretinism** (a condition in which body growth and mental development are stunted) have been eliminated by iodization of salt in the United States, but still occur in parts of the world where salt manufacture and distribution are not regulated. Selenium deficiency due to low levels of the mineral in soil is found in northeast China, and it has been associated with Keshan disease, a heart disorder prevalent among people of that area.

cretinism: arrested mental and physical development

Toxicity. Trace minerals can be toxic at higher intakes, especially for those minerals whose absorption is not regulated in the body (e.g., selenium and iodine). Thus, it is important not to habitually exceed the recommended intake levels. Although toxicity from dietary sources is unlikely, certain genetic disorders can make people vulnerable to overloads from food or supplements. One such disorder, hereditary hemochromatosis, is characterized by iron deposition in the liver and other tissues due to increased intestinal iron absorption over many years.

Chronic exposure to trace minerals through cooking or storage containers can result in overloads of iron, zinc, and copper. Fluorosis, a discoloration of the teeth, has been reported in regions where the natural content of fluoride in drinking water is high. Inhalation of manganese dust over long periods of time has been found to cause brain damage among miners and steelworkers in many parts of the world.

In summary, minerals, both major and trace, play vital roles in human health, and care must be taken to obtain adequate intakes from a wide variety of whole foods. The most common result of deficiencies is poor growth and development in children. Minerals interact with each other and with other nutrients, and caution is required when using supplements, as excess intake of one mineral can lead to the deficiency of another nutrient. SEE ALSO ANEMIA; BIOAVAILABILITY; CALCIUM; DIETARY SUPPLEMENTS; OSTEOPOROSIS; VITAMINS, FAT-SOLUBLE; VITAMINS, WATER-SOLUBLE.

Sunitha Jasti

Bibliography

Wardlaw, Gordon M. (1999). *Perspectives in Nutrition*, 4th edition. Boston: WCB McGraw-Hill.

Whitney, Eleanor N., and Rolfes, Sharon R. (1996). *Understanding Nutrition*, 7th edition. New York: West Publishing.

Internet Resources

The American Dietetic Association (2002). "Position of The American Dietetic Association: Food Fortification and Dietary Supplements." Available from <http://www.eatright.com>

The Linus Pauling Institute. "Minerals." Available from <http://osu.orst.edu/dept/lpi>

United States Department of Agriculture (2002). "Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA)." Available from <http://www.nal.usda.gov/fnic/>

Mood-Food Relationships

Research on the connection between a person's mood and the food he or she eats has reveled what many people have long believed, that eating a certain food can influence a person's mood—at least temporarily. Research by Judith Wurtman, a professor at the Massachusetts Institute of Technology (MIT), has focused on how certain foods alter one's mood by influencing the level of certain brain chemicals called **neurotransmitters**. While many other factors influence the level of these chemicals, such as **hormones**, heredity, **drugs**, and alcohol, three neurotransmitters—dopamine, norepinephrine, and **serotonin**—have been studied in relation to food, and this research has shown that neurotransmitters are produced in the brain from components of certain foods.

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

hormone: molecules produced by one set of cells that influence the function of another set of cells

drugs: substances whose administration causes a significant change in the body's function

serotonin: chemical used by nerve cells to communicate with one another

anxiety: nervousness

Effects of Neurotransmitters

Wurtman has reported that people are more alert when their brains are producing the neurotransmitters dopamine and norepinephrine, while serotonin production in the brain has been associated with a more calming, **anxiety**-reducing effect (and even drowsiness in some people). A stable brain serotonin level is associated with a positive mood state. It appears that women have a greater sensitivity than men to changes in this brain chemical. Mood swings during the menstrual cycle and **menopause** are thought to be caused by hormonal changes that influence the production of serotonin.

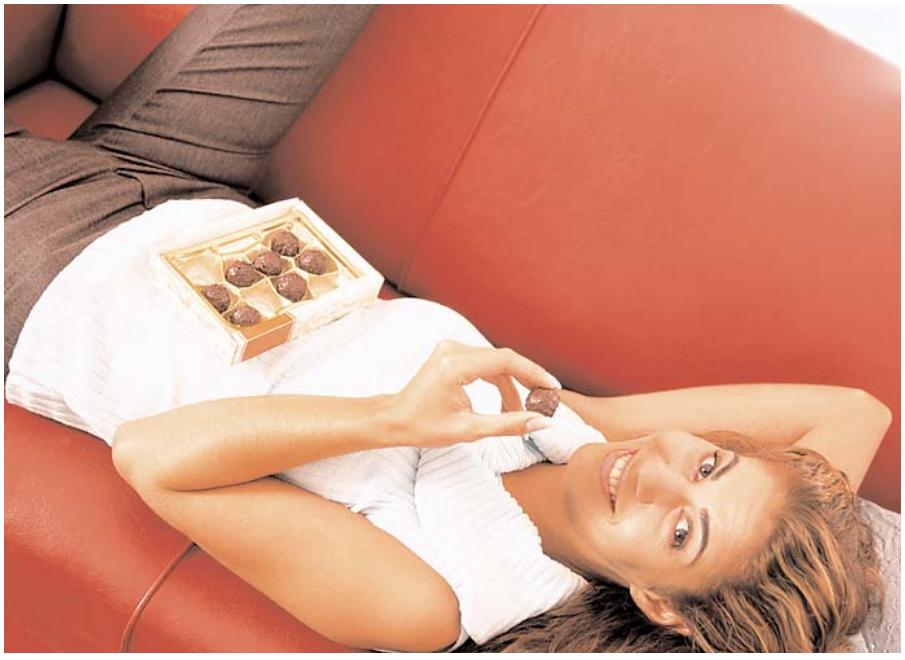
menopause: phase in a woman's life during which ovulation and menstruation end

diet: the total daily food intake, or the types of foods eaten

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

How does **diet** play a role? The foods that increase the production of serotonin in the brain are high in **carbohydrates**. Many kinds of foods carbohydrates, such as candy, cereal, and pasta, can produce a temporary increase in brain serotonin—and a subsequent calming or anxiety-reducing effect. This explains why people may feel drowsy in the afternoon after eating a large meal of pasta, since a rise in serotonin in the brain can also lead to drowsiness. Carbohydrates affect brain serotonin because they increase the amount of tryptophan in the brain. Tryptophan is the amino-acid precursor of serotonin.

The two other important brain chemicals that appear to be influenced by foods, dopamine and norepinephrine, produce a feeling of alertness, an increased ability to concentrate, and faster reaction times. There are two possible mechanisms for how this happens: (1) serotonin production is blocked by the consumption of protein-rich foods, resulting in increased alertness or concentration, or (2) levels of dopamine and norepinephrine are increased by the consumption of protein-rich foods.



Chocolate consumption stimulates the release of serotonin and endorphin into the body, which combine to produce a relaxed or euphoric feeling. This may explain why some people crave chocolate when they're feeling depressed. *[Royalty-Free/Corbis. Reproduced by permission.]*

The food-mood response is short term. Eating tuna at lunch may increase alertness and concentration for two to three hours after eating, just as having pasta with tomato sauce will produce a calming response for two to three hours. Someday, there may be menus that offer foods for their intended mood effects. Such a menu might have selections such as "Smart Soup," "Happy Hamburger," "Serene Salad," or "Sleepy Spaghetti."

Size of Meal

Another factor that influences alertness and performance is the size of a meal. Large lunches containing 1,000 **calories** have been associated with decreased performance in the afternoon. Such high-calorie lunches tend to be high in **fat**. A lunch consisting of a double hamburger, french fries, and a shake would fit into this category. The size of a meal makes a difference because fat slows down **absorption**, and because blood flow to the stomach is increased for a longer period of time, resulting in less blood flow to the brain. The result is to feel sleepy and sluggish.

calorie: unit of food energy

fat: type of food molecule rich in carbon and hydrogen, with high energy content

absorption: uptake by the digestive tract

Circadian Rhythms

Circadian rhythms also affect eating and performance. These rhythms influence when individuals are more active, and when they are more likely to be sleepy. Research indicates there are different eating patterns for individuals with different rhythms. These eating patterns can enhance **energy** levels and performance. For example, "morning people" are usually at their best and most focused during the early hours of the day. Although breakfast is important, what foods these people eat becomes more important at lunch and throughout the afternoon. The energy level of a morning person begins to drop during the afternoon, and evening is their least alert and productive time. Thus, what they choose to eat at lunch and for snacks can make a difference in how they feel later in the day.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

DIET-MOOD CONNECTION

Nutrient	Food sources	Neurotransmitter/ mechanism	Proposed effect
Protein	Meat, Milk, Eggs, Cheese, Fish, Beans	Dopamine, Norepinephrine	Increased alertness, concentration
Carbohydrate (CHO)	Grains, Fruits, Sugars	Serotonin	Increased calmness, relaxation
Calories	All Foods	Reduced blood flow to the brain	Excess calories in a meal is associated with decreased alertness and concentration after the meal

amino acid: building block of proteins, necessary dietary nutrient

chronic: over a long period

acupuncture: insertion of needles into the skin at special points to treat disease

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

Are You a Night Owl or an Early Bird?

Early Bird Traits

- Wakes up before the alarm goes off
- More energetic and productive during the morning
- Often up before daylight working on projects
- Energetic and alert during evening hours
- Typical bedtime around would be 9:00 to 10:00 p.m.

Night Owl Traits

- Only wakes up in the morning if the alarm is going off
- Ideal workday would begin at noon
- It takes several cups of coffee to function in the morning
- Most productive and alert in the afternoon and evening
- Typical bedtime would be after the late night news

Morning people need their protein-rich foods during the afternoon and evening, particularly if they need to be focused later in the day for a meeting or some other work requiring attention to detail. Instead of a lunch of pasta with marinara sauce, for example, morning people would be more alert in the afternoon if they added some grilled chicken, seafood, or other protein source to their pasta dish, thus increasing their levels of dopamine and norepinephrine.

Many people who are "evening persons," or "night owls," must nevertheless be at work at 9 a.m. For these people it is important not only to have breakfast, but to make sure that protein-rich food is part of the breakfast. Protein provides the brain with tyrosine, an **amino acid** that is a precursor of the chemicals that promote alertness. A mid-morning snack is another good time to include a protein-rich food, such as cheese or yogurt.

Positive Moods and Stress Reduction

Another group of chemicals that can influence mood and appetite are the endorphins. These are the body's natural opiate-like chemicals that produce a positive mood state, decreased pain sensitivity, and reduced stress. Endorphins are released when a person is in pain, during starvation, and during exercise—resulting in what is known as a "runner's high." Researchers are now looking at ways to utilize this response to alleviate **chronic** pain. Studies have shown that **acupuncture** may relieve pain by stimulating the release of endorphins.

A food substance related to endorphins is phenylethylamine, which is found in chocolate. Chocolate has always been a highly valued commodity in many cultures, and there is some evidence that chocolate may improve mood temporarily due to its high levels of sugar and fat, phenylethylamine, and caffeine. The sugar in chocolate is associated with a release of the neurotransmitter serotonin, and the fat and phenylethylamine are associated with an endorphin release. This combination produces an effect that has been called "optimal brain happiness." The caffeine in chocolate adds a temporary stimulant effect.

If changing one's diet does not produce a desired improvement in mood, or if feelings of sadness or disinterest occur much of the time, it is important to be evaluated for **depression**. In people who are depressed, brain serotonin levels are significantly lowered, and treatment usually involves a

medication that can elevate serotonin levels to the normal range. Although food can provide a temporary lift, it does not provide enough serotonin to alleviate depression or changes in neurotransmitters associated with eating disorders.

Research on the food-mood connection has been aimed at understanding the effects of eating particular foods during particular mood states, as well as how foods can help to achieve a particular mood state. Future research will focus on the application of this research, such as to what degree food choices can influence worker productivity or affect circadian rhythm in cases of jet lag or lack of sleep. SEE ALSO ADDICTION, FOOD; CRAVINGS; EATING HABITS.

Catherine Christie

Bibliography

Mitchell, Susan, and Christie, Catherine (1998). *I'd Kill for a Cookie*. New York: Dutton.

Wurtman, J. (1989) "Carbohydrate Craving, Mood Changes, and Obesity." *Journal of Clinical Psychiatry* 49 (Suppl.) 37–39.

Wurtman, R. J., et. al. (1986) "Carbohydrate Cravings, Obesity and Brain Serotonin." *Appetite* 7 (Suppl.): 99–103.

Wurtman, R. J., and J. J. Wurtman (1989) "Carbohydrates and Depression." *Scientific American* (January): 68–75.

National Academy of Sciences (NAS)

N

The National Academy of Sciences is a private agency that advises the federal government on scientific and technical matters. It is part of the National Academy, which also includes the National Academy of Engineering, the Institute of Medicine, and the National Research Council.

The NAS updates and publishes the **Recommended Dietary Allowances** (RDAs), which "represent the **nutrient** intake that is sufficient to meet the needs of nearly all healthy people in an age and gender group" (Wardlaw). More specific recommendations are needed for special populations, such as pregnant women, the elderly population, and those with medical conditions.

Recommended Dietary Allowances: nutrient intake recommended to promote health

nutrient: dietary substance necessary for health

In addition, since all nutrients and food components do not have established RDAs, **Dietary Reference Intakes** (DRIs) were developed as a guide to adequate and safe standards for nutrients such as **fiber**, **antioxidants**, and **trace** elements, and for upper level intakes of **vitamins** and **minerals**. SEE ALSO DIETARY REFERENCE INTAKE; RECOMMENDED DIETARY ALLOWANCES.

Dietary Reference Intakes: set of guidelines for nutrient intake

fiber: indigestible plant material which aids digestion by providing bulk

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

trace: very small amount

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion, or compound

Pauline A. Vickery

Bibliography

Wardlaw, Gordon M. (2000). *Contemporary Nutrition: Issues and Insights*, 4th edition. Boston: McGraw-Hill.

Whitney, E.; Catlado, C.; DeBruyne, L.; and Rolfe, S. (1996). *Nutrition for Health and Health Care*. Minneapolis, MN: West Publishing.

Williams, Sue R. (1993). *Nutrition and Diet Therapy*, 7th edition. St. Louis, MO: Mosby.

National Health and Nutrition Examination Survey (NHANES)

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

prevalence: describing the number of cases in a population at any one time

obesity: the condition of being overweight, according to established norms based on sex, age, and height

osteoporosis: weakening of the bone structure

In the year 1999, 64 percent of the U.S. population was **overweight** or **obese**, while the **prevalence** of **obesity** among children and adolescents more than doubled during the previous two decades. Fifty-six percent of women over the age of fifty had low bone density, and 16 percent were suffering from the debilitating disease of **osteoporosis**. And while smoking prevalence hit an all-time low among adults, it has continued to increase among America's youth.

Statistics like these sell newspapers, inspire public-policy initiatives, and provide topics for classroom discussions. But where do these statistics come from? How can scientists determine the percentage of the *entire* U.S. population that suffers from conditions such as obesity and osteoporosis or engage in unhealthy habits such as smoking?

nutrition: the maintenance of health through proper eating, or the study of same

clinical: related to hospitals, clinics, and patient care

cardiovascular: related to the heart and circulatory system

diabetes: inability to regulate level of sugar in the blood

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

Statistics such as those listed above, along with a whole host of other health and **nutrition** data, are derived from the National Health and Nutrition Examination Survey, or NHANES. NHANES is arguably the largest and longest-running national source of objectively measured health *and* nutrition data. Through physical examinations, **clinical** and laboratory tests, and personal interviews, NHANES provides a "snapshot" of the health and nutritional status of the U.S. population. Findings from NHANES provide health professionals and policymakers with the statistical data needed to determine rates of major diseases and health conditions (e.g., **cardiovascular** disease, **diabetes**, obesity, **infectious diseases**) as well as identify and monitor trends in medical conditions, risk factors, and emerging public health issues, so that the appropriate public health policies and prevention interventions can be developed.

History of NHANES

The current NHANES was born out of The National Health Survey Act of 1956. This particular piece of legislation provided for the establishment of a continuing National Health Survey to obtain information about the health status of individuals residing in the United States, including the services received for or because of health conditions. The responsibility for survey development and data collection was placed upon the National Center for Health Statistics (NCHS), a research-oriented statistical organization housed within the Health Services and Mental Health Administration (HSMHA) of the Department of Health, Education, and Welfare (now the Department of Health and Human Services). Since its inception in 1959, eight separate Health Examination Surveys have been conducted and over 130,000 people have served as survey participants.

chronic: over a long period

The first three National Health Surveys—National Health Examination Survey (NHES) I, II, and III—were conducted between 1959 and 1970, each with an approximate sample size of 7,500 individuals. NHES I (1959–1962) focused on selected **chronic** diseases of adults between 18 and 79 years of age, while NHES II (1963–1965) and NHES III (1966–1970) focused on the growth and development of children (6–11 years of age) and adolescents (12–17 years of age), respectively.

Between the passage of the 1956 Act and the completion of NHES III, numerous nutrition-related studies were conducted that indicated that **malnutrition** remained a significant problem within certain segments of the U.S. population. This data, along with increasing scientific evidence linking dietary habits and risk for disease, prompted the Department of Health, Education, and Welfare to establish a continuing National Nutrition Surveillance System in 1969 (under the authority of the 1956 act) for the purposes of measuring the nutritional status of the U.S. population and monitoring the changes over time. Rather than conduct two separate surveys, which would require two separate samples and numerous additional hours of work, it was decided that the National Nutrition Surveillance System would be combined with the National Health Examination Survey, thereby forming the National Health and Nutrition Examination Survey, or NHANES.

malnutrition: chronic lack of sufficient nutrients to maintain health

Five NHANES have been conducted since 1970. NHANES I, the first cycle of the NHANES studies, was conducted between 1971 and 1975 and included a national sample of approximately 30,000 individuals between one and seventy-four years of age. Extensive dietary intake and nutritional status were collected by interview, physical examination, and a battery of clinical tests and measurements. NHANES II (1976–1980) included just slightly over 25,000 participants and expanded the age of the first NHANES sample somewhat by including individuals as young as 6 months of age. In addition, children and adults living at or below the poverty level were sampled at higher rates than their proportions in the general population ("oversampled") because these individuals were thought to be at particular nutritional risk.

While NHANES I and II provided extensive data regarding the health and nutritional status of the general U.S. population, it was somewhat biased against other ethnic groups residing in the United States, particularly Hispanics, whose numbers had been steadily increasing since data collection began in the 1960s. Thus, a Health and Nutrition Surveillance Survey specifically targeting the three largest Hispanic subgroups in the United States—Mexican Americans, Cuban Americans, and Puerto Ricans—was conducted between 1982 and 1984. The Hispanic Health and Nutrition Examination Survey (HHANES) was similar in design (i.e., similar instrumentation and data collection procedures) to the first two cycles of NHANES and included 16,000 individuals residing in regions across the United States with large Hispanic populations.

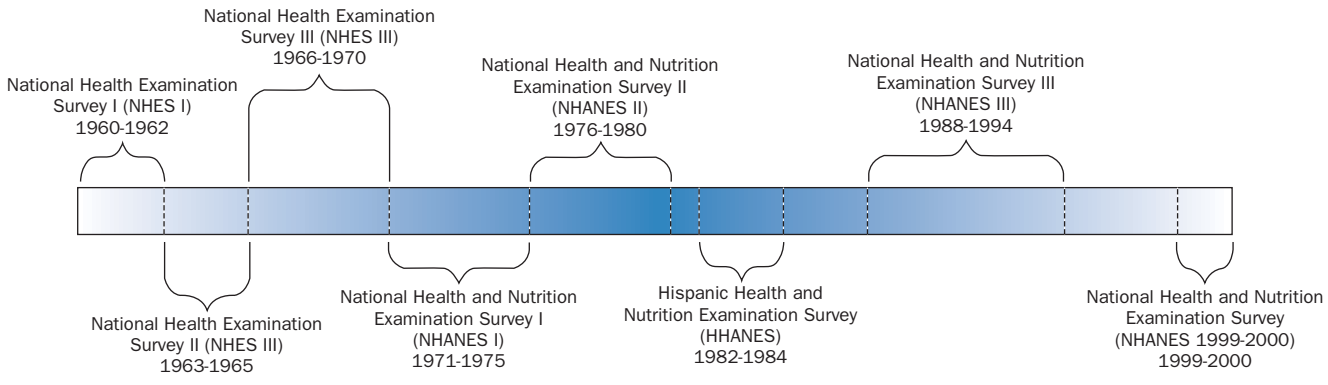
NHANES III (1988–1994) included a total of 40,000 individuals and expanded the age range even further than previous NHANES by including infants as young as two months of age, with no upper age limit on adults. In addition, to ensure the representativeness of both ethnicity and age, African Americans, Mexican Americans, infants, children, and those over sixty years old were oversampled. NHANES III also placed a greater emphasis on the effects of **environment** on health than either of the two previous NHANES (I and II). For example, data were gathered examining the levels of pesticide exposure, and the presence of carbon monoxide and various "**trace** elements" in the blood.

environment: surroundings

trace: very small amount

Beginning in 1999, NHANES became a "continuous survey." That is, unlike the previous NHANES surveys, which were conducted over a period of approximately four years with a "break" of at least one year between survey periods, the 1999–2000 survey was (and all subsequent surveys will be)

NHANES TIMELINE



conducted without breaks, on a yearly basis. As the survey period is shorter in length, the subject sample will be smaller. The 1999–2000 survey included nutritional and medical data on approximately 8,837 individuals up to 74 years of age.

Procedures: How is NHANES Data Collected?

When NHES was originally conceived, it was determined that data would come from three primary sources:

1. Direct Interview: directly interviewing the survey participant and those within their household about their health.
2. Direct Examination: conducting clinical tests, **anthropometric**, **biochemical**, and radiological measurements, and physical examinations.
3. Physician Inquiry/Medical Records: reviewing participant's medical record.

anthropometric: related to measurement of characteristics of the human body

biochemical: related to chemical processes within cells

In current practice, however, NHANES data are derived primarily from the first two sources; that is, via direct interview and direct clinical examination.

The NHANES data collection procedures have changed slightly over the years. These changes reflect not only the changing demographics of the United States over time, but also the changing nature of the survey (e.g., the inclusion of the nutrition component, the interest in the effects of environment upon health). Nonetheless, the basic tenets of data collection, particularly with regards to sampling, are similar.

Sampling. The goal of NHANES is to obtain a nationally "representative" yet manageable sample of noninstitutionalized persons residing in the United States. To achieve this goal, a nationwide probability sample of the population is selected via a complex series of statistical techniques. In very basic terms, the country is divided into geographic areas, also known as "primary sampling units" (PSUs). The PSUs are then combined to form strata, and each strata is then divided into a series of neighborhoods. Households are chosen at random from these neighborhoods, and inhabitants of those households are interviewed to determine if they are eligible for participation in the survey. Theoretically, each selected survey participant represents approximately 50,000 other U.S. residents.

Data Collection Procedures. Once a household has been identified, a trained interviewer conducts an initial in-home interview with the potential survey participant to determine his or her study eligibility. Eligibility is determined by the collective responses to two in-depth questionnaires (the NHANES *Household Adult (or Youth) Questionnaire* and the *Family Questionnaire)* and from a series of **blood pressure** measurements. If the potential participant is deemed eligible for the study, an appointment is scheduled at a mobile examination center for the complete battery of medical and nutritional tests and measurements. The mobile examination centers (MEC) consist of four large trailers that contain all of the diagnostic equipment and personnel necessary to conduct a wide range of both simple and complex physical and biochemical evaluations. Four types of data collection methods are employed in the MEC:

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

1. A physical examination (including body measurements, a variety of X-rays, audiometry, electrocardiography, bone densitometry, allergy testing, and spirometry.
2. A dental examination.
3. Specimen collection (for hematological and urinary analysis).
4. Personal interview (to collect nutrition-related information; data on sensitive subjects such as tobacco use among youngsters, sexual experience, and **depression**; and tests of cognitive development and learning achievement).

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

The nutritional assessment component of NHANES was designed to include a variety of data sources, including:

- Dietary Intake Interviews: Quantitative and qualitative dietary information is collected using a 24-hour recall and food frequency questionnaire (FFQ).
- Nutrition-Related Interview: Information that is not sufficiently obtained via the dietary intake interview is included in this interview (e.g., water intake, vitamin and mineral supplementation, meal and snack patterns, infant feeding practices, alcohol intake, and food sufficiency).
- Anthropometric Data: Height, body weight, body composition, and various body circumferences are measured in order to determine body weight-fat distribution.
- Hematological and Nutritional Biochemistries: Blood lipid levels, blood **glucose** levels, vitamin and mineral status measures (e.g., **iron**, **calcium**, sodium, potassium, chloride, **folate**, **vitamins** such as B_{12}, A, and E), and **protein** status (total protein, albumin, and creatinine) are determined.
- Nutrition-Related Clinical Assessments: A combination of the above methodologies are used to assess risk for chronic diseases such as cardiovascular disease, diabetes, osteoporosis, and gallbladder disease.

glucose: a simple sugar; the most commonly used fuel in cells

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

folate: one of the B vitamins, also called folic acid

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Results: What Have We Learned from NHANES?

NHANES is probably best known for the prevalence data it provides on obesity. Indeed, as a result of data derived from NHANES, researchers, health professionals, and makers of public policy have been able to chart the

NHANES in Action

Data derived from NHES and NHANES surveys have been instrumental in the development and implementation of a number of health-related guidelines and reforms and public-policy initiatives. Examples include:

- Growth Charts: Anthropometric data derived from NHES and NHANES has been instrumental in the development of growth charts used by pediatricians and health clinics across the United States and around the world.
- Vitamin and Mineral Fortification of Food: Nutrient intake data derived from NHANES has aided in the determination of population groups at nutritional risk and spawned measures to address these nutritional inadequacies. For example, nutrient data from the first two NHANES indicated that certain segments of the U.S. population (women of childbearing age, young children and the elderly) were consuming inadequate amounts of iron. This information led to the fortification of grain and cereal products with iron. Similarly, NHANES data provided the additional proof of the connection between folate intake and neural tube defects needed to mandate the fortification of grain and cereal products with folate, a measure that has succeeded in significantly increasing blood folate levels in participants of the most recent (1999–2000) survey.
- Lead Exposure: It was data derived from early NHANES that provided the first concrete evidence that blood levels of lead among Americans were becoming dangerously high. As a result, the Environmental Protection Agency called for a reduction in production and sales of consumer products containing relatively large amounts lead, most notably gasoline and household paints.

increasing prevalence of obesity in the United States, as well as changes in obesity demographics (e.g., age, ethnicity, gender). Nonetheless, NHANES provides much more than just obesity prevalence data. NHANES issues vital data on the prevalence and correlates of chronic diseases such as **arthritis**, cardiovascular and respiratory diseases, diabetes, gallbladder and kidney diseases, osteoporosis, and **cancer**. In addition, NHANES supplies important information on the prevalence and trends of risk factors and other key health behaviors, including alcohol use, tobacco use and exposure, drug use, sexual experience, immunization histories, and physical activity. Data from NHANES has been instrumental in the development and implementation of a number of health-related guidelines and reforms and public-policy initiatives, including growth charts for children, folate **fortification** of grain products, and a reduction in the manufacturing and sales of lead-containing products.

arthritis: inflammation of the joints

cancer: uncontrolled cell growth

fortification: addition of vitamins and minerals to improve the nutritional content of a food

Future Directions: Where Is NHANES Going from Here?

As previously mentioned, beginning in 1999, NHANES became a continuous, annual survey in order to provide more timely data on the health and nutritional status of the population. In addition, NHANES will eventually be linked with other related health and nutrition surveys of the U.S. population, including the National Health Interview Survey (NHIS) and the U.S. Department of Agriculture's Continuing Survey of Food Intakes by Individuals (CSFII). By combining and integrating the data from these extensive surveys, a more comprehensive evaluation of the current health and nutritional status of the U.S. population can be made.

Katherine A. Beals

Bibliography

McDowell, A.; Engel, A.; Massey, J. T.; Maurer, K. (1981). "Plan and Operation of the Second National Health and Nutrition Examination Survey, 1976–1980." *Vital and Health Statistics* 1(15):1–144.

National Center for Health Statistics (1965). "Cycle I of the Health and Examination Survey: Sample and Response. United States: 1960–1962." *Vital and Health Statistics* 1(4):1-43.

National Center for Health Statistics (1965). "Plan and Initial Program of the Health Examination Survey." *Vital and Health Statistics* 1(4):1–43.

National Center for Health Statistics (1978). "Plan and Operation of the Health and Nutritional Examination Survey, United States: 1971–1973. Programs and Collection Procedure." *Vital and Health Statistics* 10:1–46.

National Center for Health Statistics (1994). "Plan and Operation of the Third National Health and Nutritional Examination Survey, 1988–1994." *Vital and Health Statistics* 32:1–407.

Internet Resources

National Center for Health Statistics. "National Health and Nutrition Examination Survey." Available from <http://www.cdc.gov/nchs/nhanes> Updated April 3, 2003.

National Institutes of Health (NIH)

The U.S. National Institutes of Health (NIH) are charged with the vital mission of uncovering new knowledge that will lead to better health for everyone. To carry out this ambitious task, the NIH has become the largest agency for biomedical research in the world. It consists of twenty-seven separate institutes and centers and has a multibillion-dollar budget. However, it did not start out this way.

History of the National Institutes of Health

In 1887, the NIH began in Staten Island, New York, as a one-room federal laboratory within the Marine Hospital Service (MHS). At the time, it was called the Laboratory of **Hygiene**. The MHS was responsible for preventing the spread of **infectious disease** in the United States. For example, the staff at the MHS examined passengers on arriving ships for signs of communicable diseases such as **cholera** and yellow fever. By 1891, the federal government required the MHS to take on the additional responsibilities of developing and testing **vaccines**. That year, the service was relocated to Washington, D.C., and renamed the Hygienic Laboratory.

In 1902, Congress passed the Biologics Control Act to regulate vaccines sold in the U.S. This resulted in the Hygienic Laboratory adding divisions in chemistry, pharmacology, and zoology, all on a meager annual budget of $50,000. After ten years, this enterprise, now called the U.S. Public Health Service (PHS), was further authorized to study **chronic** diseases (e.g., **heart disease**, **diabetes**, and **cancer**) and infectious diseases (e.g., **tuberculosis**, influenza, and **malaria**). Despite working with limited funds, its investigators made several remarkable medical discoveries during this period. For example, in 1920, Joseph Goldberger discovered that *pellagra*, a skin disease widely considered to be infectious, was in fact the result of a vitamin deficiency that could be prevented by proper **nutrition**.

In 1930, the Hygienic Laboratory became the National Institutes of Health (NIH), and by 1938 the unit had moved to a privately donated estate

hygiene: cleanliness

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

cholera: bacterial infection of the small intestine causing severe diarrhea, vomiting, and dehydration

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

cancer: uncontrolled cell growth

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

nutrition: the maintenance of health through proper eating, or the study of same

in Bethesda, Maryland. Today, this is the primary home of the National Institutes of Health.

Pursuing the Mission of NIH

The activities of the NIH are overseen by the Public Health Service, which, in turn, is directed by the U.S. Department of Health and Human Services. However, the mission, goal, and activities of NIH distinguish it as a unique federation of biomedical research institutes. In pursuit of its broader mission, the specific goal of the NIH is to acquire biomedical knowledge that will enable researchers and practitioners to prevent, control, detect, and treat disease and disability. To achieve this goal, the NIH directs a number of programs and activities, including: (1) conducting research at the facility; (2) supporting scientific explorations of investigators in other settings (e.g., universities, medical schools, **clinical** centers) nationwide and internationally; (3) providing training for researchers; and (4) fostering the dissemination of medical information. The Office of the Director (OD) sets policy for planning, managing, and coordinating these programs and activities.

clinical: related to hospitals, clinics, and patient care

Within the OD is the Office of Legislative Policy and Analysis (OLPA). OLPA is responsible for making sure that the results of all of this research inform public policy and public health laws. To this end, the OLPA supervises legislative analysis and policy development, and also acts as a liaison between the NIH and Congress. As a result of the OLPA's participation in congressional hearings, for example, the Dietary Supplement Health and Education Act (DSHEA) was authorized in 1993. Consequently, the NIH established the Office of Dietary Supplements to conduct and coordinate research relating to dietary supplements and their impact on the health of the public.

The Institutes and Centers

To support its mission, the NIH has developed into a broad and complex federation consisting of a total of twenty institutes and seven centers. Each institute and center has its own medical or public health focus with well-defined priorities. For example, some institutes concentrate on a particular disease area (e.g., cancer, diabetes) whereas others support biomedical research (e.g., promoting diversity, providing medical resources).

One of the NIH's institutes is the famous U.S. National Library of Medicine (NLM), the world's largest medical library, holding nearly six million items, such as books, professional journals (e.g., *Science* and *Nature*), and photographs. A plethora of resources and search engines, including PubMed and MEDLINEplus, provide access to these materials through the World Wide Web.

In general, the institutes' research priorities are shaped by two things: (1) epidemiological assessments (i.e., studies of the distribution and determinants of diseases and injuries in populations), and (2) political pressure. In some cases, political concerns have affected plans for specific research directions regardless of the results of epidemiological assessments. For example, a wide variety of research supports the idea that stem cells (undifferentiated cells taken from human embryos) have great potential to reduce the burden of illness (stem cells can be used to create other body cells, such as blood

Accomplishments of the NIH

The NIH supports thousands of research projects every year. A small sample of the accomplishments from 2003 includes the following:

- The Human Genome Project—an ambitious international effort to identify the 30,000 genes in human DNA and determine the sequences of the three billion chemical base pairs that make up human DNA—was completed two years ahead of schedule. The data was made freely available to scientists around the world.
- New guidelines were published for the prevention, detection, and treatment of high blood pressure.
- A new Ebola vaccine proved successful in monkeys, with human trials to follow.
- The drug letrozol was shown to reduce recurrence of breast cancer.
- The serotonin transporter gene was discovered to influence the onset and severity of depression.
- Research showed that heart attack symptoms in women differ from those in men, which may help women and doctors identify the onset of an attack earlier.
- Scientists found that the levels of two proteins, beta-amyloid and tau, distinguish Alzheimer's patients from controls. This discovery may lead to the development of predictive and diagnostic tools.
- Combined estrogen and progestin therapy was found to increase the risk of dementia.
- Scientists discovered that a greater than usual number of copies of the a-synuclein gene may cause Parkinson's disease.
- A new West Nile Virus vaccine was shown to be effective in monkeys.
- An international research team found that using cloth to filter water in poor countries reduced the incidence of cholera by half.

—Paula Kepos

cells, or to regenerate tissue, bone, and muscle). However, despite the potential value of these applications, political concerns have threatened to end funding for this kind of research. On August, 9, 2001, President George W. Bush announced his decision to allow federal funds to support research on existing human embryonic stem cell lines under certain limited conditions.

Human Subjects: Protection and Ethics

Because much of the research supported by the NIH is conducted on human subjects, the NIH has several offices and programs in place to protect participants and address bioethical research issues. For example, to protect the rights and welfare of human subjects, the NIH has established at least fourteen separate Institutional Review Boards (IRBs). IRB committee members must review, and approve, all human-subject research activities prior to, and throughout, a study. Each principal investigator (the scientist in charge of directing a research project) must prove to the IRB that all of their human subjects provided **informed consent** before participating in study procedures. In addition, researchers must ensure the privacy of their participants is protected and their data are kept confidential.

informed consent: agreement to a procedure after understanding the risks

In addition to offices that protect research participants, the NIH contains a number of offices that address ethical concerns and appraise the potential social consequences of scientific pursuits. For example, the Office of Science Policy (OSP) advises the NIH director on policy issues that affect the

In 1998 the U.S. Congress committed to increase the budget of the National Institutes of Health to more than $27 billion. A press conference calling for the increase featured entertainers Christopher Reeve and Mary Tyler Moore. *[AP/Wide World Photos. Reproduced by permission.]*

research community. In addition, OSP coordinates the Trans-NIH Bioethics Committee (T-NBC), composed of scientists, ethicists, and IRB members. This group is explicitly responsible for developing policies and considering the ethical, legal, and social implications of NIH-funded research.

Funding Research Projects

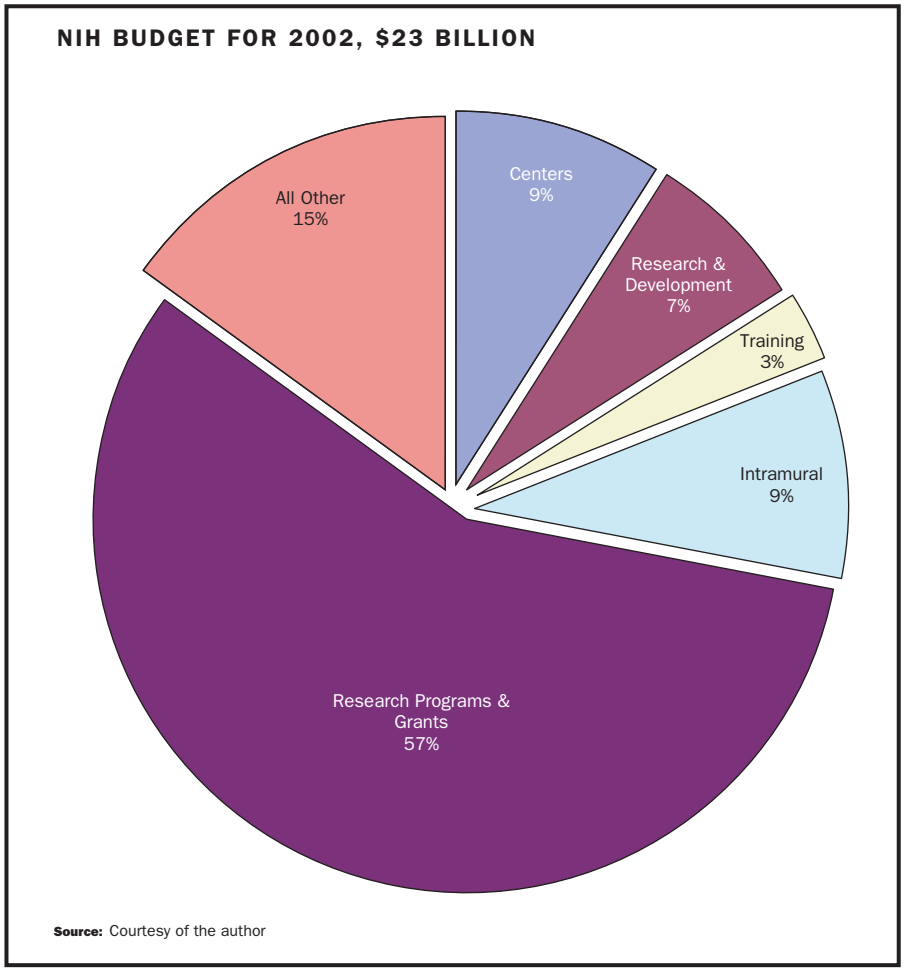
The NIH's important role in health and medical research and training is reflected in a yearly budget of 23 billion dollars (as of fiscal year 2002), a sum generated almost entirely through taxes. Today, the NIH uses these funds to support over thirty thousand research projects conducted on the main campus (intramural) and away from campus (extramural) at universities, medical schools, and independent research institutions.

Although the intramural research conducted at the NIH is important, nearly 80 percent of the NIH's budget is spent on extramural grants to investigators and research institutions throughout the nation and the world. The grants program seeks to stimulate the discovery of biomedical knowledge by encouraging qualified scientists to participate in particular types of research. In addition, research grants and contracts guarantee that facilities, equipment, and human resources are available to conduct research.

Research and Biomedical Advances

Nationwide and internationally, over fifty thousand researchers have been awarded grants to conduct their studies away from NIH's main campus. Together, these researchers have made more scientific breakthroughs than could be listed in this book. Some noteworthy examples, however, include: (1) the discovery that antiretroviral **drugs** could prevent transmission of the HIV virus from mother to infant, (2) demonstrating that weight loss

drugs: substances whose administration causes a significant change in the body's function



and restriction of dietary salt reduce the need for blood pressure-lowering drugs, (3) confirming that tight control of blood **glucose** (sugar) may help people living with diabetes prevent complications such as blindness, and (4) identifying leptin (a product of the "**obesity**" gene) and suggesting how it might be used to combat obesity in humans. A number of extramural investigators have also been honored with the Nobel Prize for their significant contributions to biomedical science. For example, the 1985 Nobel Prize in **Physiology** or Medicine was awarded jointly to Drs. Michael S. Brown and Joseph L. Goldstein for their discoveries concerning the regulation of **cholesterol metabolism** and its role in heart disease.

In addition to this work, research scientists, physicians, dentists, veterinarians, and nurses conduct more than two thousand intramural projects on the NIH campus. Several of these investigators have also received international attention for their discoveries. Currently, three Nobel laureates work at the NIH: Dr. Marshall W. Nirenberg (honored in 1968 for finding the key to cracking the **genetic** code), Dr. Julius Axelrod (honored in 1970 for discoveries concerning chemical transmitters in the **nervous system**), and Dr. D. Carleton Gajdusek (honored in 1976 for identifying the cause of kuru, a fatal infectious disease that affects the nervous system). Today, intramural researchers continue to work on projects that will, ultimately, improve the health of the public.

glucose: a simple sugar; the most commonly used fuel in cells

obesity: the condition of being overweight, according to established norms based on sex, age, and height

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

metabolism: the sum total of reactions in a cell or an organism

genetic: inherited or related to the genes

nervous system: the brain, spinal cord, and nerves that extend throughout the body

Since its humble beginning as a one-room laboratory of hygiene, the NIH has become the largest biomedical research enterprise in the world. This well-funded public program has enabled scientists to make tremendous strides in preventing, controlling, detecting, and treating disease. Still, there are enduring questions for researchers at each of the twenty-seven institutes and centers to tackle, such as ways to prevent and treat cancer, heart disease, blindness, **arthritis**, diabetes, Alzheimer's disease, **depression**, drug misuse, and AIDS. To pursue these and other issues, every year the NIH posts hundreds of requests for proposals (RFPs), encouraging scientists to submit grant proposals on different topics. At the beginning of the twenty-first century, the NIH is especially interested in supporting research that will improve the health of infants and children, women, older adults, and minorities. Future projects will help scientists, practitioners, and educators better understand how **biological** processes, behaviors, and lifestyle practices impact health and disease. For example, more will certainly be learned about nutrition-related illnesses and how **diet** influences **gene expression**. By directing research in these areas, the NIH is leading the way to better health for everyone. SEE ALSO GOLDBERGER, JOSEPH.

arthritis: inflammation of the joints

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

biological: related to living organisms

diet: the total daily food intake, or the types of foods eaten

gene expression: use of a gene to make the protein it encodes

Jessica Schulman

Bibliography

Brown, Michael S., and Goldstein, Joseph L. (1984). "How LDL Receptors Influence Cholesterol and Atherosclerosis." *Scientific American* 251:52–60.

Pittenger, Mark F.; Mackay, Alastair, M.; Beck, Stephen C.; Jaiswal, Rama K.; Douglas, Robin; Mosca, Joseph D.; Moorman, Mark A.; Simonetti, Donald W.; Craig, Stewart; and Marshak, Daniel R. (1999). "Multilineage Potential of Adult Human Mesenchymal Stem Cells." *Science* 284:143–147.

Roe, Daphne A. (1973). *A Plague of Corn: A Social History of Pellagra*. New York: Cornell University Press.

Starr, Paul (1982). *The Social Transformation of American Medicine*. Washington, DC: Basic Books.

Internet Resources

National Institutes of Health (2001). "Press Release: FY 2002 President's Budget." Available from <http://www4.od.nih.gov/officeofbudget/press2002.pdf>

National Institutes of Health, Stetton Museum of Medical Research. "Historical Resources." Available from <http://history.nih.gov>

Native Americans, Diet of

When Christopher Columbus dropped anchor on the shores of San Salvador in the Caribbean Sea, he believed he reached India. Because he believed he was in India, Columbus named the inhabitants *Indians*, a term that was soon used to refer to all the native inhabitants of North America. Today, the term *Native American* is more commonly used.

The Hardships of Settlement

New settlers in North America had a difficult time learning how to grow food and harvest crops to sustain their colonies through the land's harsh winters. The Native Americans, on the other hand, were accustomed to the climate and the land's nuances, and were familiar with what types of food were available to them during the different times of the year. They did

RATES (%) OF OVERWEIGHT AND OBESITY IN MALE AND FEMALE NATIVE AMERICANS COMPARED TO ALL U.S. RACES

Age (in years)	Overweight: American Indians/ Alaska Natives (%)	Overweight: all races in U.S. (%)	Obese: American Indians/ Alaska Natives (%)	Obese: all races in U.S. (%)
Males				
Total (18+)	**33.7**	**24.1**	**13.8**	**9.1**
18–24	21.5	13.1	11.0	5.5
25–34	31.8	19.5	11.2	7.6
35–44	37.8	27.0	11.2	10.4
45–54	49.1	33.8	28.2	14.1
55–64	45.5	33.1	16.5	13.0
65+	25.2	23.0	11.1	5.4
Females				
Total (18+)	**40.3**	**25.0**	**16.6**	**8.2**
18–24	25.2	11.5	11.7	3.9
25–34	45.1	17.4	13.8	6.0
35–44	48.5	28.1	19.7	10.8
45–54	54.0	32.0	18.7	10.9
55–64	45.6	36.2	18.8	11.5
65+	45.6	30.1	20.7	7.7

SOURCE: Broussard, et al. (1991). "Prevalence of Obesity in American Indians and Alaska Natives." *American Journal of Clinical Nutrition.*

not go hungry as the settlers did. The Native Americans were skilled agriculturists, nomadic hunters, and food gatherers who lived in relatively egalitarian communities where both the women and men had equal responsibilities.

The portal that Columbus opened when he first stepped foot on the soil of the New World in 1492 triggered a steady influx of European settlers, indelibly affecting the lives of Native Americans. However, it was Thomas Jefferson's purchase of the Louisiana Territory from France in 1803 that fundamentally changed the course of Native Americans' future in North America. Hoping to expand the nation's size, Jefferson urged the Creek and Cherokee nations of Georgia to relocate to the newly acquired land. This began an era of devastating wars over land. The many years of struggle between Native American tribes and the U.S. government resulted in the near extinction of many Native American tribes.

General Diet before the Colonial Period

The Native American population, including American Indians and Alaska Natives, once totaled nearly 24 million, with over 500 tribes. The diets of Native Americans varied by geographic region and climate. They lived in territories marked by specific natural boundaries, such as mountains, oceans, rivers, and plains. Hunting, fishing, and farming supplied the major food resources. Native Americans survived largely on meat, fish, plants, berries, and nuts.

The most widely grown and consumed plant foods were maize (or corn) in the mild climate regions and wild rice in the Great Lakes region. A process called *nixtamalizacion* (soaking dry corn in lime water) was used to soften the corn into dough, called *nixtamal* or *masa.* This was prepared in a variety of ways to make porridges and breads. Many tribes grew beans and enjoyed them as *succotash*, a dish made of beans, corn, dog meat, and bear **fat**. Tubers

fat: type of food molecule rich in carbon and hydrogen, with high energy content

(roots), also widely eaten, were cooked slowly in underground pits until the hard tough root became a highly digestible gelatin-like soup. It is estimated that 60 percent of modern agricultural production in the United States involves crops domesticated by Native Americans.

Maple sugar comprised 12 percent of the Native American diet. The Native American name for maple sugar is *Sinzibuckwud* (drawn from the wood). Sugar was a basic seasoning for grains and breads, stews, teas, berries, vegetables. In the Southwest, the Native Americans chewed the sweet heart of the agave plant.

Many tribes preferred broth and herbed beverages to water. The Chippewa boiled water and added leaves or twigs before drinking it. Sassafras was a favorite ingredient in teas and medicinal drinks. Broth was flavored and thickened with corn silk and dried pumpkin blossoms. Native Americans in California added lemonade berries to water to make a pleasantly sour drink.

Sacred and Ceremonial Foods

Sacred foods included bear, organ meats, and *blood soup*. The Horns Society, a militant group of the Blackfoot Nation, used *pemmican*, made with berries, for its sacred communion meal. Boiled buffalo tongue was a delicacy and was served as the food of communion at the Sun Dance, a Lakota and Plains Indian courtship dance that also celebrated the renewal of spiritual life. Blood soup, made from a mixture of blood and corn flour cooked in broth, was used as a sacred meal during the nighttime Holy Smoke ceremony of the Sioux, a celebration of Mother Earth that involved the use of the "peace pipe." Wolves and coyotes were the only animals that were not hunted for food, because they were regarded as teachers or pathfinders and held as sacred by all tribes.

At marriage ceremonies, the bride and groom exchanged food instead of rings. The groom brought venison or some other meat to indicate his intention to provide for the household. The bride provided corn or bean bread to symbolize her willingness to care for and provide nourishment for her household.

Current Food Practices

Native American diets and food practices have possibly changed more than any other ethnic group in the United States. Although the current diet of Native Americans may vary by tribe, and by personal traits such as age (e.g., young versus old), it closely resembles that of the U.S. white population. Their diet, however, is poorer in quality than that of the general U.S. population. A recent study found that only 10 percent of Native Americans have a healthful diet, while 90 percent have a poor quality that needs improvement. The majority of Native Americans have diets that are too high in fat (62%). Only 21 percent eat the recommended amount of fruit on any given day, while 34 percent eat the recommended amount of vegetables, 24 percent eat the recommended amount of grains, and 27 percent consume the recommended amount of dairy products. Native Americans are also four times more likely to report not having enough to eat than other U.S. households.

The frybread taco is a relatively recent addition to Native American fare. It requires white wheat flour, which came to the New World with Europeans. *[Photograph by Catherine Karnow. Corbis. Reproduced by permission.]*

Diet-Related Health Issues

Heart disease is the leading cause of death among Native Americans. Risk factors, such as **high blood pressure**, cigarette smoking, high blood **cholesterol**, **obesity**, and **diabetes**, are health conditions that increase a person's chance for having heart disease. The more risk factors a person has, the greater chance a person may have for developing heart disease. Sixty-four percent of Native American men and 61 percent of women have one or more of these risk factors.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

obesity: the condition of being overweight, according to established norms based on sex, age, and height

diabetes: inability to regulate level of sugar in the blood

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

Diabetes.

Type II Diabetes is one of the most serious health problems for Native Americans in the United States. It is estimated that 12.3 percent of Native Americans over nineteen years of age have type II diabetes, compared to about 6 percent of the general U.S. population—a statistic that has caused health experts to say diabetes has reached widespread proportions. On average, Native Americans are 2.8 times more likely to be diagnosed with diabetes than whites of a similar age. Diabetes is a major cause of health problems and deaths in most Native American populations. Diabetes rates for Native Americans vary by tribal group.

Obesity.

Obesity is a major risk factor for both type II diabetes and heart disease. On average, 30 percent of all adult Native Americans are **obese**. Both males and females are consistently more **overweight** and obese than the total U.S. population. Among the Pima of Arizona and Mexico, for example, 95 percent of those with diabetes are also overweight. In addition to the increase in obesity among adults, obesity in children has also become a serious health problem. For both adults and children, the increasingly high rates of obesity have been associated with a high-fat diet and decreased levels of physical activity.

obese: above accepted standards of weight for sex, height, and age

overweight: weight above the accepted norm based on height, sex, and age

Conclusion

The history of the Native American people provides evidence of a culture strong enough to withstand the most difficult hardships. Though their lives

were changed in many ways over the centuries, their cooking and eating traditions have become mainstays of contemporary American cuisine. Many Native American recipes have been adopted by white populations in different regions in the United States, including succotash in the South, wild rice dishes in the northern Plains, pumpkin soup in New England, chili in the Southwest, broiled salmon in the Pacific Northwest, and corn on the cob in most areas of the country. Indeed, Native Americans have influenced American cuisine in ways the white population has yet to acknowledge.

Of greater importance, however, is the dire need to focus on the failing health of Native Americans. For complex reasons, Native Americans have not had the opportunity to access health care in ways that other Americans have. This has caused serious health problems. The limitations imposed on their living conditions, in concert with the socioeconomic obstacles that Native Americans face, challenge their livelihood. Though some programs have begun to target Native Americans' health problems, their future depends on receiving proper care for modern-day diseases. SEE ALSO CORN OR MAIZE-BASED DIETS.

M. Cristina Flaminiano Garces
Lisa A. Sutherland

Bibliography

Brill, Steve, and Dean, Evelyn (1994). *Identifying and Harvesting Edible and Medicinal Plants.* New York: Hearst Books.

Centers for Disease Control and Prevention (2000). "Prevalence of Selected Cardiovascular Disease Risk Factors by Sociodemographic Characteristics among American Indians and Alaska Natives." *Morbidity and Mortality Weekly Report.*

Fiple, Kenneth F., and Coneè Ornelas, Krimhil, eds. (2000). *The Cambridge World History of Food*, Volumes 1 and 2. Cambridge, U.K.: Cambridge University Press.

Gohdes, D. (1995). "Diabetes in North American Indians and Alaska Natives." In *Diabetes in America.* Bethesda, MD: National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health.

Greaves, Tom, ed. (2002). *Endangered Peoples of North America: Struggles to Survive and Thrive.* Westport, CT: Greenwood Press.

Jennings, Francis (1975). *The Invasion of America: Indians, Colonialism, and the Cant of Conquest.* New York: W. W. Norton.

Jennings, Jesse D., ed. (1978). *Ancient Native Americans.* San Francisco, CA: W.H. Freeman.

Kavasch, Barrie (1977). *Native Harvests: Recipes and Botanicals of the American Indian.* New York: Vintage Books.

Lytle, L. A.; Dixon, L. B.; Cunningham-Sabo, L.; Evans, M.; Gittelsohn, J.; Hurley, J.; Snyder, P.; Stevens, J.; Weber, J.; Anliker, J.; Heller, K.; and Story, M. (2002). "Dietary Intakes of Native American Children: Findings from the Pathways Feasibility Study." *Journal of American Dietetic Association* 102(4):555–558.

National Institute of Diabetes and Digestive and Kidney Diseases (1995). *The Pima Indians: Pathfinders for Health.* Washington, DC: U.S. Government Printing Office.

Penner, Lucille Recht (1994). *A Native American Feast.* New York: Macmillan.

United States Department of Agriculture, Center for Nutrition Policy and Promotion (1999). "The Diet Quality of American Indians: Evidence from the Continuing Survey of Food Intakes by Individuals." *Nutrition Insights* 12.

Wolf, B. (1980). *The Ways of My Grandmothers.* New York: William Morrow.

Zinn, Howard (1980). *A People's History of the United States.* New York: Harper Collins.

Nongovernmental Organizations

The term *nongovernmental organization* (NGO) gained widespread use beginning in 1945, when it was used in the United Nations Charter to clearly

distinguish between governmental and private organizations. To be considered an NGO, an organization must be free from government control, nonprofit, not considered a political party, and not involved in criminal activity.

While NGOs are, by definition, independent from government, they often engage in political activities and work closely with governments. NGOs are involved in activities related to international development, including relief work, provision of health and human services, advocacy for human rights, and environmental protection. There are several types of NGOs, such as charity organizations, churches, research institutes, community-based organizations, and lobbying groups. Those whose primary focus is on the development and implementation of projects and programs are referred to as operational NGOs, and those whose primary focus is on defending or promoting a certain cause or influencing policies are called advocacy, or campaigning, NGOs. However, both operational and advocacy NGOs have to mobilize financial resources, needed materials, and volunteers in order to achieve their goals and purposes.

NGOs can be divided into three broad categories based on the scope of their work: community-based organizations (CBOs), national organizations, and international organizations. CBOs are usually established by members of a local community to serve their own needs. National organizations are formed to serve people within an entire country, and international organizations are usually headquartered in a developed country and provide services to more than one developing country. CBOs, national organizations, and international organizations may interact and work together. Since the mid-1970s the number of NGOs around the world has increased substantially—by the late twentieth century there were between 6,000 and 30,000 national NGOs and thousands of CBOs (the data on the number of NGOs is, unfortunately, very incomplete). SEE ALSO DISASTER RELIEF ORGANIZATIONS.

Laura Nelson

Bibliography

Basch, Paul F. (1999). *Textbook of International Health*. New York: Oxford University Press.

Internet Resources

Duke University Perkins Library. "Non-Governmental Organizations Research Guide." Available from <http://docs.lib.duke.edu/igo/guides/ngo>

Willetts, Peter (2002). "What is a Non-Governmental Organization?" Available from <http://www.staff.city.ac.uk/p.willetts>

World Bank. "NGO World Bank Collaboration." Available from <http://www.worldbank.org>

Northern Europeans, Diet of

The countries of northern Europe include the United Kingdom of Great Britain (England, Scotland, Wales, Northern Ireland), the Republic of Ireland (now a sovereign country), and France. (Although southern France is generally considered to be part of southern Europe, it will be included in this discussion.) These countries are all part of the European Union. England and France have a very diverse population due to the large number of immigrants from former colonies and current dependent territories. Catholicism and Protestantism are the dominant religions.

Nutritional Status

Cardiovascular disease (e.g., **coronary heart disease**, **stroke**, **hypertension**) is the most common cause of death in these countries, and smoking rates are high. **Obesity** is the fastest growing **chronic** disease, especially among children. Alcoholism is high, especially among the Irish.

France's low rate of **heart disease** has been termed the "French Paradox." The theory is that France's low rate of heart disease is due to the regular consumption of wine, despite the high intake of saturated fats. However, recent evidence suggests that the rate of heart disease in France may have been underestimated and underreported, for while the rate of heart disease is lower in France than most countries, it is still the number one cause of death in France. In addition, the consumption of **saturated fat** has increased, which will eventually result in increased risk for coronary heart disease (CHD), regardless of wine intake.

Eating Habits and Meal Patterns

The northern European **diet** generally consists of a large serving of meat, poultry, or fish, accompanied by small side dishes of vegetables and starch. The traditional diet is high in **protein**, primarily from meat and dairy products. The diet tends to be low in whole grains, fruits, and vegetables. Immigrants from this region of the world brought this eating pattern to North America and it still influences the "meat and potatoes" American meal. The influence of each country's food habits on each other is also extensive.

England

English cuisine was primarily shaped during the Victorian era. The diet relies heavily on meats, dairy products, wheat, and root vegetables. The English are famous for their flower gardens, but they are also known for their kitchen gardens, which yield an abundance of herbs and vegetables. Breakfast is very hearty and generally consists of bacon, eggs, grilled tomato, and fried bread. Kippers (smoked herring) are also popular at breakfast. Many Britons still partake in afternoon tea, which consists of tiny sandwiches (no crust) filled with cucumber or watercress, scones or crumpets with jam or clotted cream, cakes or tarts, and a pot of hot tea. Tea shops abound in England, Wales, and Scotland, and Britons drink about four cups of tea a day. Coffee is also very popular with the younger generation.

The pub (short for "public house") is a central part of life and culture in the United Kingdom (Britain has over 61,000 pubs). British pubs are very cozy and homey, and they are famous for their beers, which are very strong. Pubs also serve food. The most common British pub meal is the "ploughman's lunch," named for traditional farmworkers. It consists of a large chunk of cheese, a hunk of homemade bread, pickled onion, and ale. Other popular menu items are shepherd's pie, Cornish pastry, Stargazy pie, and Lancashire hot pot. Britain's most famous dish is fish and chips, traditionally made with cod or pollack. There are some 8,500 fish-and-chip shops across the United Kingdom—they outnumber McDonald's eight to one.

Scotland

Scottish cuisine is centered on fresh raw ingredients such as seafood, beef, game, fruits, and vegetables. Porridge, or boiled oatmeal, is usually eaten

cardiovascular: related to the heart and circulatory system

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

hypertension: high blood pressure

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

diet: the total daily food intake, or the types of foods eaten

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

"Bangers and mash," a dish of sausage and mashed potatoes, is a favorite in English pubs. The Northern European diet is high in animal protein and fat, but it does not include many fruits or vegetables. *[Royalty-Free/Corbis. Reproduced by permission.]*

for breakfast. It is cooked with salt and milk—Scots do not usually eat their oatmeal with sugar or syrup.

The Aberdeen-Angus breed of beef cattle is widely reared across the world and is famous for rich and tasty steaks. Scottish lamb also has an excellent international reputation. Game such as rabbit, deer, woodcock, and grouse also plays an important role in the Scottish diet. Fish and seafood are abundant due to the numerous seas, rivers, and lochs (lakes). Scottish kippers and smoked salmon are international delicacies. As in other parts of the United Kingdom, there are numerous tea shops. Scotland is also known for its excellent whiskey and cheeses.

Scotland's national dish is haggis, which is made from sheep's offal. The windpipe, lungs, heart, and liver of the sheep are boiled and then minced. The mixture is then combined with beef suet and oatmeal. The mixture is placed inside the sheep's stomach, which is then sewn shut and boiled.

Wales

The food in Wales is pretty much the same as in Britain or Scotland, but there are a number of specialties. The leek (a vegetable) is a national emblem

and is used in a number of dishes. St. David is the patron saint of Wales and the leek is worn on St. David's Day, March 1, a national holiday. Potato is a dietary staple. Fish and seafood are abundant, especially trout and salmon. Popular dishes in Wales include Welsh rarebit (or rabbit), poacher's pie, faggots (made from pig liver), Glamorgan sausage (which is actually meatless), and Welsh salt duck.

Ireland

The island of Ireland consists of Northern Ireland and the Republic of Ireland. The Republic of Ireland is a state that covers approximately five-sixths of the island, while the remaining sixth of the island is known as Northern Ireland and is part of the United Kingdom of Great Britain and Northern Ireland. Northern Ireland is predominantly Protestant and the Republic of Ireland is predominantly Catholic.

Milk, cheese, meat, cereals, and some vegetables formed the main part of the Irish diet before the potato was introduced to Ireland in the seventeenth century. The Irish were the first Europeans to use the potato as a staple food. The potato, more than anything else, contributed to the population growth on the island, which had less than 1 million inhabitants in the 1590s but had 8.2 million in 1840. However, the dependency on the potato eventually led to two major famines and a series of smaller famines.

The potato is still the staple food in Ireland, though other root vegetables, such as carrots, turnips, and onions, are eaten when in season. A traditional Irish dish is *colcannon*, made of mashed potatoes, onions, and cabbage. It came to the United States in the 1800s with the huge wave of Irish immigration, and is often served on St. Patrick's Day (March 17). Corned beef and cabbage are also eaten on St. Patrick's Day.

Breakfast is a large meal, usually consisting of oatmeal porridge, eggs, bacon, homemade bread, butter, and preserves. Strong black tea with milk and sugar is served with all meals. Lunch is the main meal of the day and is usually eaten at home with the whole family. Lunch is often a hearty soup, followed by meat, potatoes, vegetable, bread, and dessert. Afternoon tea is still common. A light supper is served later in the evening. Irish pubs are known throughout the world for their vibrant and friendly atmosphere. There are many different types of pubs, including dining pubs, music pubs, and pubs with accommodations (room and board). Irish whiskey and ale are also world-renowned.

France

One of modern France's greatest treasures is its rich cuisine. The French have an ongoing love affair with food. Families still gather together for the Sunday midday feast, which is eaten leisurely through a number of appetizers and main courses. Most French meals are accompanied by wine.

French cuisine is divided into classic French cuisine (*haute* cuisine) and provincial or regional cuisine. Classic French cuisine is elegant and formal and is mostly prepared in restaurants and catered at parties. More simple meals are usually prepared at home. Buttery, creamy sauces characterize classic French cuisine in the west, northwest, and north-central regions. The area surrounding Paris in the north-central region is the home of classic

French cuisine. The area produces great wine, cheese, beef, and veal. Fish and seafood are abundant in the northern region, and the famous Belon oysters are shipped throughout France. Apples are grown in this region and apple brandy and apple cider are widely exported. Normandy is known for its rich dairy products, and its butter and cheeses are among the best in the world. The Champagne district is located in the northernmost region, bordering Belgium and the English Channel, and is world-renowned for its sparkling wines. Only those produced in this region can be legally called "champagne" in France.

German cuisine has influenced French cuisine in the east and northeast parts of the country. Beer, sausage, sauerkraut, and goose are very popular, for example (goose fat is used for cooking). Famous dishes from these regions include *quiche Lorraine* and goose liver paté (*pâté de fois gras*). The south of France borders the Mediterranean Sea, and the cuisine in this region is similar to that of Spain and Italy. Olive oil, tomatoes, garlic, herbs, and fresh vegetables are all widely used. Famous dishes from this region are black truffeles, *ratatouille*, *salade Niçoise*, and *bouillabaisse*.

The French eat three meals a day and rarely eat snacks. They usually eat a light continental breakfast consisting of a baguette (French bread) or croissant with butter or jam. Strong coffee with hot milk accompanies breakfast (sometimes hot chocolate). Lunch is the largest meal of the day. Wine is drunk with lunch and dinner, and coffee is served after both meals. France is also known for its exquisite desserts such as *crème brûlée* and *chocolate mousse*. SEE ALSO CENTRAL EUROPEANS AND RUSSIA, DIETS OF; FRENCH PARADOX; SCANDINAVIANS, DIET OF.

Delores C. S. James

Bibliography

Kittler, P. G., and Sucher, K. P. (2001). *Food and Culture*, 3rd edition. Stamford, CT: Wadsworth.

Internet Resources

Frommer's. "Great Britain." Available from <http://www.frommers.com/destinations/greatbritain>

Diners Digest. "English Food." Available from <http://www.cuisinenet.com/glossary/england.html>

Linnane, John (2000). "A History of Irish Cuisine." Available from <http://www.ravensgard.org/prdunham/irishfood.html>

Nutrient Density

Nutrient density is a measure of the nutrients a food provides compared to the **calories** it provides. Foods low in calories and high in nutrients are *nutrient dense*, while foods high in calories and low in nutrients are *nutrient poor*. Nutrient-dense foods should be eaten often, whereas nutrient-poor foods should only be eaten occasionally. A healthful **diet** includes mostly nutrient-dense foods. People who restrict their calories should obtain as much **nutrition** as they can from the calories they consume by choosing nutrient-dense foods. Those who consistently choose nutrient-poor foods will not get the nutrients they need. SEE ALSO NUTRIENTS.

nutrient: dietary substance necessary for health

calorie: unit of food energy

diet: the total daily food intake, or the types of foods eaten

nutrition: the maintenance of health through proper eating, or the study of same

Beth Fontenot

Nutrient-Drug Interactions

drugs: substances whose administration causes a significant change in the body's function

over-the-counter: available without a prescription

nutrient: dietary substance necessary for health

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Medications have become an integral part of life for many people. Medicine serves to help people when they are sick, allowing them to live longer and healthier lives. With rapidly growing research and technology, medications are more beneficial, and new ones continue to be discovered. **Drugs** do need to be taken with caution, however. All medications, whether prescribed by a doctor or bought **over-the-counter**, are capable of harmful side effects. The foods people eat contain **nutrients** that are used by the body to produce **energy**. Sometimes, certain medications may interact with both the food eaten and the nutrients the food gives to the body for proper functioning. When the body is unable to use a nutrient due to a drug that has been taken, a nutrient-drug interaction has occurred.

Function of a Drug

A drug is taken to prevent or treat sickness and disease. It is important to know what happens in the body when a drug is taken in order to better understand the interaction between nutrients and drugs. The action of a drug taken orally generally occurs in four steps: (1) the drug dissolves in the stomach, (2) the drug is absorbed into the blood and moves via the blood to the area of the body that needs it, (3) the body reacts to the medicine, and (4) the body gets rid of the drug by way of the kidney, liver, or both.

Adverse Effects of Nutrient-Drug Interactions

A nutrient-drug interaction may impact the body in several ways. Certain foods can affect the rate at which the body uses a medication. A drug will not work as well if a certain nutrient in a food speeds up or slows down the

NUTRIENT-DRUG INTERACTIONS

Drug	Indication	Possible Effects
Coumadin	Anticoagulant (blood thinner)	Vitamin K is a nutrient in the body that helps blood to clot. Vitamin K is present in foods such as green, leafy vegetables and fish. It will interfere with a blood thinner like coumadin.
Dilantin	Anticonvulsant (anti-seizure)	Vitamin D and folic acid levels in the body are decreased by the taking of these types of drugs.
Norvasc	Antihypertensive (for high blood pressure)	Consuming foods high in sodium (i.e., licorice, processed meats, canned foods) will decrease the effectiveness of the drug.
Aspirin	Anti-inflammatory/pain reliever	Taking large amounts of these drugs will cause a loss of Vitamin C in the body.
Birth control pills	Oral contraceptives	Women who take these drugs often have low levels of folic acid and Vitamin B_6 in the blood.
Dyazide/Thiazide	Diuretics (water-eliminating)	Taking diuretics often leads to a loss of potassium in the body.
Tetracycline	Antibiotic	Calcium may interact with the effectiveness of the antibiotic. Avoid dairy products for two to three hours before and after taking the medicine.
Lipitor/Zocor	Statins (cholesterol-lowering drugs)	Antioxidants (Vitamin A, C, E, B, folic acid) may interact with the drug by reversing its effect.
Prednisone	Corticosteroid	The drug may increase appetite thus increasing nutrient intake.
Lasix	Diuretic (water-eliminating)	The drug may decrease appetite thus decreasing nutrient intake.

SOURCE: Compiled from references in the bibliography.

drug's **absorption** into the body. Short- or long-term instances of nutrient-drug interactions may be life threatening. A nutrient-drug interaction may also impact the nutritional status of the body. Nutrient-drug interactions can occur with both prescription and over-the-counter medicine.

Impact of Food on Effectiveness of a Drug

A medication has ingredients, just as food does, that allow it to function correctly when taken in order to help the body in some way. A food may interfere with the effectiveness of a drug if the food interacts with the ingredients in the medication, preventing the drug from working properly. Nutrients in food may either delay absorption into the body or speed up elimination from the body, either or which can impact a drug's effectiveness. For example, the acidic ingredients in fruit juices are capable of decreasing the power of **antibiotics** such as penicillin. Tetracycline, another infection-fighting drug, is impacted by the consumption of dairy products. Many medications that are taken to fight **depression** can be dangerous if mixed with beverages or foods that consist of tyramine, which is found in items such as beer, red wine, and some cheeses.

Food can also impact the effectiveness of a drug due to the way it is consumed. Generally, medicine is to be taken at the same time food is eaten. This is because the medicine may upset the stomach if the stomach is empty. However, sometimes taking a drug at the same time that food is eaten can interfere with the way the medicine is absorbed by the body.

Some drugs may affect the absorption of nutrients, while some foods—for example, those containing caffeine—can amplify or modify the effects of certain drugs. Taking drugs with hot beverages could also make them less effective. *[Octane Photographic. Reproduced by permission.]*

Impact on Nutritional Status

A drug has the capacity of interfering with a person's nutritional status. Appetite may be stimulated by a certain drug, resulting in an increase in nutrient intake due to more food being eaten. However, drugs may also cause a decrease in appetite, leading to a decrease in nutrient intake. In this case, a drug could possibly cause a nutritional deficiency. Nutritional status may also be impacted by a drug's effect on the three main nutrients: **carbohydrates**, **fat**, and **protein**. A drug may speed up or slow down the breakdown of these three nutrients, which are essential to the body's functioning. When a drug affects the absorption of nutrients from food into the body, less energy is available to be used by the body. The impact of the nutrient-drug interaction may vary according to the medicine taken, the dose of the medicine given, and the form taken (e.g., pill, liquid).

absorption: uptake by the digestive tract

antibiotic: substance that kills or prevents the growth of microorganisms

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

The Elderly and Nutrient-Drug Interactions

Elderly persons are at a significant risk for nutrient-drug interactions. This population often takes the highest amount of medications, and with the use of multiple drugs, certain problems may exist. A loss of appetite, a reduced sense of taste and smell, and swallowing problems all may result from medication use in elderly people.

Malnutrition is a common problem among older adults. Therefore, nutritional status may be already impacted by decreased nutrient intake. This may only worsen the effect of a possible nutrient-drug interaction. Elderly people who take many drugs on a routine basis for long periods of time are at greatest risk of nutrient depletion and **nutritional deficiencies**.

malnutrition: chronic lack of sufficient nutrients to maintain health

nutritional deficiency: lack of adequate nutrients in the diet

Tips for Avoiding Interactions

There are ways to avoid placing the body at risk of an unwanted nutrient-drug interaction. The following are tips to remember about taking medications and will help avoid interactions:

- Be sure to read the label on a prescription medicine and ask a pharmacist or physician if something is not clear.
- Read all directions, warnings, and any possible side effects printed on all drug labels and information in the package.
- Always take medications with a full glass of water.
- A drug may not work correctly if a medicine is taken improperly; do not stir medication into food or take apart capsules (unless told to do so).
- Take vitamin and mineral supplements before or after medicine, as they may interact with certain drugs.
- Avoid stirring drugs into hot drinks such as coffee because the drug's effectiveness can be destroyed by the hot temperature.
- Do not drink alcohol when taking any medicine.
- Always tell a physician and pharmacist about all medicines being taken, including both prescription and over-the-counter drugs. SEE ALSO ADULT NUTRITION; ALTERNATIVE MEDICINES AND THERAPIES; NUTRIENTS; NUTRITIONAL DEFICIENCY.

D. Michelle Swords

Bibliography

Alonso-Aperte, E., and Varela-Moreiras, G. (2000). "Drugs-Nutrient Interactions: A Potential Problem during Adolescence." *European Journal of Clinical Nutrition* 54:S69–S74.

Heimburger, Douglas C., and Weinsier, Roland L. (1997). *Handbook of Clinical Nutrition*, 3rd edition. St. Louis, MO: Mosby.

Mahan, L. Kathleen, and Escott-Stump, Sylvia (1996). *Krause's Food, Nutrition, and Diet Therapy*, 9th edition. Philadelphia: W. B. Saunders Company.

Roe, Daphne A. (1994). "Medications and Nutrition in the Elderly." *Primary Care* 21:135–147.

Worthington-Roberts, Bonnie S., and Rodwell Williams, Sue (1996). *Nutrition throughout the Life Cycle*, 3rd edition. Boston: WCB/McGraw-Hill.

Internet Resources

College of Agricultural Sciences, Penn State Unviersity. "Facts about Food/Drug Interactions." Available from <http://www.penpages.psu.edu/>

University of Florida, Cooperative Extension Service, Institute of Food and Agricultural Sciences. "Food/Drug and Drug/Nutrient Interactions: What You Should Know about Your Medications." Available from <http://edis.ifas.ufl.edu/HE776>

Nutrients

nutrition: the maintenance of health through proper eating, or the study of same

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

An important aspect of **nutrition** is the daily intake of **nutrients**. Nutrients consist of various chemical substances in the food that makes up each person's **diet**. Many nutrients are essential for life, and an adequate amount of nutrients in the diet is necessary for providing **energy**, building and main-

THE THREE FUNCTIONS OF NUTRIENTS

Provide Energy	Promote growth and development	Regulate body functions
Carbohydrates	Proteins	Proteins
Proteins	Lipids	Lipids
Lipids (fats and oils)	Vitamins	Vitamins
	Minerals	Minerals
	Water	Water

taining body organs, and for various **metabolic** processes. People depend on nutrients in their diet because the human body is not able to produce many of these nutrients—or it cannot produce them in adequate amounts.

metabolic: related to processing of nutrients and building of necessary molecules within the cell

Nutrients are essential to the human diet if they meet two characteristics. First, omitting the nutrient from the diet leads to a nutritional deficiency and a decline in some aspect of health. Second, if the omitted nutrient is put back into the diet, the symptoms of nutritional deficiency will decline and the individual will return to normal, barring any permanent damage caused by its absence.

There are six major classes of nutrients found in food: **carbohydrates**, **proteins**, **lipids** (fats and oils), **vitamins** (both fat-soluble and **water-soluble**), **minerals**, and water. These six nutrients can be further categorized into three basic functional groups.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

lipid: fats, waxes and steroids; important components of cell membranes

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

water-soluble: able to be dissolved in water

mineral: an inorganic (non-carbon-containing) element, ion or compound

Carbohydrates

Carbohydrates are the major source of energy for the body. They are composed mostly of the elements carbon (C), hydrogen (H), and **oxygen** (O). Through the bonding of these elements, carbohydrates provide energy for the body in the form of kilocalories (kcal), with an average of 4 kcal per gram (kcal/g) of carbohydrates (a kcal is equivalent to a calorie on a nutritional label of a packaged food).

oxygen: O_2, atmospheric gas required by all animals

molecule: combination of atoms that form stable particles

sucrose: table sugar

glucose: a simple sugar; the most commonly used fuel in cells

Carbohydrates come in a variety of sizes. The smallest carbohydrates are the simple sugars, also known as monosaccharides and disaccharides, meaning that they are made up of one or two sugar **molecules**. The best known simple sugar is table sugar, which is also known as **sucrose**, a disaccharide. Other simple sugars include the monosaccharides **glucose** and fructose, which are found in fruits, and the disaccharides, which include sucrose, lactose (found in milk), and maltose (in beer and malt liquors). The larger carbohydrates are made up of these smaller simple sugars and are known as polysaccharides (many sugar molecules) or complex carbohydrates. These are usually made up of many linked glucose molecules, though, unlike simple sugars, they do not have a sweet taste. Examples of foods high in complex carbohydrates include potatoes, beans, and vegetables. Another type of complex carbohydrate is dietary **fiber**. However, although fiber is a complex carbohydrate made up of linked sugar molecules, the body cannot break apart the sugar linkages and, unlike other complex carbohydrates, it passes through the body with minimal changes.

fiber: indigestible plant material which aids digestion by providing bulk

Although carbohydrates are not considered to be an essential nutrient, the body depends on them as its primary energy source. The body utilizes most carbohydrates to generate glucose, which serves as the basic functional

molecule of energy within the cells of the human body (glucose is broken down to ultimately produce adenosine triphosphate, or ATP, the fundamental unit of energy). When the supply of carbohydrates is too low to adequately supply all the energy needs of the body, **amino acids** from proteins are converted to glucose. However, the typical American individual consumes more than adequate amounts of carbohydrates to prevent this utilization of protein.

amino acid: building block of proteins, necessary dietary nutrient

Proteins

Proteins are composed of the elements carbon (C), oxygen (O), hydrogen (H), and **nitrogen** (n). They have a variety of uses in the body, including serving as a source of energy, as substrates (starter materials) for tissue growth and maintenance, and for certain **biological** functions, such as making structural proteins, transfer proteins, **enzyme** molecules, and **hormone** receptors. Proteins are also the major component in bone, muscle, and other tissues and fluids. When used for energy, protein supplies an average of 4 kcal/g.

nitrogen: essential element for plant growth

biological: related to living organisms

enzyme: protein responsible for carrying out reactions in a cell

hormone: molecules produced by one set of cells that influence the function of another set of cells

Proteins are formed by the linking of different combinations of the twenty common amino acids found in food. Of these, ten are essential for the human in the synthesis of body proteins (eight are essential throughout a human's life, whereas two become essential during periods of rapid growth, such as during infancy).

Protein may be found in a variety of food sources. Proteins from animal sources (meat, poultry, milk, fish) are considered to be of high biological value because they contain all of the essential amino acids. Proteins from plant sources (wheat, corn, rice, and beans) are considered to be of low biological value because an individual plant source does not contain all of the essential amino acids. Therefore, combinations of plant sources must be used to provide these nutrients.

Protein deficiency is not common in the American diet because most Americans consume 1.5 to 2 times more protein than is required for the body to maintain adequate health. This excess intake of protein is not considered to be harmful for the average healthy individual. However, when protein intake is inadequate, but total caloric intake is sufficient, a condition known as **kwashiorkor** may occur. Symptoms of kwashiorkor include an enlarged stomach, loss of hair and hair color, and an enlarged liver. Conversely, if protein and caloric intake are both inadequate, a condition known as **marasmus** occurs. Marasmus presents with a stoppage of growth, extreme muscle loss, and weakness.

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

Lipids

Lipids, which consist of fats and oils, are high-energy yielding molecules composed mostly of carbon (C), hydrogen (H), and oxygen (O) (though lipids have a smaller number of oxygen molecules than carbohydrates have). This small number of oxygen molecules makes lipids **insoluble** in water, but soluble in certain organic solvents. The basic structure of lipids is a **glycerol** molecule consisting of three carbons, each attached to a fatty-acid chain. Collectively, this structure is known as a **triglyceride**, or sometimes it is called a triacylglycerol. Triglycerides are the major form of energy stor-

insoluble: not able to be dissolved in

glycerol: simple molecule that forms a portion of fats

triglyceride: a type of fat

The Food Guide Pyramid groups foods together based on their nutrient content. In theory, a diet designed around the pyramid will include all the essential nutrients that the body needs to thrive. *[Photograph by Gabe Palmer. Corbis. Reproduced by permission.]*

age in the body (whereas carbohydrates are the body's major energy source), and are also the major form of fat in foods. The energy contained in a gram of lipids is more than twice the amount in carbohydrates and protein, with an average of 9 kcal/g.

Lipids can be broken down into two types, saturated and unsaturated, based on the chemical structure of their longest, and therefore dominant, fatty acid. Whether a lipid is solid or liquid at room temperature largely depends on its property of being saturated or unsaturated. Lipids from plant sources are largely unsaturated, and therefore liquid at room temperature. Lipids that are derived from animals contain a higher amount of saturated fats, and they are therefore solid at room temperature. An exception to this rule is fish, which, for the most part, contain unsaturated fat. The important difference between saturated and unsaturated **fatty acids** is that saturated fatty acids are the most important factor that can increase a person's **cholesterol** level. An increased cholesterol level may eventually result in the clogging of blood **arteries** and, ultimately, **heart disease**.

fatty acids: molecules rich in carbon and hydrogen; a component of fats

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

artery: blood vessel that carries blood away from the heart toward the body tissues

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Not all fatty acids are considered harmful. In fact, certain unsaturated fatty acids are considered essential nutrients. Like the essential amino acids, these fatty acids are essential to a person's diet because the body cannot produce them. The **essential fatty acids** serve many important functions in the body, including regulating **blood pressure** and helping to synthesize and repair vital cell parts. It is estimated that the American diet contains about three times the amount of essential fatty acids needed daily. Lipids are also required for the **absorption** of fat-soluble vitamins, and they are generally thought to increase the taste and flavor of foods and to give an individual a feeling of fullness.

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

absorption: uptake by the digestive tract

Vitamins

Vitamins are chemical compounds that are required for normal growth and **metabolism**. Some vitamins are essential for a number of metabolic reactions that result in the release of energy from carbohydrates, fats, and proteins. There are thirteen vitamins, which may be divided into two groups: the four fat-soluble vitamins (vitamins A, D, E, and K) and the nine water-soluble vitamins (the **B vitamins** and vitamin C). These two groups are dissimilar in many ways. First of all, cooking or heating destroys the water-soluble vitamins much more readily than the fat-soluble vitamins. On the other hand, fat-soluble vitamins are much less readily excreted from the body, compared to water-soluble vitamins, and can therefore accumulate to excessive, and possibly toxic, levels. This means, of course, that levels of water-soluble vitamins in the body can become depleted more quickly, leading to a vitamin deficiency if those nutrients are not replaced regularly. Deficiencies of vitamins may result from inadequate intake, as well as from factors unrelated to supply. For instance, vitamin K and **biotin** are both produced by **bacteria** that live within the **intestines**, and a person can become deficient if these bacteria are removed by **antibiotics**. Other factors that may result in a vitamin deficiency include disease, pregnancy, drug interactions, and newborn development (newborns lack the intestinal bacteria that create certain vitamins, such as biotin and vitamin K).

metabolism: the sum total of reactions in a cell or an organism

B vitamins: a group of vitamins important in cell energy processes

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

bacteria: single-celled organisms without nuclei, some of which are infectious

intestines: the two long tubes that carry out much of the processes of digestion

antibiotic: substance that kills or prevents the growth of microorganisms

Minerals

Minerals are different from the other nutrients discussed thus far, in that they are inorganic compounds (carbohydrates, proteins, lipids, and vitamins are all organic compounds). The fundamental structure of minerals is usually nothing more than a molecule, or molecules, of an element. The functions of minerals do not include participation in the yielding of energy. But they do play vital roles in several **physiological** functions, including critical involvement in **nervous system** functioning, in cellular reactions, in water balance in the body, and in structural systems, such as the skeletal system.

Because minerals have a very simple structure of usually one or more molecules of an element, they are not readily destroyed in the heating or cooking process of food preparation. However, they can leak out of the food substance that contains them and seep into the water or liquid the food is being cooked in. This may result in a decreased level of minerals being consumed if the liquid is discarded.

There are many minerals found within the human body, but of the sixteen (or possibly more) essential minerals, the amount required on a daily

physiological: related to the biochemical processes of the body

nervous system: the brain, spinal cord, and nerves that extend throughout the body

basis varies enormously. This is why minerals are subdivided into two classes: macrominerals and microminerals. Macrominerals include those that are needed in high quantities, ranging from milligrams to grams. **Calcium**, phosphorous, and magnesium are macrominerals. Microminerals are those necessary in smaller quantities, generally between a microgram and a milligram. Examples of microminerals include copper, chromium, and selenium. Dietary requirements for some minerals have yet to be established.

calcium: mineral essential for bones and teeth

Water

Water makes up the last class of nutrients, though the fact that it is considered a nutrient is surprising to many people. Water, however, has many necessary functions in the human body. Some of its actions include its use as a solvent (a substance that other substances dissolve in), as a lubricant, as a conduction system for transportation of vital nutrients and unnecessary waste, and as a mode of temperature regulation.

There are many available sources of water other than tap water and bottled water. Some foods have a high water content, including many fruits and vegetables. In addition, the body can make small amounts of water from various metabolic prcesses that result in molecules of water as a by-product. This, however, is by no means sufficient for the body's needs of water. It is generally recommended that people drink eight cups (or nearly 2 liters) of water a day to maintain an adequate supply. SEE ALSO Carbohydrates; Fats; Kwashiorkor; Marasmus; Minerals; Nutritional Deficiency; Protein; Vitamins, Fat-Soluble; Vitamins, Water-Soluble; Water.

Susan S. Kim
Jeffrey Radecki

Bibliography

Harper, A. (1999). "Defining the Essentiality of Nutrients." In *Modern Nutrition in Health and Disease*, 9th edition, ed. M. E. Shills, et al. Baltimore, MD: Williams and Wilkins.

Morrison, Gail, and Hark, Lisa (1999). *Medical Nutrition and Disease*, 2nd edition. Cambridge, MA: Blackwell Science.

Subar, A. F., et al. (1998). "Dietary Sources of Nutrients in the U.S. Diet, 1989 to 1991." *Journal of the American Dietetic Association* 98:537.

Wardlaw, Gordon M., and Kessel, Margaret (2002). *Perspectives in Nutrition*, 5th edition. Boston: McGraw-Hill.

Nutrition

Nutrition is the science that studies the interactions between living organisms and food. Human nutrition includes the study of **nutrients** and other substances found in foods; how the human body uses nutrients for growth and maintenance; and the relationship between foods, food components, dietary patterns, and health. The study of nutrition encompasses all aspects of the ingestion, digestion, absorption, transport, **metabolism,** interaction, storage, and excretion of nutrients by the body. In a broader sense, the study of nutrition also includes the various psychological, sociological, cultural, technological, and economic factors that affect the foods and dietary patterns chosen by an individual.

nutrient: dietary substance necessary for health

metabolism: the sum total of reactions in a cell or an organism

Beth Fontenot

Nutrition Education

nutrition: the maintenance of health through proper eating, or the study of same

behavioral: related to behavior, in contrast to medical or other types of interventions

Nutrition education is a critical component of most major health promotion and disease prevention programs. Research indicates that **behavioral** change is directly related to the amount of nutrition education received. Nutrition Education involves the communication of nutrition-related information that will equip individuals, families, and communities to make healthful food choices. The media remain the primary source of nutrition information in the United States. Thus, nutrition education also focuses on discriminating between credible and noncredible sources of nutrition information. Nutrition messages and programs must be culturally relevant and specific to the target group. Registered dietitians are the professionals who are specifically trained to deliver information on food and nutrition.

Cindy Martin

Bibliography

American Dietetic Association (2003). "Nutrition Services: An Essential Component of Comprehensive School Health Programs." *Journal of the American Dietetic Association* 103:505–514.

Internet Resources

Ferme, Lori (2002). "Nutrition and You: Trends 2002." Available from <http://www.eatright.org>

Smith, Barbara (1995). "Past Experiences and Needs for Nutrition Education: Summary and Conclusions of Nine Case Studies." Available from <http://www.fao.org>

Nutrition Programs in the Community

nutrition: the maintenance of health through proper eating, or the study of same

In the United States, as in most developed countries, a number of services and programs exist to help those who are in need due to age, illness, poverty or adverse circumstances. This is often not the case in less-developed countries, where individuals and communities experience hardships due to a lack of social, health, and welfare services. In the United States, private charitable organizations, churches, and the government assist in providing what is often called a "safety net" of services, including **nutrition** or food services, to prevent or reduce deprivation for individuals and communities. The nutrition programs that have the greatest impact are those supported by the government, and in most cases the federal government provides resources to states through various funding methods.

FNS Programs

The Food and Nutrition Service (FNS) of the United States Department of Agriculture (USDA) was established in 1969. The purpose of this agency is to: (1) make food assistance available to the needy, (2) improve the eating habits of children, and (3) assist with the distribution of surplus foods, thereby stabilizing farm prices. A number of programs exist to achieve these goals.

National School Lunch Program.

The U.S. Congress established the National School Lunch Program (NSLP) in 1946 to safeguard the health and well-being of children and encourage

the domestic consumption of nutritious agricultural commodities. Participating schools in all the states receive cash subsidies and free commodities from the USDA. Schools and residential child-care institutions are responsible for providing lunches that meet specific nutritional standards. Students are eligible to receive lunches free or at a reduced price depending on their family's income (some pay full price). Though based on the rationale that a child cannot learn if he or she is hungry, in recent years there have been more concerns with the possible overconsumption of some **nutrients**, particularly **fat**. Some evaluations have suggested that school lunches may not be as healthy as they could be.

nutrient: dietary substance necessary for health

fat: type of food molecule rich in carbon and hydrogen, with high energy content

School Breakfast Program. This program was established as a permanent program for public and nonprofit private schools in 1975. The School Breakfast Program (SBP) helps states to provide a free or reduced-price nutritious breakfast to students in participating schools. Breakfasts may be hot or cold, but they must meet exact standards, provide specific foods, and meet one-fourth of the RDAs (**Recommended Dietary Allowances**) over time. Eligibility requirements are similar to the NSLP.

Recommended Dietary Allowances: nutrient intake recommended to promote health

Summer Food Service Program for Children. During school vacations, eligible children are able to receive meals and snacks under this program. Community agencies, nonprofit organizations, governmental units, recreational facilities, and summer camps are allowed to sponsor this program in communities where 50 percent or more of the children are from households that are at or below 185 percent of the poverty level. This nutrition program was established in 1975.

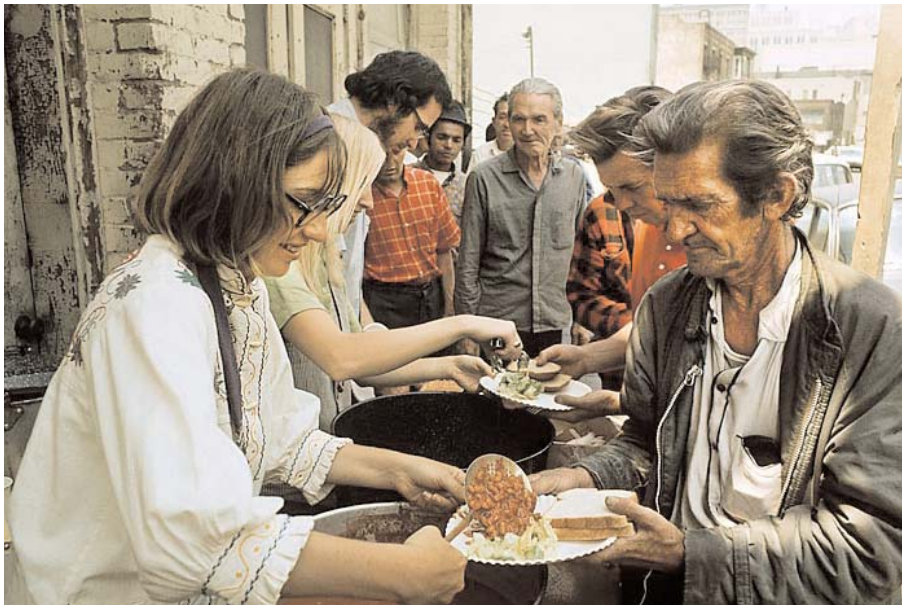
Special Milk Program. Since 1966 this program has been available to provide cash reimbursement for each half-pint of milk provided to students in schools not participating in the National School Lunch Program. The purpose is to encourage the consumption of milk. Children are eligible to participate regardless of income.

The Women, Infants, and Children Program (WIC). This program provides, at no cost, assistance to purchase supplemental nutritious foods, nutrition education, and referrals to other agencies. Pregnant and postpartum women, infants, and children under five years of age who meet specific health risk and income requirements are eligible to participate. The WIC Farmers Market, where available, allows participants to acquire fresh produce. WIC was authorized in 1972 and has proven to be cost-effective in reducing and preventing problems such as **anemia** and poor birth outcomes in the populations served.

anemia: low level of red blood cells in the blood

Food Stamp Program. The purpose of the Food Stamp Program, established in 1977, is to improve the diets of people with low incomes. Assistance is provided, through food stamps, for purchasing foods. Recently, more efforts have been made to also provide some nutrition education.

Commodity Supplemental Food Program. Since 1973 this program has provided direct food distribution to persons over sixty years old, and to lower income people, in some states. Specific foods are provided to meet participants' nutritional needs. Persons participating in WIC are not eligible for this program.



A variety of community nutrition programs receive aid from the federal government. For example, the U.S. Department of Agriculture distributes food surpluses to charitable institutions, which then provide the food to people in need. *[Photograph by Vince Streano. Corbis. Reproduced by permission.]*

Separate USDA programs also exist for providing commodities and surplus foods to charitable institutions, child- and adult-care programs, Indian reservations, and for temporary emergency food assistance. Other USDA programs, such as the Expanded Food and Nutrition Program and the Nutrition and Education Training Program, exist to increase nutrition knowledge and skills.

DHHS Programs

Another agency that plays a major role in meeting community nutrition needs is the U.S. Department of Health and Human Services (DHHS), which oversees a number of nutrition programs.

Nutrition Program for Older Americans.

Funds are given to state agencies on aging to coordinate a variety of services for the elderly, including congregate and home-delivered meals. A nutritious lunch, nutrition education, opportunities for social interaction, referral, and transportation assistance are provided. Meals are free, but participants may make a voluntary contribution. All persons over sixty years old, and their spouses (of any age), may participate, and income is not a factor for eligibility. This program was authorized in 1965.

Head Start Program.

Officially established in 1967, Head Start provides education, nutrition, and social and health services to participants. Specifically, nutritious meals, snacks, nutrition assessment, and nutrition education are provided to children and parents. To be eligible, children must be three to five years old and from a lower-income family.

DHHS also provides funding for the Title V Maternal Child Health Program, which does provide some nutrition assessment and nutrition education to children, adolescents, and women of childbearing age. This program provides a variety of other health-related services and specific programs for special-needs children and for those at risk for physical or developmental disabilities. States determine how these federal funds will be used, so the program does vary depending on the state.

While many programs are available, nutrition-related diseases and hunger still exist as real problems for some Americans. There are many who fail to gain the available benefits due to a variety of barriers. For example, homeless people often lack transportation and are unable to provide the required documentation to access some services.

Government agencies provide the majority of nutrition programs, but many religious and charitable organizations also assist in meeting the huge needs. Catholic Charities, Meals on Wheels, and the American Heart Association are examples of nonprofit groups that put forth extensive efforts to feed those in need and educate the public on relevant food and nutrition-related issues. SEE ALSO MEALS ON WHEELS; SCHOOL FOOD SERVICE; SCHOOL-AGED CHILDREN, DIET.

Leslene Gordon

Bibliography

Boyle, Marie A., and Morris, Diane H. (1994). *Community Nutrition in Action: An Entrepreneurial Approach.* New York: West Publishing.

Endres, Jeannette B. (1999). *Community Nutrition: Challenges and Opportunities.* New Jersey: Prentice Hall.

Frankle, Reva T., and Owen, Anita L. (1993). *Nutrition in the Community: The Art of Delivering Services.* St. Louis, MO: Mosby.

Nutritional Assessment

A **nutrition** assessment is an in-depth evaluation of both objective and subjective data related to an individual's food and **nutrient** intake, lifestyle, and medical history.

nutrition: the maintenance of health through proper eating, or the study of same

nutrient: dietary substance necessary for health

Once the data on an individual is collected and organized, the practitioner can assess and evaluate the nutritional status of that person. The assessment leads to a plan of care, or intervention, designed to help the individual either maintain the assessed status or attain a healthier status.

Elements of the Assessment

The data for a nutritional assessment falls into four categories: **anthropometric**, **biochemical**, clinical, and dietary.

anthropometric: related to measurement of characteristics of the human body

biochemical: related to chemical processes within cells

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Anthropometrics.

Anthropometrics are the objective measurements of body muscle and **fat**. They are used to compare individuals, to compare growth in the young, and to assess weight loss or gain in the mature individual. Weight and height are the most frequently used anthropometric measurements, and skinfold measurements of several areas of the body are also taken.

As early as 1836, tables had been developed to compare weight and height in order to provide a reference for an individual's health status. The Metropolitan Life Insurance Company revised height and weight tables in 1942, using data from policyholders, to relate weight to disease and mortality. There has been much discussion about the relevance (and appropriateness) of using the individuals who buy life insurance as a basis for "ideal" height and weight. There are also a number of problems with using a table to determine whether an individual is at the right weight—or even what the "ideal

1983 METROPOLITAN HEIGHT AND WEIGHT TABLES

Women

Height Feet–inches		Small frame	Medium frame	Large frame
4	10	102–111	109–121	118–131
4	11	103–113	111–123	120–134
5	0	104–115	113–126	122–137
5	1	106–118	115–129	125–140
5	2	108–121	118–132	128–143
5	3	111–124	121–135	131–147
5	4	114–127	124–138	134–151
5	5	117–130	127–141	137–155
5	6	120–133	130–144	140–159
5	7	123–136	133–147	143–163
5	8	126–139	136–150	146–167
5	9	129–142	139–153	149–170
5	10	132–145	142–156	152–173
5	11	135–148	145–159	155–176
6	0	138–151	148–162	158–179

1983 METROPOLITAN HEIGHT AND WEIGHT TABLES

Men

Height Feet–inches		Small frame	Medium frame	Large frame
5	2	128–134	131–141	138–150
5	3	130–136	133–143	140–153
5	4	132–138	135–145	142–156
5	5	134–140	137–148	144–160
5	6	136–142	139–151	146–164
5	7	138–145	142–154	149–168
5	8	140–148	145–157	152–172
5	9	142–151	148–160	155–176
5	10	144–154	151–163	158–180
5	11	146–157	154–166	161–184
6	0	149–160	157–170	164–188
6	1	152–164	160–174	168–192
6	2	155–168	164–178	172–197
6	3	158–172	167–182	176–202
6	4	162–176	171–187	181–207

weight" means. Tables should therefore be used only as a guide, and other measurements should be included in the data collection and evaluation.

In 1959, research indicated that the lowest mortality rates were associated with below-average weight, and the phrase "desirable weight" replaced "ideal weight" in the title of the height and weight table.

To further characterize an individual's height and weight, tables also include body-frame size, which can be estimated in many ways. An easy way is to wrap the thumb and forefinger of the nondominant hand around the wrist of the dominant hand. If the thumb and forefinger meet, the frame is medium; if the fingers do not meet, the frame is large; and if they overlap, the frame is small.

Determining frame size is an attempt at attributing weight to specific body compartments. Frame size identifies an individual relative to the bone size, but does not differentiate muscle mass from body fat. Because it is the muscle mass that is metabolically active and the body fat that is associated with disease states, **Body Mass Index** (BMI) is used to estimate the body-fat mass. BMI is derived from an equation using weight and height.

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

To estimate body fat, skinfold measurements can be made using skinfold calipers. Most frequently, tricep and subscapular (shoulder blade) skinfolds are measured. Measurements can then be compared to reference data—and to previous measurements of the individual, if available. Accurate measuring takes practice, and comparison measurements are most reliable if done by the same technician each time.

To estimate desirable body weight for amputees, and for paraplegics and quadriplegics, equations have been developed from cadaver studies, estimating desirable body weight, as well as **calorie** and **protein** needs. Calorie needs are determined by the height, weight, and age of an individual, which determine an estimate of daily needs.

calorie: unit of food energy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

The **Harris-Benedict equation** is frequently used, but there are quicker methods to estimate needs using just height and weight. Opinions and methods vary on how to estimate calorie needs for the **obese**. As previously mentioned, body fat is less metabolically active and requires fewer calories for support than muscle mass. If an individual's current body weight is more than 125 percent of the desirable weight for the individual's height and age, then using body weight to estimate calories needs usually leads to an overestimation of those needs.

Harris-Benedict equation: a formula for calculating a person's minimum energy expenditure

obese: above accepted standards of weight for sex, height, and age

Biochemical data. Laboratory tests based on blood and urine can be important indicators of nutritional status, but they are influenced by nonnutritional factors as well. Lab results can be altered by medications, **hydration** status, and disease states or other **metabolic** processes, such as **stress**. As with the other areas of nutrition assessment, biochemical data need to be viewed as a part of the whole.

hydration: degree of water in the body

metabolic: related to processing of nutrients and building of necessary molecules within the cell

stress: heightened state of nervousness or unease

Clinical data. Clinical data provides information about the individual's medical history, including **acute** and **chronic** illness and diagnostic procedures, therapies, or treatments that may increase nutrient needs or induce **malabsorption**. Current medications need to be documented, and both prescription **drugs** and **over-the-counter** drugs, such as laxatives or analgesics, must be included in the analysis. **Vitamins**, **minerals**, and **herbal** preparations also need to be reviewed. Physical signs of **malnutrition** can be documented during the nutrition interview and are an important part of the assessment process.

acute: rapid-onset and short-lived

chronic: over a long period

malabsorption: decreased ability to take up nutrients

drugs: substances whose administration causes a significant change in the body's function

over-the-counter: available without a prescription

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

herbal: related to plants

malnutrition: chronic lack of sufficient nutrients to maintain health

Dietary data. There are many ways to document dietary intake. The accuracy of the data is frequently challenged, however, since both questioning and observing can impact the actual intake. During a nutrition interview the practitioner may ask what the individual ate during the previous twenty-four hours, beginning with the last item eaten prior to the interview. Practitioners can train individuals on completing a food diary, and they can request that the record be kept for either three days or one week. Documentation should include portion sizes and how the food was prepared. Brand names or the restaurant where the food was eaten can assist in assessing the details of the intake. Estimating portion sizes is difficult, and requesting that every food be measured or weighed is time-consuming and can be impractical. Food models and photographs of foods are therefore used to assist in recalling the portion size of the food. In a metabolic study, where accuracy in the quantity of what was eaten is imperative, the researcher may ask the individual to prepare double portions of everything that is

eaten—one portion to be eaten, one portion to be saved (under refrigeration, if needed) so the researcher can weigh or measure the quantity and document the method of preparation.

Food frequency questionnaires are used to gather information on how often a specific food, or category of food is eaten. The Food Guide Pyramid suggests portion sizes and the number of servings from each food group to be consumed on a daily basis, and can also be used as a reference to evaluate dietary intake.

During the nutrition interview, data collection will include questions about the individual's lifestyle—including the number of meals eaten daily, where they are eaten, and who prepared the meals. Information about **allergies**, food intolerances, and food avoidances, as well as caffeine and alcohol use, should be collected. Exercise frequency and occupation help to identify the need for increased calories. Asking about the economics of the individual or family, and about the use and type of kitchen equipment, can assist in the **development** of a plan of care. Dental and oral health also impact the nutritional assessment, as well as information about **gastrointestinal** health, such as problems with **constipation**, gas or diarrhea, vomiting, or frequent heartburn.

allergy: immune system reaction against substances that are otherwise harmless

development: the process of change by which an organism becomes more complex

gastrointestinal: related to the stomach and intestines

constipation: difficulty passing feces

Evaluation

After data are collected, the practitioner uses past experience as well as reference standards to assimilate the information into an assessment that provides an understanding of the individual's nutritional status. The practitioner uses the anthropometric data to assess ideal and desirable weight, as well as skinfold measurements to determine body fat. Height, weight, and age are plugged into the Harris-Benedict equation to determine calorie and protein needs. Using the clinical, biochemical, and dietary data, influences on the nutritional status can be determined. A nutritional intervention, which usually includes dietary guidance and exercise recommendations, is then formulated and discussed with the individual. SEE ALSO ADOLESCENT NUTRITION; ADULT NUTRITION; ANTHROPOMETRIC MEASUREMENTS; BODY MASS INDEX; DIETARY ASSESSMENT; EATING HABITS; FOOD GUIDE PYRAMID; NUTRITION; NUTRITION EDUCATION; OBESITY.

Carole S. Mackey

Bibliography

Christie, Catherine, and Mitchell, Susan, eds. (2000). *Handbook of Medical Nutrition Therapy: The Florida Diet Manual.* Lighthouse Point, FL: Florida Dietetic Association.

Grant, Anne, and DeHoog, Susan (1999). *Nutrition Assessment and Support*, 5th edition. Seattle, WA: Grant and DeHoog.

Williams, Sue Rodwell (1997). *Nutrition and Diet Therapy*, 8th edition. St. Louis, MO: Mosby.

Winkler, Marion Feitelson, and Lysen, Lucinda (1993). *Suggested Guidelines for Nutrition and Metabolic Management of Adult Patients Receiving Nutrition Support.* Chicago, IL: American Dietetic Association.

Nutritional Deficiency

Nutritional deficiencies occur when a person's **nutrient** intake consistently falls below the recommended requirement. Nutritional deficiencies can lead

nutritional deficiency: lack of adequate nutrients in the diet

nutrient: dietary substance necessary for health

Children between 10–19 years of age face serious nutritional deficiencies worldwide, according to the World Health Organization. About 1,200 million, or 19 percent of adolescents suffer from poor nutrition that hurts their development and growth. *[Photograph by Jason Laure. Reproduced by permission.]*

to a variety of health problems, the most prevalent of which are **anemia**, beriberi, **osteoporosis**, pellagra, and **rickets**. Anemia occurs when the body does not have enough red blood cells to transport **oxygen** from the lungs to the body's cells. The most common symptom of anemia is a constant feeling of **fatigue**. Making sure that one's **diet** contains the proper amounts of **iron**, **folate**, and vitamin B_{12} can prevent anemia.

Prolonged thiamine deficiency can result in one of the more serious nutritional deficiencies, beriberi. Thiamine plays a major role in nerve processes, and a prolonged deficiency can result in nerve damage as well as heart and other muscle damage. Beriberi can be prevented by eating a diet containing foods rich in thiamine, such as meats, **legumes**, and whole-wheat breads.

Osteoporosis is an **asymptomatic** condition in which the loss of **minerals** can cause the body's bones to become porous and fragile. Making sure that one's diet contains the recommended amount of **calcium** and **vitamin D** can reduce the risk of developing osteoporosis.

The niacin-deficiency disease, pellagra, can produce symptoms such as dermatitis, **dementia**, diarrhea, and even death. Pellagra can be prevented through eating almost any protein-rich foods.

anemia: low level of red blood cells in the blood

osteoporosis: weakening of the bone structure

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

oxygen: O_2, atmospheric gas required by all animals

fatigue: tiredness

diet: the total daily food intake, or the types of foods eaten

iron: nutrient needed for red blood cell formation

folate: one of the B vitamins, also called folic acid

legumes: beans, peas and related plants

asymptomatic: without symptoms

mineral: an inorganic (non-carbon-containing) element, ion or compound

calcium: mineral essential for bones and teeth

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

dementia: loss of cognitive abilities, including memory and decision-making

fortification: addition of vitamins and minerals to improve the nutritional content of a food

Rickets, or defective bone growth, is the result of an excessive vitamin D deficiency. It has been virtually wiped out in the United States due to the vitamin D **fortification** of milk. SEE ALSO ANEMIA; BERIBERI; OSTEOPOROSIS; PELLAGRA; RICKETS.

Beth Hensleigh

Internet Resources

Centers for Disease Control and Prevention. "CDC Identifies Nutritional Deficiencies Among Young Children." Available from <http://www.cdc.gov/nccdphp/dnpa/press/archive/nutritional_deficit.htm>

U.S. Food and Drug Administration. "Economic Characterization of the Dietary Supplement Industry Final Report." Available from <http://www.cfsan.fda.gov/∼comm/ds-econ4.html>

Nutritionist

nutrition: the maintenance of health through proper eating, or the study of same

Nutritionists are individuals who have studied the science of **nutrition**. Many nutritionists have a master's or doctoral degree in nutrition science and conduct research on food safety, eating habits, or the impact of food and nutrition on health. Some nutritionists are registered dietitians (RDs). An RD is a health professional who is trained to provide reliable nutrition advice and care in a variety of settings. In many states, nutritionists must be licensed or certified to practice in **clinical** and community settings. These licensed or certified nutritionists must meet the same requirements as an RD. Otherwise, many people with little or no education in nutrition science may be called nutritionists or nutrition counselors.

clinical: related to hospitals, clinics, and patient care

States regulate nutrition and dietetic professionals by one or more of the following methods:

- *Licensing.* Licensing statutes explicitly define the scope of practice, and it is illegal to practice without first obtaining a license from the state.

There is evidence that a healthy diet can improve longevity and prevent disease. Nutritionists research the diet's impact on overall health and advise patients, communities, hospitals, and companies about the science and methods of nutrition. *[Photograph by Nathan Benn. Corbis. Reproduced by permission.]*

- *Statutory certification.* Certification statutes limit the use of particular titles to persons meeting predetermined requirements. However, persons who are not certified may still practice the occupation or profession as long as they do not use the particular titles.
- *Registration.* This is the least restrictive form of state regulation. As with certification, unregistered persons may be permitted to practice the profession if they do not use the state-recognized title. Typically, exams are not given and enforcement of the registration requirement is minimal.

Many state licensure boards use the qualifications established by the American Dietetic Association (ADA) Commission on Dietetic Registration to establish who may practice in the discipline. These standards require that an individual:

1. Complete a bachelors degree and course work approved by the ADA Commission on Accreditation for Dietetics Education
2. Complete accredited and supervised practice components of at least 900 hours in clinical, community, and food-service settings
3. Pass a national exam administered by the Commission on Dietetic Registration
4. Complete continuing professional education requirements to maintain licensure or registration. SEE ALSO CAREERS IN DIETETICS; DIETITIAN.

Catherine Christie

Internet Resources

American Dietetic Association. "Becoming a Registered Dietitian." Available from <http://www.eatright.org/becomeanrd.html>

American Dietetic Association. "State Professional Regulation." Available from <http://www.eatright.org/gov/st042500.html>

Obesity

Obesity, defined as a **body mass index** of 30 or greater, is an epidemic in the United States and other industrialized nations, and it is rapidly becoming one in developing nations. As countries transition to westernized lifestyles, obesity tends to increase. Obesity rates vary from as little as 2 percent in some Asian countries to as much as 75 percent in some Pacific nations. There are more than 300 million **obese** persons in the world, and more than 750 million **overweight** persons. In the United States, 34 percent of adults are overweight and 30.5 percent are obese. Between 1980 and 2000, the percentage of overweight children ages six to eleven doubled, from 7 percent to 15 percent, and the percentage of overweight adolescents ages twelve to nineteen tripled, from 5 percent to 16 percent (Ogden, et al.). In Europe, the thinnest country is Sweden, with about 10 percent obesity, while the fattest is Lithuania, with about 79 percent obesity. The sad fact is the **prevalence** of obesity appears to be increasing in all countries.

An obese person has a 50 to 100 percent increased risk of premature death compared to someone of normal weight. In the United States, more than 300,000 deaths a year are attributable to obesity. Obesity is associated with type 2 **diabetes**, **coronary heart disease**, **stroke**, **hypertension**,

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

obese: above accepted standards of weight for sex, height, and age

overweight: weight above the accepted norm based on height, sex, and age

prevalence: describing the number of cases in a population at any one time

diabetes: inability to regulate level of sugar in the blood

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

hypertension: high blood pressure

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

cancer: uncontrolled cell growth

osteoarthritis: inflammation of the joints

elevated blood **cholesterol**, some cancers (e.g., colon, endometrial, kidney, gallbladder, and postmenopausal breast **cancer**), **osteoarthritis**, gallbladder disease, and respiratory disease. In addition, obesity is often associated with discrimination and prejudice, causing some obese people to suffer poor self-esteem and reduced quality of life. The health care costs attributable to obesity exceed $100 billion a year in the United States, more than 6 percent of the total health care costs.

What Causes Obesity?

Obesity is caused by many factors. A person's weight is determined by a combination of **genes**, **metabolism**, behavior, culture, and **environment**. Genes and metabolism may help explain about 25 to 40 percent of body weight. However, a person's environment overwhelms the minor influences of biology. While genes may increase one's risk for obesity, they do not by themselves cause obesity. Genes certainly can't explain the rapidly increasing prevalence of obesity around the world.

gene: DNA sequence that codes for proteins, and thus controls inheritance

metabolism: the sum total of reactions in a cell or an organism

environment: surroundings

For most people, obesity results from eating too much and not being active enough. The overwhelming factors responsible for obesity are environmental. Modern Western society encourages poor diets and lack of exercise. For example, portion sizes continue to increase. Americans were eating about 200 more **calories** per day in 2003 than they were in 1993. **Fast-food** restaurants encourage customers to "super size" and purchase "value" meals. Many target children, using well-known movie stars and cartoon characters in their advertising. Further, people eat out more often than in the past and many restaurants offer huge portion sizes. Americans seem determined to get as much food as they can for their money.

calorie: unit of food energy

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

sedentary: not active

Television contributes to obesity through commercials urging people to buy food of low nutritional value, and by encouraging **sedentary** behavior. Many people tend to snack while watching television. Americans simply don't get enough physical activity. Less than one-third of American adults report that they do at least thirty minutes of brisk walking or other moderate activity on most days of the week, and almost half do no leisure-time activity at all. Almost half of U.S. high school students watch television more than two hours every day. This lack of physical activity is contributing to the increases in obesity and to other health-related conditions.

Treatment of Obesity

Weight loss in obese persons improves health. Weight losses of ten to twenty pounds have been shown to lower **blood pressure**, blood cholesterol, and blood **glucose** (in persons with type 2 diabetes), and to improve other health problems. An obese person does not have to lose fifty or a hundred pounds to realize health benefits, however, for even modest losses of weight can lead to major health benefits.

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

glucose: a simple sugar; the most commonly used fuel in cells

Diets

Reducing calories is one requirement for weight loss. Cutting only 100 extra calories a day from one's **diet** will lead to a weight loss of 10 pounds in a year, while cutting 500 calories a day will lead to a loss of 50 pounds in a year. Most health organizations recommend a specific distribution of calo-

diet: the total daily food intake, or the types of foods eaten

The Cost of Obesity

American spend more than $33 billion annually on weight loss, including low-calorie foods and fees at weight-loss clinics. A study estimated the health care cost of overweight and obesity to be $120 billion. This includes direct costs, such as doctor visits and medication, and indirect costs, such as wages lost by people too ill to work and the value of future earnings cut short by premature death. There are 63 million doctor visits per year related to obesity, and approximately 40 million workdays are lost.

—Paula Kepos

Joining a support group may help an obese person to lose weight. Losing weight can prevent a wide array of health problems that result from obesity and that generally lower the life expectancy of an obese person. *[Photograph by Carolyn A. McKeone. Photo Researchers, Inc. Reproduced by permission.]*

ries. For example, about 25 to 30 percent of total calories should be from **fat** (mainly unsaturated fat, such as olive oil, corn oil, and safflower oil), 15 percent from **protein**, and 50 to 60 percent from **carbohydrates** (mainly complex carbohydrates, such as fruits and vegetables). Recommended total calories should be based on height, weight, age, and activity level. A plant-based diet, consisting of an abundance of fresh vegetables and fruit and limited in calories, seems to be a healthful one for most people.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

Physical Activity

Burning only an extra 100 calories a day by walking briskly for about 20 minutes will lead to a weight loss of about 10 pounds a year, while burning an extra 300 calories by walking briskly for about 60 minutes a day will lead to a weight loss of about 30 pounds. Physical activity contributes to weight loss, decreases abdominal fat, increases cardiorespiratory fitness, and helps with maintenance of lost weight. Any **aerobic** exercise, such as swimming, bicycling, jogging, skiing, or dancing, leads to these benefits, but for most obese people brisk walking seems to be the easiest activity to do. Other forms of exercise, such as resistance training or lifting weights, can also be helpful in a weight loss program. Finding ways to be more active every day, such as walking up a flight of stairs rather than taking the elevator, or walking somewhere rather than driving, can help a person burn calories without much effort.

aerobic: designed to maintain adequate oxygen in the bloodstream

Combined Diet and Exercise

The combination of a reduced-calorie diet and increased physical activity will lead to better weight loss than either one done separately. Small changes in diet and physical activity done each day is the key to long-term, successful weight loss for most obese people. SEE ALSO BODY IMAGE; BODY MASS INDEX; CHILDHOOD OBESITY; FAD DIETS; FAST FOODS; OVERWEIGHT; WEIGHT LOSS DIETS; WEIGHT MANAGEMENT.

John P. Foreyt

Bibliography

Flegal, Katherine M.; Carroll, Margaret D.; Ogden, Cynthia L.; and Johnson, Clifford L. (2002). "Prevalence and Trends in Obesity among U.S. Adults, 1999–2000." *Journal of the American Medical Association* 288(14):1723–1727.

Foreyt, John P.; McInnis, Kyle J.; Poston, Walker S. C.; and Rippe, James M.; eds. (2003). *Lifestyle Obesity Management.* Malden, MA: Blackwell.

Ogden, Cynthia L.; Flegal, Katherine M.; Carroll, Margaret D.; and Johnson, Clifford L. (2002). "Prevalence and Trends in Overweight among U.S. Children and Adolescents, 1999–2000." *Journal of the American Medical Association* 288(14):1728–1732.

Poston, Walker S. C., and Foreyt, John P. (1999). "Obesity Is an Environmental Issue." *Atherosclerosis* 146:201–209.

Omega-3 and Omega-6 Fatty Acids

fatty acids: molecules rich in carbon and hydrogen; a component of fats

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

hormone: molecules produced by one set of cells that influence the function of another set of cells

prostaglandin: hormone that helps regulate inflammation and other tissue processes

hypertension: high blood pressure

arthritis: inflammation of the joints

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

cardiovascular: related to the heart and circulatory system

candidiasis: a yeast infection

eczema: skin disease causing itching and flaking

psoriasis: skin disorder characterized by red, dry, scaly skin

fat: type of food molecule rich in carbon and hydrogen, with high energy content

calorie: unit of food energy

legumes: beans, peas, and related plants

Fatty acids are organic compounds composed of carbon chains of varying lengths, with an acid group on one end and hydrogen bound to all the carbons of the chain. **Essential fatty acids** (EFAs) are those that are necessary for health, but cannot be synthesized by the body. Therefore, it is important to supply the body with EFAs through one's daily dietary intake. EFAs are also called *vitamin F* or *polyunsaturates.* They are important ingredients for the growth and maintenance of cells. The body utilizes essential fatty acids for **hormone** production, specifically for the production of **prostaglandins**, which aid in reducing **hypertension**, migraine headaches, and **arthritis**.

Essential fatty acids offer many positive effects for the body, including the nourishment of skin and hair; reduction of **blood pressure**, **cholesterol**, and **triglyceride** levels; prevention of arthritis and inflammation; and the reduction of the risk of **blood clotting**. Furthermore, essential fatty acids help protect the body from **cardiovascular** disease, **candidiasis**, **eczema**, and **psoriasis**, and they play a critical role in brain development and in the transmission of nerve impulses.

Types of EFAs

There are basically two types of essential fatty acids, *omega-3* fatty acids, also known as linolenic acids, and *omega-6* fatty acids, which are also called linoleic acids. The two types are distinguished by their chemical structures. Omega-3 EFAs are found in deepwater fish, fish oil, and some vegetable oils, such as canola, flaxseed, and walnut oil. Nuts are also a good source of *omega-3* fatty acids, particularly hazelnuts, almonds, pecans, cashews, walnuts, and macadamia nuts. The best fish oil sources are salmon, mackerel, anchovies, sardines, and herring, which have a high **fat** content and provide more omega-3 than other fish. Flaxseeds are also a good source, and they are low in saturated fats and **calories** and have no cholesterol. Omega-6 fatty acids are found in raw nuts, seeds, **legumes**, and in unsaturated vegetable oils, such as borage oil, grape seed oil, primrose oil, sesame oil, and soybean oil.

Benefits of EFAs

There are many health benefits attributable to essential fatty acids. Research has shown that diets rich in monounsaturated fatty acids, which contain the *omega-3* variety, reduce total mortality by 70 percent in patients who have

Omega-3 fatty acids have a balancing effect on omega-6 fatty acids. Both are essential nutrients, but they should be consumed in equal proportions. For Americans, that means substituting fish or nuts for fried foods once or more weekly. *[National Audubon Society Collection/Photo Researchers, Inc. Reproduced by permission.]*

already experienced a **heart attack**. This has led to a general recommendation to consume at least one meal a week of fish rich in *omega-3* fatty acids. It is generally accepted that *omega-3* fatty acids help to reduce the levels of triglycerides in the body, thus decreasing the risk of **heart disease**.

Omega-6 fatty acids have been shown to be beneficial in the reduction of cholesterol levels when they are substituted for saturated fats in a person's **diet**. The benefit in consuming *omega-6* fatty acids therefore lies in the fact that they reduce the **incidence** of coronary **artery** disease, which is a condition where excess cholesterol builds up on the arteries of the heart, eventually blocking the flow of blood and causing a heart attack. SEE ALSO FATS; HEART DISEASE; LIPID PROFILE.

Susan S. Kim
Jeffrey Radecki

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diet: the total daily food intake, or the types of foods eaten

incidence: number of new cases reported each year

artery: blood vessel that carries blood away from the heart toward the body tissues

Bibliography

Masley, Steven C. (1998). "Dietary Therapy for Preventing and Treating Coronary Artery Disease." *American Family Physician* 57:1299–1305. Also available from <http://www.aafp.org>

Sizer, Frances, and Whitney, Eleanor (2000). *Nutrition: Concepts and Controversies*, 8th edition. Stamford CT: Wadsworth/Thomson Learning.

Oral Health

Oral tissues, such as the gingiva (gums), teeth, and muscles of mastication (chewing muscles), are living tissues, and they have the same **nutritional requirements** as any other living tissue in the body. When adequate, nutritious food is not available, oral health may be compromised by nutrient-deficiency diseases, such as **scurvy**. In contrast, when food is freely available, as in many industrialized societies, oral health may be compromised by both the continual exposure of the oral **environment** to food and the presence of **chronic** diseases, such as **diabetes**. The **diet** not only affects the number and kinds of carious lesions (cavities), but also is an important factor in the development of periodontal disease (gum disease).

nutritional requirements: the set of substances needed in the diet to maintain health

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

environment: surroundings

chronic: over a long period

diabetes: inability to regulate level of sugar in the blood

diet: the total daily food intake, or the types of foods eaten

caries: cavities in the teeth

According to the U.S. Surgeon General's report, *Healthy People 2010*, dental **caries** have significantly declined in the United States since the early 1970s. However, it remains an important concern, especially in specific subgroups in the U.S. population. For example, 80 percent of dental caries in children's permanent teeth are concentrated in 25 percent of the child and adolescent population, particularly in individuals from low socioeconomic backgrounds.

Factors Affecting Nutrition and Oral Health

Sugar, particularly the frequent ingestion of sweets (cakes, cookies, candy), is related to both dental caries and periodontal disease. For example, populations with a frequent exposure to sugar, such as agricultural workers in sugar-cane fields (who may chew on sugar cane while they work), have a greater number of decayed, missing, and restored teeth. Sugar (**sucrose**), has a unique relationship to oral health. Sucrose can supply both the substrate (building blocks) and the **energy** required for the creation of dental **plaque** (the mesh-like scaffold of **molecules** that harbor **bacteria** on tooth surfaces). Sucrose also releases **glucose** during digestion, and oral bacteria can **metabolize** the glucose to produce organic acids. However, oral bacteria can also produce organic acids from foods other than sugar.

sucrose: table sugar

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

molecule: combination of atoms that form stable particles

bacteria: single-celled organisms without nuclei, some of which are infectious

glucose: a simple sugar; the most commonly used fuel in cells

metabolize: processing of a nutrient

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

malnutrition: chronic lack of sufficient nutrients to maintain health

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

Oral health may be related to many nutritional factors other than sugar, including the number of times a day a person eats or drinks, the frequent ingestion of drinks with low **acidity** (such as fruit juices and both regular and diet soft drinks), whether a person is exposed to fluoride (through fluoridated water, fluoridated toothpaste, or fluoride supplements), and whether an **eating disorder** is present. Not only can the diet affect oral health, but also oral health can affect eating patterns. This is particularly true in individuals with very poor oral health, who may not be able to chew without pain or discomfort. Older, *edentulous* (having no teeth) patients who have had a **stroke** with the accompanying chewing and swallowing problems may be at significant nutritional risk, particularly if they are living alone and on a limited income. Finally, **malnutrition** (both **undernutrition** and overnutrition) have specific effects on oral health.

Undernutrition and Oral Health

Although oral diseases associated with vitamin deficiencies are rare in the United States and other industrialized countries, they may be common in emerging "third-world" nations. In these countries, the limited supply of nutrient-dense foods or the lack of specific nutrients in the diet (vitamin C, **niacin**, etc.) may produce characteristic oral manifestations. In addition, unusual food practices, such as chewing sugar cane throughout the day or other regional or cultural nutritional practices, may decrease the oral health of specific populations.

niacin: one of the B vitamins, required for energy production in the cell

Vitamin-deficiency diseases may produce characteristic signs and symptoms in the oral cavity (mouth). For example, in a typical B-vitamin deficiency, a person may complain that the tongue is red and swollen and "burns" (*glossitis*), that changes in taste have occurred, and that cracks have appeared on the lips and at the corners of the mouth (angular cheilosis). In a vitamin C deficiency, petechiae (small, hemorrhaging red spots) may appear in the oral cavity, as well as on other parts of the body, especially after pressure has been exerted on the tissue. In addition, the gums may bleed upon probing with a dental instrument.

In humans, **calcium** deficiency rarely, if ever, causes the production of hypoplastic enamel (poorly mineralized enamel) similar to the **osteoporosis** produced in bone. Teeth appear to have a **biological** priority over bone when calcium is limited in the diet.

calcium: mineral essential for bones and teeth

osteoporosis: weakening of the bone structure

biological: related to living organisms

Oral health problems associated with **nutritional deficiencies** occur not only in populations with a limited food supply. Individuals whose chewing and swallowing abilities have been compromised by oral **cancer**, radiation treatment, or AIDS may also exhibit signs and symptoms of nutritional deficiencies.

nutritional deficiency: lack of adequate nutrients in the diet

cancer: uncontrolled cell growth

Overnutrition and Oral Health

The proliferation of foods high in **calories**, **fat**, sugar, and salt, and low in nutritional content—such as that found in **fast-food** restaurants and vending machines—has created a "toxic" food environment in many industrialized countries, and this has had an important impact on oral health. Oral bacteria have the ability to synthesize the acids that dissolve tooth enamel from many different types of foods, not just sugar. Frequency of eating is a major factor related to poor oral health in infants, as well as children and adults. *Baby bottle tooth decay*, also called *nursing bottle caries*, is a term that refers to the caries formed when an infant is routinely put to sleep with a bottle. *Breastfeeding caries* is a condition associated with the constant exposure of an infant's oral environment to breast milk, while *pacifier caries* occurs when a pacifier is dipped in honey prior to inserting the pacifier into an infant's mouth.

calorie: unit of food energy

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Both childhood and adult **obesity** are on the rise, and they have reached epidemic proportions in some countries. Obesity is traditionally associated with increased rates of non-insulin-dependent diabetes; elevations in **blood pressure**; and elevated **serum** glucose, blood **cholesterol**, and **triglycerides** (blood fat)—but it is also associated with decreased oral health status. For example, the number of servings of fruit juice and soft drinks ingested each

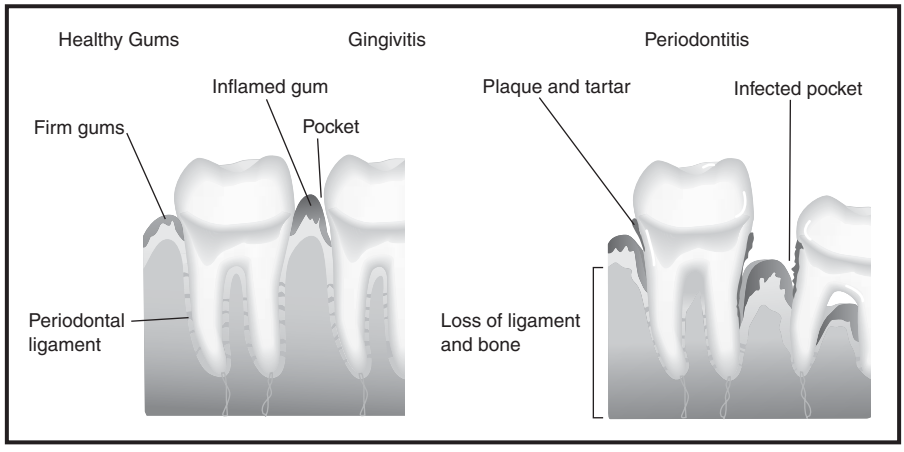
obesity: the condition of being overweight, according to established norms based on sex, age, and height

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

serum: non-cellular portion of the blood

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat



Oral diseases like gingivitis (left) and periodontitis (right) may result from overnutrition. When food consumption is excessive, or when the foods consumed are frequently sugary or acidic, the enamel on teeth can dissolve and gums can be infected. *[The Gale Group.]*

day is correlated not only with obesity in children, but also with increased caries. The American Academy of Pediatrics has warned parents on the overuse of fruit juices in children's diets.

Although diet soft drinks do not contain sugar, they do contain both carbonic and phosphoric acids and can directly destroy tooth enamel, particularly if the teeth are periodically exposed to a diet drink throughout the day. The direct demineralization of tooth enamel by regular and diet soft drinks has similarities to the demineralization of tooth enamel common in **anorexia** nervosa, in which forced regurgitation of food exposes lingual tooth surfaces (the side of the tooth facing the tongue) to stomach acids. In the case of enamel erosion produced by soft drinks and juices, effects are usually seen on all the tooth surfaces.

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

Fluoride and Oral Health

No discussion of nutrition and oral health would be complete without mentioning the role of the **micronutrient** fluoride. The addition of fluoride to the public drinking water supply is rated as one of the most effective preventive public health measures ever undertaken. Fluoride reduces dental caries by several different mechanisms. The fluoride ion may be integrated into enamel, making it more resistant to decay. In addition, fluoride may inhibit oral microbial **metabolism**, lowering the production of organic acids.

micronutrient: nutrient needed in very small quantities

metabolism: the sum total of reactions in a cell or an organism

The relationship of nutrition to oral health includes much more than a simple focus on sugar's relationship to caries. It includes factors such as an individual's overall dietary patterns, exposure to fluoride, and a person's systemic health. SEE ALSO Baby Bottle Tooth Decay; Breastfeeding; Fast Foods; Obesity.

Warren B. Karp

Internet Resources

American Dental Association. "Oral Health Topics." Available from <http://www.ada.org>

American Dietetic Association. "Position of the American Dietetic Assoication: Oral Health and Nutrition." Available from <http://www.eatright.com>

U.S. Department of Health and Human Services. "Healthy People 2010." Available from <http://www.health.gov/healthypeople>

Oral Rehydration Therapy

Oral rehydration therapy (ORT) involves the replacement of fluids and **electrolytes** lost during an episode of diarrheal illness. Diarrheal illnesses are pervasive worldwide, and they have a particularly large impact in the developing world. Children under the age of five are the major victims and account for over 3 million deaths a year due to **dehydration** associated with diarrheal illness. The World Health Organization (WHO) estimates that over one million deaths are prevented annually by ORT. An oral rehydration solution (ORS) is the cornerstone of this treatment. Between 90 and 95 percent of cases of **acute**, watery diarrhea can be successfully treated with ORT.

electrolyte: salt dissolved in fluid

dehydration: loss of water

acute: rapid-onset and short-lived

Ancient civilizations in India and China made use of sugar and starch solutions to treat dehydration. Oral rehydration solutions make use of the ability of **glucose** to increase the resorption of fluids and salts into the intestinal wall. The current understanding of ORT was developed in 1968 by researchers responding to a **cholera** epidemic that began in 1958 in Bangladesh. **Intravenous** rehydration was inaccessible to much of the population that diarrhea affected, and it was found that oral rehydration solutions could replace such treatment cheaply and effectively. Most importantly, it was easily accessible in the form of prepackaged or homemade solutions.

glucose: a simple sugar; the most commonly used fuel in cells

cholera: bacterial infection of the small intestine causing severe diarrhea, vomiting, and dehydration

intravenous: into the veins

WHO and UNICEF are the principal sponsors of global rehydration projects. These projects involve the development and distribution of prepackaged solutions, combined with education efforts for instruction in home preparation and delivery. There is some variation among packaged solutions, but the principle ingredients are glucose, sodium, and potassium. The UNICEF recipe for a simple homemade solution contains five cupfuls of boiled water, eight teaspoons of sugar, and one teaspoon of salt, resulting in one liter of solution. Double-sided measuring spoons have also been distributed to standardize measurement. In addition, fruit juices, coconut water, and other indigenous solutions can adequately approximate ORS.

Oral rehydration therapy has increased in use since its development, and it has potential for even greater use. However, severe cases of dehydration continue to need supervised medical care. SEE ALSO DEHYDRATION; DIARRHEA; MALNUTRITION; UNITED NATIONS CHILDREN'S FUND (UNICEF).

Seema Pania Kumar

Bibliography

Agency for International Development (1988). *Oral Rehydration Therapy: A Revolution in Child Survival.* Weston, MA: Oegeschlager, Gunn & Hain.

Semba, Richard, and Bloem, Martin (2001). *Nutrition and Health in Developing Countries.* Totowa, NJ: Humana Press.

Internet Sources

Rehydration Project. Available from <http://rehydrate.org>

Organic Foods

In response to a need to standardize the use of such terms as *organic* and *natural*, the U.S. Congress passed the Organic Foods Production Act of

Advantages of Organically Grown Foods

- Less artificial or synthetic pesticides, herbicides, fertilizer, and hormone residue.
- May contain higher concentration of nutrients and phytochemicals.
- May taste better.
- Environmental advantages, such as enhanced soil fertility, higher biodiversity, and increased water conservation.
- Decreased energy input for production.
- May have higher animal welfare standards.

Disadvantages of Organic Foods

- More expensive.
- May be fertilized with manure or sewage containing potentially harmful organisms.
- May have undesirable appearance.
- May be cross-contaminated with chemicals from other farms (also a risk with conventionally grown foods).
- Lower crop yield.
- Uncertainty over long-term sustainability of crop.

ecological: related to the environment and human interactions with it

biodiversity: richness of species within an area

biological: related to living organisms

drugs: substances whose administration causes a significant change in the body's function

hormone: molecules produced by one set of cells that influence the function of another set of cells

1990, which established the U.S. National Organic Standards Board (NOSB). In 1995, the NOSB defined *organic agriculture* as "an **ecological** production management system that promotes and enhances **biodiversity**, **biological** cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony." Organic production uses "materials and practices that enhance the ecological balance of natural systems and that integrate the parts of the farming system into an ecological whole," though such practices "cannot ensure that products are completely free of residues" of pesticides, herbicides, and other additives or contaminants. However, "methods are used to minimize pollution from air, soil, and water. Organic food handlers, processors, and retailers adhere to standards that maintain the integrity of organic agricultural products. The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people" (NOSB).

Certification and Labeling of Organic Foods

According to regulations set forth by the United States Department of Agriculture (USDA), organic foods must come from farms or ranches certified by a state or private agency that has been accredited by the USDA. Foods labeled "100 percent organic" must contain only organically produced ingredients, excluding water and salt. Foods labeled "organic" must contain, by weight, at least 95 percent organically produced ingredients. Products meeting these requirements must display these terms on their principal display panel and may use the USDA seal and the seal or mark of certifying agents on packages and in advertisements. Foods labeled "made with organic ingredients" must contain, by weight, at least 70 percent organic ingredients. Up to three separate organic ingredients may be listed on the principal display label, and a certifying agent's seal or mark may be used on the package. The use of a USDA seal is prohibited, however. Livestock can be certified "organic" if they have been raised on organic foodstuffs for over one year.

Other labeling provisions include:

- Packaging of any product labeled "organic" must state the actual percentage of organic ingredients and use the word "organic" to modify each organically produced ingredient.
- The name and address of the certifying agent must be displayed on the label's information panel.
- There are no restrictions on the use of truthful labeling claims, such as "pesticide free," "no **drugs** or growth **hormones** used," or "sustainably harvested."
- Products made with less than 50 percent organic ingredients may make no claim other than designating specific organic ingredients with the ingredient information.

Over ninety private organizations and state agencies (certifying agents) currently accredit farms that produce organic food, but standards for growing and labeling organic food may differ. For example, different agencies may permit or prohibit the use of specific natural pesticides or fertilizers in growing organic food. In addition, some of the language contained on seals, labels, and logos approved by organic certifiers may differ.

Science has not proven any nutritional difference between organically grown foods and conventionally grown foods. However, the methods employed by organic farmers may be more sustainable in the long term than conventional farming. *[Photograph by Robert J. Huffman. Field Mark Publications. Reproduced by permission.]*

The Market for Organic Foods

The global market for organic foods is expected to expand from $26 billion in 2001 to $80 billion in 2008. The greatest market growth has been in the European Union, where market revenues were forecast to expand by a third in 2001 to reach $12 billion, largely due to growth in Germany, Italy, France, and the United Kingdom. In all these countries, except the United Kingdom, growth has resulted from organic foods moving into mainstream marketing channels and from increased consumer interest. Japan is the third largest market for organic foods and accounts for the bulk of Asian organic market revenues. High growth is also occurring in Singapore, Hong Kong, and Taiwan, though these markets remain much smaller than the Japanese market.

The U.S. organic foods marketplace reached $6.95 billion in sales in 2001, up 19 percent from 2000. Sales are expected to increase in the United States, reaching $20 billion by 2008. The largest market for organic products worldwide is in fresh produce. Other popular organic foods include soy foods, meat, poultry, eggs, and meat and dairy alternatives.

Fresh produce is the top-selling organic food, but organic dairy products are rapidly gaining popularity. Organic foods can be significantly more expensive than their conventionally grown counterparts, and research has not proven that health reasons alone justify their cost. *[AP/Wide World Photos. Reproduced by permission.]*

nutrient: dietary substance necessary for health

fat: type of food molecule rich in carbon and hydrogen, with high energy content

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

fiber: indigestible plant material which aids digestion by providing bulk

cancer: uncontrolled cell growth

Safety and Nutritional Value of Organic Foods

The **nutrient** content of plants is determined primarily by heredity, and organic foods generally contain no less **fat** or sodium, or more **vitamins**, **minerals**, or **fiber**, than the same food grown using conventional methods.

However, organic farming methods can enhance soil fertility, resulting in an increased concentration of some minerals and phtyochemicals in organic food. Organic food cannot be guaranteed pesticide-free, though organic farmers use only naturally occurring pesticides such as sulfur, copper, nicotine, and *Bacillus thuringiensis* (a naturally occurring bacterial disease of insects). Organic foods may contain pesticide residues that have drifted from farm to farm, or residual pesticides found in soil or water, though the amounts of such residues are certainly greater in conventionally produced foods, where pesticides are directly applied to the crops.

Furthermore, there is no evidence of consistent differences in appearance, flavor, or texture between organic foods and conventionally produced foods. Organic foods may be more susceptible to microbiological contamination. Several food-borne illness outbreaks resulting from *Salmonella enteriditis*, *Listeria monocytogenes*, and *E. coli* O157:H7 have been associated with consumption of organically grown produce.

Organic foods can be more costly than conventionally grown foods. The USDA Economic Research Service, in *USDA/ERS Food Cost Review 1950–97*, reports that in 1995 an average American household with two parents and two children spent $6,992 on food. Purchasing only organic foods would increase total food costs by $4,000 to $10,977 per year. However, as the organic market grows, the cost is likely to continue to drop.

Organic agriculture is generally seen to be environmentally friendly. Organic agriculture decreases the amount of nitrogen-containing chemicals that seep into groundwater supplies, decreases soil deterioration via crop rotation, and minimizes exposure of farm workers and livestock to potentially harmful compounds. However, use of animal manures may increase the risk of food-borne illness, and a dependence on nitrogen-fixing, green-manure crops uses large amounts of land. On the other hand, these methods can make nutrients more available to subsequent crops, increase crop productivity, and conserve water resources.

Many kinds of pesticides, including insecticides and herbicides, are commonly used in producing and marketing the food supply. High doses of some of these chemicals have been shown to cause **cancer** in laboratory animals, though the low concentrations found in some foods are generally well within established limits. Environmental pollution by slowly degrading pesticides can lead to food-chain bioaccumulation and persistent residues in body fat. These residues may increase the risk for certain cancers. Studies have shown that concentrations in tissues are low, and the evidence has not been conclusive. Continued research regarding pesticide use is therefore essential to insure food safety, improved food production, and reduced environmental pollution.

Sensible food practices can significantly reduce pesticide residue on foods. Such practices include washing and scrubbing fresh produce under running water, peeling and trimming produce when possible, removing the outer leaves of leafy vegetables, and trimming fat from meat and skin from

poultry and fish. Eating a variety of foods from a variety of sources will reduce the likelihood of exposure to a single pesticide.

Organic foods are produced with ecologically based practices, such as biological pest management and composting. To be labeled "organic," foods must have been produced on certified organic farms and conform to established labeling requirements. From a scientific viewpoint, organic foods are no safer or nutritious than conventionally produced foods. Most major health organizations maintain that the health benefits of consuming a **diet** rich in fruits, vegetables, and whole grains significantly outweigh any health risk from residual pesticide, herbicide, or fertilizer consumption. According to the American Institute for Cancer Research, there is no convincing evidence that eating foods containing **trace** amounts of chemicals such as fertilizers, pesticides, herbicides, and drugs used on farm animals increases the risk for cancer. Organic agriculture provides consumers with an additional choice when purchasing food, however, and also provides some assurance of where a food was produced and how it was produced. SEE ALSO FOOD LABELS; FOOD SAFETY; VEGETARIANISM.

diet: the total daily food intake, or the types of foods eaten

trace: very small amount

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Berlau, John (1999). "The Risky Nature of Organics: Growing Produce in Manure Raises Concerns." *Investor's Business Daily*, March 3.

Bourn, D., and Prescott, J. (2002). "A Comparison of the Nutritional Value, Sensory Qualities, and Food Safety of Organically and Conventionally Grown Produced Foods." *Critical Reviews in Food Science and Nutrition* 42(1):1–34.

Hartman Group (2000). *Organic Lifestyle Shopper Study: Mapping the Journey of Organic Consumers.* Bellevue, WA: Author.

Williams, P. R., and Hammitt, J. K. (2001). "Perceived Risks of Conventional and Organic Produce: Pesticides, Pathogens, and Natural Toxins." *Risk Analysis* 21(2):319–330.

Internet Resources

Elitzak, Howard (1999). "USDA/ERS Food Cost Review 1950–97." Available from <http://www.ers.usda.gov/publications/aer780/>

National Organic Standards Board. "National Organic Program." Available from <http://www.ams.usda.gov/nosb>

Nutrition Business Journal (2001). "Organic Foods Report 2001." Available from <http://www.nutritionbusiness.com>

Organisms, Food-Borne

Food-borne organisms are **bacteria**, **viruses**, and **parasites** that can cause illnesses which are either infectious or toxic in nature. They enter the body through the ingestion of contaminated food or water. Every person is at risk of food-borne illness, although infants, the elderly, the **immunocompromised**, and the **malnourished** are particularly at risk. Food-borne illness may be mild, seriously debilitating, or even fatal. Illness is typically characterized by diarrhea, vomiting, or both, but it can also involve other parts of the body, such as the central **nervous system**. Food-borne illness outbreaks most often result from inadequate cooking, inadequate holding temperatures, cross-contamination, unsafe food sources, and poor personal **hygiene**.

bacteria: single-celled organisms without nuclei, some of which are infectious

virus: noncellular infectious agent that requires a host cell to reproduce

parasite: organism that feeds off other organisms

immunocompromised: having a weakened immune system

malnourished: lack of adequate nutrients in the diet

nervous system: the brain, spinal cord, and nerves that extend throughout the body

hygiene: cleanliness

Mad Cow and Creutzfeldt-Jakob

New variant Creutzfeldt-Jakob disease (vCJD) is a rare, fatal brain disorder that is contracted by eating meat from cows infected with bovine spongiform encephalopathy (BSE, or "mad cow disease"). The disease has an incubation period lasting years or decades and has no known cure. As of December 2003, 153 cases of vCJD had been reported worldwide, the vast majority of which were in people who had lived in the United Kingdom during a BSE epidemic that lasted from 1980 to 1996. In 2003 a cow with BSE was discovered in the United States for the first time.

—Paula Kepos

Magnitude of Food-Borne Illness

Most of the available food-borne illness data is from industrialized nations, but the situation in poorer nations is probably worse. Developing countries may not have the resources needed to identify and document food-borne illness outbreaks, or outbreaks may go unreported in an effort to prevent negative publicity, which could affect a nation's tourism and trade industries.

Food-borne illnesses are a widespread and growing public health problem, both in developed and developing countries. The global **incidence** of food-borne illness is difficult to estimate, but it has been reported that, in 1998 alone, 2.2 million people, including 1.8 million children, died from diarrheal diseases, with a great proportion of these cases attributed to contaminated food and drinking water. Furthermore, diarrhea is a major cause of **malnutrition** in infants and young children.

In industrialized countries, the percentage of people suffering from food-borne illness each year has been reported to be as high as 30 percent. In the United States, for example, around 76 million cases of food-borne illness, resulting in 325,000 hospitalizations and 5,000 deaths, are estimated to occur each year. According to the U.S. Department of Agriculture, just seven food-borne organisms cause between 3.3 million and 12.3 million cases, and between 3,000 and 9,000 deaths, each year. While less well documented, developing countries bear the brunt of the problem due to the presence of a wide range of food-borne illness, including those caused by parasites and underlying food-safety problems.

Food contamination creates an enormous social and economic burden on communities and their health systems. In the United States, illness caused by the major **pathogens** alone are estimated to cost up to $37.1 billion annually in medical costs and lost productivity. The cost of food-borne illness in Australia is estimated at about $487 million to $1.9 billion per year. The re-emergence of **cholera** in Peru in 1991 resulted in the loss of $700 million in fish and fishery-product exports.

Historical Outbreaks

Food-borne illnesses emerge as a result of several factors. These include the **globalization** of the food supply, the inadvertent introduction of pathogens into new geographic areas, individual or group exposure to unfamiliar food-borne hazards while abroad, evolution of **microorganisms**, increases in the immunocompromised human population (those who are aging, HIV positive, or malnourished), and increases in the numbers of people eating away from home.

Food-borne illness outbreaks can take on massive proportions. In 1988, for example, an outbreak of **hepatitis** A resulting from the consumption of contaminated clams affected some 300,000 individuals in China. In 1994 an outbreak of **salmonellosis** due to contaminated ice cream occurred in the United States, affecting an estimated 224,000 persons. In 1996 an outbreak of **Escherichia coli** O157:H7 in Japan affected over 6,300 school children and resulted in two deaths. Outbreaks of **listeriosis** have been reported in many countries, including Australia, Switzerland, France, and the United States (outbreaks in France in 2000 and in the United States in 1999 were caused by contaminated pork tongue and hot dogs, respectively). As of

incidence: number of new cases reported each year

malnutrition: chronic lack of sufficient nutrients to maintain health

pathogen: organism that causes disease

cholera: bacterial infection of the small intestine causing severe diarrhea, vomiting, and dehydration

globalization: development of worldwide economic system

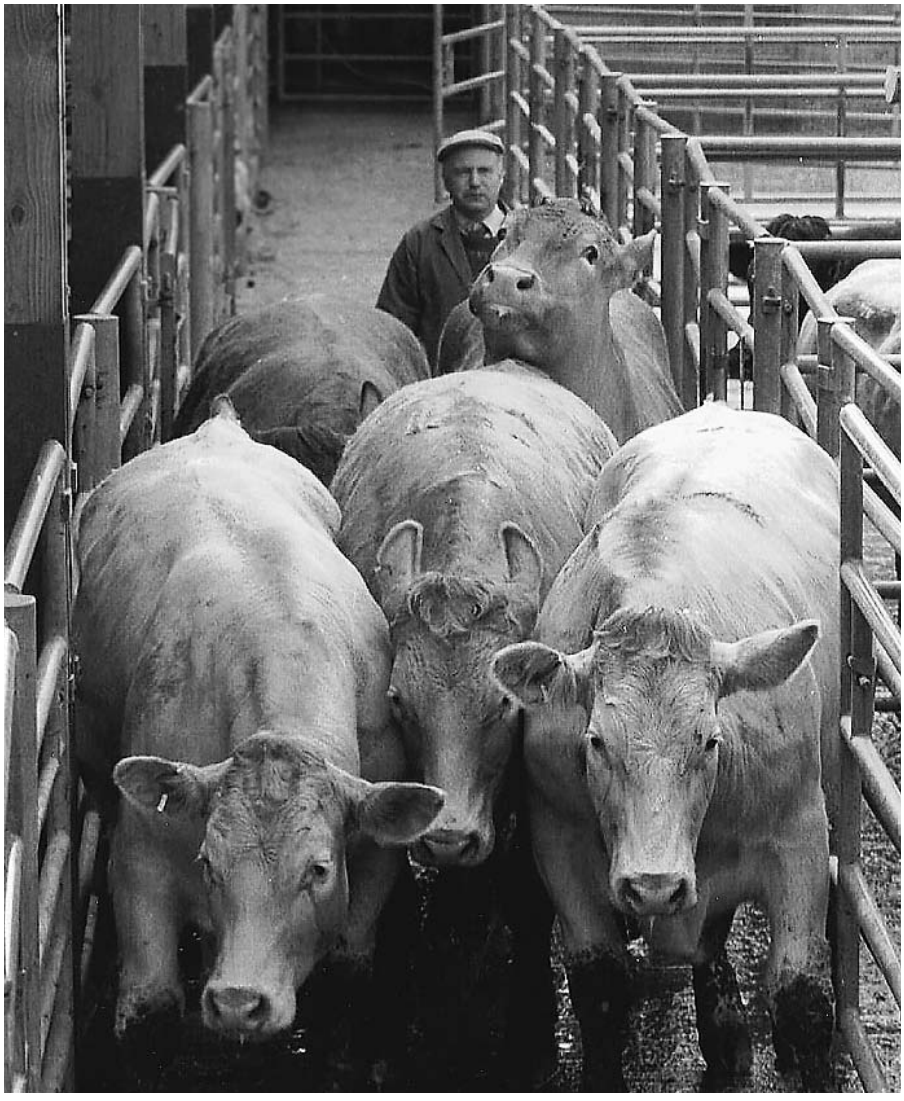
microorganisms: bacteria and protists; single-celled organisms

hepatitis: liver inflammation

salmonellosis: food poisoning due to Salmonella bacteria

Escherichia coli: common bacterium found in human large intestine

listeriosis: infectious disease caused by Listeria bacteria



In December 2003, the USDA announced a recall of 10,410 pounds of beef that may have been exposed to the tissues of an animal that suffered from bovine spongiform encephalopathy, or so-called "mad cow disease." The recall generated a sensational response, even though other food-borne illnesses present a far greater danger to U.S. consumers. *[AP/Wide World Photos. Reproduced by permission.]*

January 2002, 119 people had developed variant Creutzfeldt-Jakob disease (the human variant of mad cow disease) secondary to exposure to infected animal products. Most of those cases were in Great Britain, but five cases were reported in France.

Types of Food-Borne Pathogens

Bacteria causing food-borne illness include *Escherichia coli* O157:H7, *Campylobacter jejuni*, *Salmonella*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Clostridium perfringens*, *Vibrio parahaemolyticus*, *Vibrio vulnificus*, and *Shigella*. Bacteria are responsible for more cases of food-borne illness than any other organisms. Food can be contaminated with vegetative bacteria as well as spores. Vegetative bacteria can be reduced in food by proper sanitation and cooking techniques. When conditions become ideal for growth, bacterial spores germinate and reproduce rapidly and produce **toxins**, which result in illness.

toxins: poisons

Viruses, such as hepatitis A virus and Norwalk virus, can also cause food-borne illness. Viruses require a living host (human or animal) to grow and reproduce; they do not multiply in foods. However, a susceptible individual

MICROORGANISMS RESPONSIBLE FOR COMMON FOOD–BORNE ILLNESS

Microorganism	Food–borne illness	Symptoms	Common food sources	Incubation
Bacillus cereus	Intoxication	Watery diarrhea and cramps, or nausea and vomiting	Cooked product that is left uncovered —milk, meats, vegetables, fish, rice, and starchy foods	0.5–15 hours
Campylobacter jejuni	Infection	Diarrhea, perhaps accompanied by fever, abdominal pain, nausea, headache, and muscle pain	Raw chicken, other foods contaminated by raw chicken, unpasteurized milk, untreated water	2–5 days
Clostridium botulinum	Intoxication	Lethargy, weakness, dizziness, double vision, difficulty speaking, swallowing, and/or breathing; paralysis; possible death	Inadequately processed, home-canned foods; sausages; seafood products; chopped bottled garlic; kapchunka; molona; honey	18–36 hours
Clostridium perfringens	Infection	Intense abdominal cramps, diarrhea	Meats, meat products, gravy, Tex-Mex type foods, other protein-rich foods	8–24 hours
Escherichia coli group	Infection	Watery diarrhea, abdominal cramps, low-grade fever, nausea, malaise	Contaminated water, undercooked ground beef, unpasteurized apple juice and cider, raw milk, alfalfa sprouts, cut melons	12–72 hours
Listeria Monocytogenes	Infection	Nausea, vomiting, diarrhea; may progress to headache, confusion, loss of balance and convulsions; may cause spontaneous abortion	Ready-to-eat foods contaminated with bacteria, including raw milk, cheeses, ice cream, raw vegetables, fermented raw sausages, raw and cooked poultry, raw meats, and raw and smoked fish	Unknown; may range from a few days to 3 weeks
Salmonella species	Infection	Abdominal cramps, diarrhea, fever, headache	Foods of animal origin; other foods contaminated through contact with feces, raw animal products, or infected food handlers. Poultry, eggs, raw milk, meats are frequently contaminated.	12–72 hours
Shigella	Infection	Fever, abdominal pain and cramps, diarrhea	Fecally contaminated foods	12–48 hours
Staphylococcus aureus	Intoxication	Nausea, vomiting, abdominal cramping	Foods contaminated by improper handling and holding temperatures—meats and meat products, poultry and egg products, protein-based salads, sandwich fillings, cream-based bakery products	1–12 hours
Hepatitis A	Infection	Jaundice, fatigue, abdominal pain, anorexia, intermittent nausea, diarrhea	Raw or undercooked molluscan shellfish or foods prepared by infected handlers	15–50 days
Norwalk-type viruses	Infection	Nausea, vomiting, diarrhea, abdominal cramps	Shellfish grown in fecally contaminated water; water and foods that have come into contact with contaminated water	12–48 hours
Giardia lamblia	Infection	Diarrhea, abdominal cramps, nausea	Water and foods that have come into contact with contaminated water	1–2 weeks
Trichinella spiralis	Infection	Nausea, diarrhea, vomiting, fatigue, fever, abdominal cramps	Raw and undercooked pork and wild game products	1–2 days

only needs to ingest a few viral particles to become ill. Frequent and proper handwashing is the most effective way to control the spread of food-borne viruses.

Parasites such as *Giardia lamblia*, *Cyclospora cayetanensis*, and *Cryptosporidium parvum* are another origin of food-borne illness. Parasites are small or microscopic creatures that, like viruses, require a living host to survive. **Parasitic** infection is far less common than bacterial or viral food-borne illness.

parasitic: feeding off another organism

Other food-borne organisms include naturally occurring toxins such as mycotoxins, marine **biotoxins**, cyanogenic glycosides (compounds that can form cyanide when ingested), and toxins occurring in poisonous mushrooms. These can all cause severe illnesses. Mycotoxins, such as aflatoxin and ochratoxin A, are found at measurable levels in many staple foods, and the health

biotoxin: poison made by living organisms

implications of long-term exposure to such toxins are poorly understood. Although not considered food-borne organisms, cleaning solutions, some **food additives**, pesticides, herbicides, and heavy metals may also cause illness associated with ingestion of contaminated food.

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

Prevention of Food-Borne Illness at Home and in Institutions

The World Health Organization has issued ten guidelines for developing culture-specific food-safety education:

1. Choose foods processed for safety, such as pasteurized dairy products and juices, or meat and poultry treated with ionizing radiation.
2. Cook food thoroughly—cook roasts to 145°F, ground beef to 160°F, and poultry to 180°F. Cook eggs until yolks and whites are firm. Use a meat thermometer.
3. Eat cooked foods immediately—food-borne organisms reproduce rapidly as food cools to room temperature.
4. Store cooked foods carefully—cooked foods should be held below 40°F or above 140°F.
5. Reheat cooked foods thoroughly—reheat all cooked foods to 165°F.
6. Avoid contact between raw foods and cooked foods—contact surfaces include cutting boards, utensils, and hands.
7. Wash hands repeatedly. Washing hands with warm water and soap before handing foods, after every interruption, and between handling raw and cooked foods is the most effective way to prevent food-borne illness.
8. Keep all kitchen surfaces meticulously clean—every food scrap, crumb, or dirty spot is a potential reservoir for organisms.
9. Protect foods from pests. Insects, rodents, and other animals frequently carry organisms that can cause food-borne illness.
10. Use safe water. If there is any doubt of the safety of the water supply, boil water before drinking it, using it in food preparation, or making ice.

The Hazard Analysis Critical Control Point (HACCP) system is used by institutions to anticipate and prevent food safety violations before they occur. HACCP flowcharts allow food managers to identify the critical control points, which are operations (practice, preparation step, or procedure) in the production of a food, and to make corrections as needed to prevent or eliminate hazards, or reduce them to acceptable levels. HACCP recipes provide detailed guidelines to food-service workers, and records assist health department personnel as they perform routine inspections of a facility. SEE ALSO ADDITIVES AND PRESERVATIVES; FOOD SAFETY; ILLNESSES, FOOD-BORNE; PESTICIDES.

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Cody, Mildred, and Kunkel, M. Elizabeth (2002). *Food Safety for Professionals*, 2nd edition. Chicago: American Dietetic Association.

Marriott, Norma G. (1999). *Principles of Food Sanitation*, 4th edition. Gaithersburg, MD: Aspen.

McSwane, David; Rue, Nancy; and Linton, Richard (1998). *Essentials of Food Safety and Sanitation.* Upper Saddle River, NJ: Prentice Hall.

Scott, Elizabeth, and Sockett, Paul (1998). *How to Prevent Food Poisoning: A Practical Guide to Safe Cooking, Eating, and Food Handling.* New York: John Wiley.

World Health Organization (2002). *Emerging Foodborne Diseases.* Geneva: Author.

Osteomalacia

osteomalacia: softening of the bones

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

calcium: mineral essential for bones and teeth

phosphorus: element essential in forming the mineral portion of bone

metabolism: the sum total of reactions in a cell or an organism

absorption: uptake by the digestive tract

bowel: intestines and rectum

lactose intolerance: inability to digest lactose, or milk sugar

malaise: illness or lack of energy

osteoporosis: weakening of the bone structure

incidence: number of new cases reported each year

Osteomalacia is a disease in which insufficient mineralization leads to a softening of the bones. Usually, this is caused by a deficiency of **vitamin D**, which reduces bone formation by altering **calcium** and **phosphorus metabolism**. Osteomalacia can occur because of reduced exposure to sunlight (which, after touching the skin, causes the body to make vitamin D), insufficient intake of vitamin D–enriched foods (like vitamin D–fortified milk), or improper digestion and **absorption** of food with vitamin D (as in **bowel** disorders such as **lactose intolerance** or celiac disease).

This disease causes the bending and misshaping of bones, such as bowlegging of the lower limbs, and is called rickets when it occurs in children. Affected children are usually listless and irritable. Symptoms in adults are often delayed until the disorder has advanced. These include easy fatigability, **malaise**, diffuse bone pain, and spasms. Muscular weakness occurs in severe cases. Osteomalacia should not be confused with **osteoporosis**, which is a disease of normal mineralization but decreased amounts of bone.

Osteomalacia can be diagnosed by blood and urine tests and confirmed by bone biopsy and X-rays. Treatment consists of oral doses of vitamin D, calcium, and phosphorus as well as increased exposure to ultraviolet light.

The easy availability of vitamin D–fortified milk has reduced the **incidence** of osteomalacia in developed countries to 0.1 percent. In areas with high levels of vegetarianism, such as in Asia, the incidence has been reported to be nearly 15 percent. Vitamin D, a fat-soluble vitamin, while not readily found in vegetables, is available in cheese, butter, cream, fish, oysters, fortified milk, and fortified cereals. SEE ALSO CALCIUM; OSTEOPOROSIS; RICKETS; VITAMINS, FAT-SOLUBLE.

Chandak Ghosh

Internet Resources

WebMD Health. "Osteomalacia." Available from <http://www.my.webmd.com>

University of Washington, Department of Medicine. "Osteoporosis and Bone Physiology: Osteomalacia." Available from <http://courses.washington.edu/bonephys/>

Osteopenia

osteoporosis: weakening of the bone structure

Osteopenia is defined as the stage of low bone density that precedes **osteoporosis**. At this stage, bone density is below average but not as low as occurs with osteoporosis. The World Health Organization formed a committee in 1994 to define osteoporosis, and four categories were defined: normal, osteopenia, osteoporosis, and established osteoporosis. All of these categories are measured by bone density and the prevalence of fractures. In osteopenia,

bone density falls between one standard deviation and 2.5 standard deviations below average. Risk factors include age, race, and ethnicity, and the use of **hormones**. Although treatment for osteopenia is largely affected by age and the presence of fractures, women between the ages of fifty and seventy can prevent it by taking **estrogen** with **calcium** and exercising regularly.

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

calcium: mineral essential for bones and teeth

According to the National Osteoporosis Foundation, approximately 10 million women and 2 million men in the United States have osteoporosis. Men have bones that are much larger and stronger than women's bones, which is why women suffer from the condition more often than men. However, both men and women share similar risk factors for osteoporosis (e.g., prolonged exposure to certain medications, **chronic** diseases that affect vital organs, undiagnosed low levels of **testosterone**, lifestyle habits, age, heredity, race), so methods of intervention are similar. SEE ALSO CALCIUM; OSTEOMALACIA; OSTEOPOROSIS; RICKETS; VITAMINS, FAT-SOLUBLE.

chronic: over a long period

testosterone: male sex hormone

Daphne C. Watkins

Internet Resources

Simmons, Sandra. "Common Myths about Osteopenia." Available from <http://www.ctds.info/osteopenia-2.html>

National Osteoporosis Foundation. "Osteoporosis: What Is It?" Available from <http://www.nof.org>

Osteoporosis

Osteoporosis, which is characterized by a decrease in the mass of otherwise normal bone is the most common **metabolic** bone disease. Normal bone is made of a hard outer shell (the cortex) and an inner network of spicules (fibers), called trabeculae, that give bone its characteristic strength. Bone mass is maintained at a progressive and then constant level until around the age of thirty-five. This maintenance is accomplished through bone remodeling, a cycle of breaking down and building up of bone. This cycle is controlled by **osteoblast** cells, which make bone, and osteoclast cells, which destroy bone. Beginning around age forty, the rate at which bone breaks down can exceed that at which it is built, resulting in diminished mass and a diminished amount of **calcium** in the bone. For women, in addition to this normal age-related bone loss, **menopause** and its subsequent reduction in female **hormone** levels (specifically **estrogen**) cause a specific loss in cortical and trabecular bone. In those who develop osteoporosis, the reduction in cortical and trabecular bone can be up to 30-40 percent, resulting in fragile bones that are prone to fracture.

osteoporosis: weakening of the bone structure

metabolic: related to processing of nutrients and building of necessary molecules within the cell

osteoblast: cell that forms bone

calcium: mineral essential for bones and teeth

menopause: phase in a woman's life during which ovulation and menstruation end

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

Several factors contribute to the development of osteoporosis. Smoking, alcohol, and a **sedentary** lifestyle have all been shown to increase the risk of developing the disorder. Age and gender are also contributory factors. Women who have low estrogen levels (e.g., after menopause) are more likely to develop osteoporosis than others. Also, men generally maintain a higher bone density than women, making them less susceptible to the condition. Race can also play a role. Africans and people of African descent, for example, have a naturally higher bone density than Europeans and people of European descent and are therefore less likely to develop osteoporosis. A family history of osteoporosis certainly predisposes an individual to the

sedentary: not active

An elderly woman exhibits a dowager's hump, which is one symptom of osteoporosis. The hump is caused by repeated compression fractures of weakened vertebrae, which cause the upper spine to curve forward. *[© Lester V. Bergman/Corbis. Reproduced by permission.]*

gene: DNA sequence that codes for proteins, and thus controls inheritance

steroid: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

stress: heightened state of nervousness or unease

chronic: over a long period

phosphorus: element essential in forming the mineral portion of bone

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

condition, and research is currently underway to identify **genes** linked to it. Other risk factors include long-term **steroid** therapy, Cushing's disease, hyperparathyroidism, and hyperthyroidism.

Traditionally, low intake of calcium and **vitamin D**, both of which are essential to bone building and maintenance, have been associated with osteoporosis as well. However, the role of dietary calcium remains controversial. Countries in Europe and North America, where the dietary intake of calcium is adequate, still show very high rates of osteoporosis. Studies have shown that high-protein diets, like those found in Europe and North America, raise the body's calcium requirement, thereby creating a calcium deficit in some.

One of the difficulties in understanding and managing osteoporosis is that its signs and symptoms are not apparent until the late stages of the disease, and many people with the osteoporosis are not diagnosed or treated until a fracture occurs. Hip and wrist fractures are very common, and vertebral compression fractures can occur with as little **stress** as that from sneezing or bending. These compressions can cause **chronic** backaches or cause patients to seemingly "lose height" as the vertebrae progressively curve into what is known as the "dowager's hump." Fractures also occur in the ribs, pelvis, and humerus (upper arm bone). Hip fractures can be the most devastating, often leading to death or long-term disability.

The most commonly used method to diagnose osteoporosis is to measure bone mineral density using dual energy X-ray absorbitometry (DEXA scans). This test is performed routinely in people who have risk factors or a prior diagnosis of osteoporosis. Density is usually measured in the lower spine or the hip, and the procedure is noninvasive and well tolerated. Quantitative CT (computerized tomography) scans and densitometry are also used, though less commonly. Blood levels of calcium, **phosphorus**, and parathyroid hormone—three hormones directly involved in bone building and remodeling—are usually normal. A more recent test that measures calcium excretion in urine may prove to be a helpful way of identifying risks for osteoporosis.

Early intervention and treatment of osteoporosis can halt or slow its progress. In some cases treatment can even reverse changes in bone density due to osteoporosis at least to a certain degree. Research regarding primary prevention of osteoporosis is ongoing. Supplements of dietary calcium and vitamin D, as well as weight-bearing exercises for the upper body, have been shown to slow bone loss. The use of supplementary estrogen (hormone replacement therapy) is very controversial. While estrogen has been shown to decrease bone loss and reduce the risks of certain fractures, it may also increase the risk of certain cancers and **heart disease**. **Drugs** called *bisphosphonates* stop osteoclast activity, increase bone density, and decrease the risk of fracture. In addition, supplements of calcitonin, a protein naturally made by the thyroid, can inhibit bone resorption by osteoclasts. It is important to identify those who may be at risk as early as possible, so that a healthy lifestyle, including a **diet** high in calcium and vitamin D, as well as exercise and early screening can be instituted.

According to the National Osteoporosis Foundation, 10 million people in the United States suffer from osteoporosis, while 34 million have early signs of bone density loss that could lead to osteoporosis (as of 2003). But despite what is known about populations at risk and potential treatments

for osteoporosis, some research reports that up to 40 percent of Caucasian women in the postmenopausal age group will sustain an osteoporotic fracture during the course of their lifetime (see Schnitzer). Approximately 20 percent of those women who sustain hip fractures will die within one year of the fracture, and those who survive will most likely require nursing-home care (see Andreoli). As populations around the world live longer, osteoporosis may continue to be an epidemic, and understanding how to identify, diagnose, and treat populations at risk will be of paramount importance. SEE ALSO AGING AND NUTRITION; CALCIUM; OSTEOMALACIA; OSTEOPENIA; RICKETS; VITAMINS, FAT-SOLUBLE; WOMEN'S NUTRITIONAL ISSUES.

Seema P. Kumar
Neela Pania

drugs: substances whose administration causes a significant change in the body's function

diet: the total daily food intake, or the types of foods eaten

Bibliography

Andreoli T. E., ed. (2001). "Osteoporosis." In Cecil *Essentials of Medicine, 5th edition.* Philadelphia: W. B. Saunders.

Looker A. C.; Orwell, E. S.; Johnston C. C., Jr.; et al. (1997). "Prevalence of Low Femoral Bone Density in Older U.S. Adults from NHANES III." *Journal of Bone Mineral Research* 12:1761–1768.

Internet Resources

National Osteoporosis Foundation. <http://www.nof.org>

Schnitzer, T. J. (2002). "Diagnosis and Treatment for Osteoporosis: Current Status and Expectations for the New Millennium." Available from http://www.medscape.com/viewprogram/605.

Overweight

The term ***overweight*** is used to describe an excess amount of total body weight including all tissues (fat, bone, muscle, etc.) and water. **Obesity**, in contrast, is an excess amount of body fat. An adult woman or man who has a body-fat percentage exceeding 35 percent (for women) or 25 percent (for men) is considered **obese**. A person can be overweight without being obese, as many professional football players and bodybuilders are, for such individuals have large amounts of muscle but not much fat. Likewise, a person can be obese without being overweight, such as some elderly individuals or lazy "couch potatoes," who may not weigh a lot but have too much body fat. However, almost all obese people are also overweight.

overweight: weight above the accepted norm based on height, sex, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

obese: above accepted standards of weight for sex, height, and age

Because body fat is very difficult to measure accurately, height and weight are used to estimate overweight and obesity. **Body mass index** (BMI) is a formula that combines both height and weight. It is computed as weight in kilograms divided by height in meters squared, or as weight in pounds times 703 divided by height in inches squared. Normal weight for adults is represented by a BMI of 18.5 to 24.9; overweight by a BMI of 25 to 29.9; and obesity by a BMI of 30 or greater. SEE ALSO OBESITY; WEIGHT LOSS DIETS; WEIGHT MANAGEMENT.

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

John P. Foreyt

Bibliography

Foreyt, John P., and St. Jeor, Sachiko T. (1997). "Definitions of Obesity and Healthy Weight." In *Obesity Assessment: Tools, Methods, Interpretation*, edited by Sachiko St. Jeor. New York: Chapman & Hall.

Poston, Walker S. C., and Foreyt, John P. (2002). "Body Mass Index: Uses and Limitations." *Strength and Conditioning Journal* 24(4):15–17.

U.S. Department of Health and Human Services (2001). *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity.* Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General.

Internet Resources

National Heart, Lung, and Blood Institute. "Clinical Guidelines on Overweight and Obesity." Available from <http://www.nhlbi.nih.gov>

Pacific Islander Americans, Diet of

The Pacific Islands contain 789 habitable islands and are divided into the three geographic areas: Polynesia, Melanesia, and Micronesia. According to the 2000 U.S. Census, there are over a million Pacific Islanders in the United States, most of whom live in California, Hawaii, Washington, Utah, and Texas. Pacific Islander ethnicities in the United States include Carolinian, Fijian, Guamanian, Hawaiian, Kosraean, Melanesian, Micronesian, Northern Mariana Islander, Palauan, Papua New Guinean, Ponapean, Polynesian, Samoan, Solomon Islander, Tahitian, Tarawa Islander, Tongan, Trukese (Chuukese), and Yapese. Prior to 1980, Pacific Islander Americans (except Hawaiians) were classified with Asian Americans under the classification of "Asian and Pacific Islander American." Today, the U.S. Census Bureau includes Pacific Islander Americans under the classification of "Native Hawaiian and Other Pacific Islander." Pacific Islanders are a racially and culturally diverse population group, and they follow a wide variety of religions and have an array of languages.

morbidity: illness or accident

obesity: the condition of being overweight, according to established norms based on sex, age, and height

obese: above accepted standards of weight for sex, height, and age

genetic: inherited or related to the genes

sedentary: not active

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

chronic: over a long period

diabetes: inability to regulate level of sugar in the blood

hypertension: high blood pressure

cardiovascular: related to the heart and circulatory system

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Nutrition and Health Status

Accurate mortality and **morbidity** statistics for this population are limited, mainly because data on Pacific Islander Americans were classified with Asian Americans until a few years ago. Pacific Islander Americans have a high rate of **obesity**, and Native Hawaiians and Samoans are among the most **obese** people in the world. Dietary and lifestyle changes, as well as a likely **genetic** predisposition to store fat, are possible causes for this high rate. Lifestyles have changed from an active farming- and fishing-based subsistence economy to a more **sedentary** lifestyle. Pacific Islanders may be genetically predisposed to store fat for times of scarcity (the "thrifty gene" phenotype), and there is evidence that prenatal **undernutrition** modifies fetal development, predisposing individuals to adult obesity and **chronic** diseases.

Besides obesity, Pacific Islander Americans have high rate of **diabetes**, **hypertension**, **cardiovascular** disease, and **stroke**. Data collected from 1996 to 2000 suggest that Native Hawaiians are 2.5 times more likely to have diagnosed diabetes than white residents of Hawaii of similar age. Guam's death rate from diabetes is five times higher than that of the U.S. mainland, and diabetes is one of the leading causes of death in American Samoa. Overall, Pacific Islander Americans have much lower rates of **heart disease** than other minority groups in the United States, but it is still the leading cause of death within this population. Risk factors for and mortality from heart disease are high partly because of higher rates of obesity, diabetes, and **high**

NATIVE HAWAIIAN AND OTHER U.S. PACIFIC ISLANDER POPULATION, 2000

National Origin	Population	Percent
Total	**874,414**	**100.0%**
Polynesian		
Native Hawaiian	401,162	45.9
Samoan	133,281	15.2
Tongan	36,840	4.2
Tahitian	3,313	0.4
Tokelauan	574	0.1
Polynesian, not specified	8,796	1.0
Micronesian		
Guamanian or Chamorro	92,611	10.6
Mariana Islander	141	*
Saipanese	475	0.1
Palauan	3,469	0.4
Carolinian	173	*
Kosraean	226	*
Pohnpeian	700	0.1%
Chuukese	654	0.1
Yapese	368	*
Marshallese	6,650	0.8
I-Kiribati	175	*
Micronesian, not specified	9,940	1.1
Melanesian		
Fijian	13,581	1.6
Papua New Guinean	224	*
Solomon Islander	25	*
Ni-Vanuatu	18	*
Melanesian, not specified	315	*
Other Pacific Islander	174,912	20.0

*Less than 0.1%.

SOURCE: U.S. Census Bureau, Census 2000.

The numbers by national origin do not add up to the total population figure because respondents may have put down more than one country. Respondents reporting several countries are counted several times. The total includes Native Hawaiian and other Pacific Islanders alone or in combination with other races or groups. Native Hawaiian and Pacific Islander population alone in 2000 was 398,835.

blood pressure. The poor health status of Pacific Islander Americans is also linked to socioeconomic indicators—Native Hawaiians have the worst socioeconomic indicators, the lowest health status, and the most diet-related maladies of all American minorities.

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

Eating Habits and Meal Patterns

The cuisine of Pacific Islander Americans varies slightly from culture to culture and is a blend of native foods and European, Japanese, American, and Asian influences. As with many cultures, food plays a central role in the culture. Pacific Islander Americans typically eat three meals a day. Breakfast is usually cereal and coffee; traditional meals are eaten for lunch or dinner; and fruits, fruit juices, vegetables, and nuts (e.g., peanuts and macadamia) are eaten in abundance. Milk and other dairy products are uncommon and there is a high **prevalence** of **lactose intolerance** among Pacific Islander Americans. Thus, **calcium** deficiency is prevalent.

prevalence: describing the number of cases in a population at any one time

lactose intolerance: inability to digest lactose, or milk sugar

calcium: mineral essential for bones and teeth

Starchy foods are the foundation of the traditional diet. For example, the traditional Hawaiian diet is 75 to 80 percent starch, 7 to 12 percent fat, and 12 to 15 percent **protein**. Starch in the traditional diet comes primarily from root vegetables (e.g., taro, cassava, yam, green bananas, and breadfruit). In addition, the traditional diet is plentiful in fresh fruits, juices, nuts, and greens. Traditional meals include *poi* (boiled taro), breadfruit, green bananas, fish, or pork. Many dishes are cooked in coconut milk, and seaweed is often used as a vegetable or a condiment.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Nutritional Transition

Americanized: having adopted more American habits or characteristics

Many Pacific Islander Americans now eat an **Americanized** diet consisting of fast foods and highly processed foodstuffs such as white flour, white sugar, canned meat and fish, butter, margarine, mayonnaise, carbonated beverages, candies, cookies, and sweetened breakfast cereals. Rice is now a staple food, having taken over yam and taro in popularity in the 1980s and 1990s. This nutritional transition has resulted in an increase in cardiovascular disease (i.e., **coronary heart disease**, stroke, hypertension), obesity, and type 2 diabetes.

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

socioeconomic status: level of income and social class

Nutrition education is needed to stimulate nutrition-related indigenous knowledge and the consumption of traditional nutrient-rich local foods as a more healthful alternative to fast foods and **processed foods**. There is also an urgent need for increased awareness of the health perils of obesity, especially among individuals with low **socioeconomic status**. Many health professionals are now emphasizing eating traditional "native" foods and encouraging residents to get back to a healthy lifestyle and to their cultural roots. Language is a major barrier to health education and medical interventions, however, and more health professionals need to be recruited from this population into health and medical fields in specific geographic areas. Professionals from the dominant (white) culture also need to become more culturally competent. SEE ALSO CARDIOVASCULAR DISEASE; DIETARY TRENDS, AMERICAN; OBESITY.

Ranjita Misra
Delores C. S. James

Bibliography

Galanis D. J.; McGarvey, S. T.; Quested, C.; Sio, B.; and Afele-Fa'amuli, S. A. (1999). "Dietary Intake of Modernizing Samoans: Implications for Risk of Cardiovascular Disease." *Journal of the American Dietetic Association* 99(2):184–90.

Kittler, P. G., and Sucher, K. P. (2001). *Food and Culture*, 3rd edition. Stamford, CT: Wadsworth.

Wang, C. Y.; Abbot, L.; Goodbody, A. K.; and Hui, W. T. (2002). "Ideal Body Image and Health Status in Low-Income Pacific Islanders." *Journal of Cultural Diversity* 9(1):12–22.

Internet Resources

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). "Diabetes in Asian and Pacific Islander Americans." Available from <http://diabetes.niddk.nih.gov/>

U.S. Geological Survey, Biological Resources Division. "The Status and Trends of the Nation's Biological Resources: Hawaii and the Pacific Islands." Available from <http://biology.usgs.gov/>

Pacific Islanders, Diet of

The Pacific Ocean—the world's largest ocean—extends about 20,000 kilometers from Singapore to Panama. There are 789 habitable islands within the "Pacific Islands," a geographic area in the western Pacific comprising Polynesia, Melanesia, and Micronesia. Polynesia includes 287 islands and is triangular, with Hawaii, New Zealand, and Easter Island at the apexes. Other major Polynesian islands include American (Eastern) Samoa, Western Samoa, Tonga, Tahiti, and the Society Islands. The Hawaiian Islands have been studied more than most other Pacific islands primarily because Hawaii

is part of the United States of America. The Melanesian Islands (Melanesia) include the nations of Fiji, Papua New Guinea, Vanuatu, the Solomon Islands and New Caledonia (a French dependent). The 2,000 small islands of Micronesia include Guam (American), Kiribati, Nauru, the Marshall Islands, the Northern Mariana Islands, the Gilbert Islands, Palau, and the Federated States of Micronesia. Migration is very fluid between Polynesia, Melanesia, and Micronesia, and many Pacific Islanders also migrate to the United States and other countries. Pacific Islanders are a racially and culturally diverse population, and the people of the islands follow a wide variety of religions.

Nutritional Status

Mortality and **morbidity** statistics are limited, mainly because data on Pacific Islanders are often included with those on other Asians. A high percentage of Pacific Islanders live in poverty, though **nutritional deficiencies** are rare when there are adequate **calories**. Because Pacific Islander diets are based on whole foods found in nature and prepared without excess cooking, the recommended daily amounts of many **vitamins** and **minerals** can be met in only one meal. In addition, all of the fresh fruits consumed (mainly in the morning and during the afternoon) are abundant in **nutrients**.

Anemia, riboflavin deficiency, and **calcium** deficiency are common nutritional problems in the rural and urban areas of many islands, while **heart disease**, **hypertension**, type 2 **diabetes**, **obesity**, and other **chronic** diseases are on the rise. This is primarily due to a transition from traditional nutritious diets of fresh fruits, vegetables, poultry, and seafood to a **diet** with large amounts of imported and highly refined Western foods that are low in **fiber** and high in **fat** and sugars. Cigarette smoking, an increase in alcohol consumption, and a decreased level of physical activity are also contributing factors.

Obesity among Pacific Islanders is among the highest in the world, regardless of the island. Obesity may be due to a **genetic** predisposition and a cultural preference toward being heavy, but there is a high **prevalence** of physical inactivity among this population. Attitudes toward obesity are slowly changing, however, and it is gradually being viewed as unhealthy. Small studies that have placed **obese** and diabetic individuals on traditional diets have shown very good results, as individuals lost weight and diabetics were able to reduce or eliminate the need for **insulin**.

Eating Habits and Meal Patterns

While the islands are geographically close, the Pacific Island region is racially and culturally diverse. The cuisine varies slightly from island to island and is a blend of native foods with European, Japanese, and American influences. The cuisine is also influenced by the Asian Indians, Chinese, Korean, and Filipino agricultural workers who arrived in the eighteenth century. Food plays a central role in Pacific Islander culture; it represents prosperity, generosity, and community support. Hospitality is extended to visitors, who are usually asked to share a meal. Even if a visitor is not hungry, he or she will generally eat a small amount of food so that the host is not disappointed. Food is also often given as a gift, and a refusal of food is considered an insult to the host or giver.

morbidity: illness or accident

nutritional deficiency: lack of adequate nutrients in the diet

calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

nutrient: dietary substance necessary for health

anemia: low level of red blood cells in the blood

calcium: mineral essential for bones and teeth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

diet: the total daily food intake, or the types of foods eaten

fiber: indigestible plant material which aids digestion by providing bulk

fat: type of food molecule rich in carbon and hydrogen, with high energy content

genetic: inherited or related to the genes

prevalence: describing the number of cases in a population at any one time

obese: above accepted standards of weight for sex, height, and age

insulin: hormone released by the pancreas to regulate level of sugar in the blood

Breadfruit (being prepared here) is one of many starchy fruits traditionally eaten by Pacific Islanders. The diet also includes abundant fresh vegetables, fish, and nuts. *[Photograph by Wolfgang Kaehler. Corbis. Reproduced by permission.]*

Fruits, fruit juices, vegetables, and nuts (e.g., peanuts, macadamia, and litchi) are eaten in abundance, while milk and other dairy products are uncommon (there is a high prevalence of **lactose intolerance** among Pacific Islanders). Coconuts are plentiful, and both the milk and dried fruit are used to flavor meals. Pigs, chickens, and cows exist on the Pacific Islands, but in areas like Fiji they are expensive, so local villagers tend to purchase them only for large celebrations and feasts. Modern conveniences exist in many areas, but it is not uncommon for villagers to cook on outdoor fires or kerosene stoves. Many villagers still eat with their hands, and a bowl of water is provided for washing hands (a guest may request one before the meal if it is not offered).

lactose intolerance: inability to digest lactose, or milk sugar

Pacific Islanders typically eat three meals a day. Breakfast usually includes cereal and coffee, while traditional meals are eaten for lunch and dinner. However, in areas such as Hawaii, Samoa, and Guam, traditional foods now contribute only minimally to daily intake, most of which is made up of imported foods or fast food.

Traditional Cooking Methods and Food Habits

The traditional Pacific Islander diets are superior to Western diets in many ways. The weaknesses of the traditional Pacific Island diets are minimal and the strengths are immense. Traditional foods are nutrient-dense, meals are prepared in healthful ways, and oils are used sparingly. The high-fiber, low-fat nature of these diets reduces the risk for heart disease, hypertension, **stroke**, diabetes, obesity, and certain types of **cancer**.

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

cancer: uncontrolled cell growth

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Starchy foods are the foundation of the traditional diet. For example, the traditional Hawaiian diet is 75 to 80 percent starch, 7 to 12 percent fat, and 12 to 15 percent **protein**. Starch in the diet comes primarily from root vegetables and starchy fruits, such as taro, cassava, yam, green bananas, and breadfruit. In addition, the traditional diet is plentiful in fresh fruits, juices, nuts, and the cooked greens of the starch vegetables (e.g., taro, yam). Traditional meals include *poi* (boiled taro), breadfruit, green bananas, fish, or pork. *Poi* is usually given to babies as an alternative to cereal. Many dishes are

cooked in coconut milk, and more than forty varieties of seaweed are eaten, either as a vegetable or a condiment. Local markets with fresh foods are still abundant in most islands.

As expected, fish and other seafood are abundant in the Pacific Islands and are eaten almost every day in some islands. Most fish and seafood are stewed and roasted, but some are served marinated and uncooked. Pork is the most common meat, and it is used in many ceremonial feasts. Whole pigs are often cooked in pits layered with coals and hot rocks. Throughout the Pacific Islands, pit-roasted foods are used to commemorate special occasions and religious celebrations. The part of the pig one receives depends on one's social standing.

Samoans usually welcome visitors with a *kava* ceremony. Kava is made from the ground root of a pepper plant and is mixed with water. It is strained and usually served in a stone bowl or a half of a coconut shell. It looks like dirty water and tastes somewhat like dirty licorice. Guests are expected to drink it in one gulp. In Hawaii, *luaus* are common. A *luau* usually features pit-roasted pig, chicken, fish, and vegetables.

Traditional meals are highly seasoned with ginger, lime or lemon juice, garlic, onions, or scallions, depending on the dish. Lard and coconut oil (both saturated fats) are the most common fats used in cooking and give foods a distinctive flavor. Traditional beverages include fruit juices, coconut water, local alcoholic concoctions, and teas (primarily introduced by Asian immigrants).

Nutritional Transition

Many Pacific Islanders have moved to a more Western diet consisting of fast foods and **processed foods**, and as a result the **incidence** of both obesity and diabetes have soared. Pacific Islanders now rely on imported foods that are highly processed, such as white flour, white sugar, canned meat and fish, margarine, mayonnaise, carbonated beverages, candies, cookies, and breakfast cereals. Many locals sell their fruits and vegetables and then in turn purchase imported foods. On many islands, 80 to 90 percent of the foods are now imported. Imported rice is becoming the staple food in some areas, instead of locally grown provisions, and the ability to purchase imported foods is now a status symbol. Agricultural production also plays a role in the dietary transition. Local fruits and vegetables are increasingly less available due to population growth, urbanization, exporting of produce, and selling produce to hotels for the tourism industry. Traditional methods of hunting and gathering wild food, farming, processing, storing, and preserving traditional foods have all but disappeared in some areas.

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

incidence: number of new cases reported each year

Even though the health focus has been on the increase in obesity and diabetes, a different problem has occurred in Fiji. A dramatic increase in disordered eating among teenage girls has been observed in this nation, beginning with the introduction of television in 1995. In 1998 a researcher on Fiji reported that:

- 74 percent of girls reported feeling "too big or fat" at least sometimes.
- Of those who watched television at least three nights per week, 50 percent perceived themselves as too fat and 30 percent were more likely to diet.
- 62 percent reported dieting in the previous month, a comparable or higher proportion than reported in U.S. samples.

Many health professionals in the Pacific Islands, especially Hawaii, are now emphasizing eating traditional foods and encouraging residents to get back to a healthy lifestyle and to their cultural roots. Programs may now need to be developed to target eating disorders and disturbances.

The natural beauty of the Pacific Islands makes them popular destinations for ecotourists, and food-borne and water-borne diseases are the number one cause of illness among travelers. Visitors are therefore advised to wash their hands often and to drink only bottled or boiled water or carbonated drinks in cans or bottles. They also should avoid tap water, fountain drinks, and ice cubes. SEE ALSO ASIANS, DIET OF; DIABETES MELLITUS; DIETARY TRENDS, INTERNATIONAL; OBESITY; PACIFIC ISLANDER AMERICANS, DIET OF.

Delores C. S. James

Bibliography

Becker, A.; Burwell, R.; Navara, K.; and Gilman, S. (2003). "Binge Eating and Binge-Eating Disorder in a Small-Scale, Indigenous Society: The View From Fiji." *International Journal of Eating Disorders* 34(4):423–432.

Kittler, P. G., and Sucher, K. P. (2001). *Food and Culture*, 3rd edition. Stamford, CT: Wadsworth.

Internet Resources

Union College. "Fiji: A Digital Ethnography." Available from <http://fiji.union.edu>

U.S. Geological Survey, Biological Resources Division. "The Status and Trends of the Nation's Biological Resources: Hawaii and the Pacific Islands." Available from <http://biology.usgs.gov/>

Pasteur, Louis

French chemist and microbiologist
1822–1895

Louis Pasteur was born in Dole, France, on December 27, 1822. He was the only son of Jean Pasteur, a poorly educated leather tanner. Pasteur was not a very good student in elementary school and he preferred fishing and painting to studying. As he got older, however, he began to show an interest in scientific subjects, especially chemistry. Although he demonstrated a lot of talent as a painter, Pasteur's father encouraged him to study throughout high school and he was accepted to the best university in France, the École Normale in Paris.

While at the university, Pasteur began to pursue his interests in science and discovery. He became a professor and researcher after graduating from college and was most interested in applying his knowledge of science to help people live healthier lives. Throughout his lifetime, Pasteur made incredible contributions to the fields of medicine, chemistry, and biology by sharing his ideas and inventions with the world. He first discovered the dangers of germs that spread infections. He also discovered treatments for deadly diseases such as tetanus, **tuberculosis**, **diphtheria**, and rabies.

Pasteur was best known for inventing the process that became known as **pasteurization**. In 1864, the emperor of France, Napoleon III, asked Pasteur to investigate why wine and beer became sour shortly after they were made. The souring of wine and beer was a major economic problem in France, since many farmers relied on the sale of these beverages to earn a living.

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

diphtheria: infectious disease caused by Cornybacterium diphtheriae, causing damage to the heart and other organs

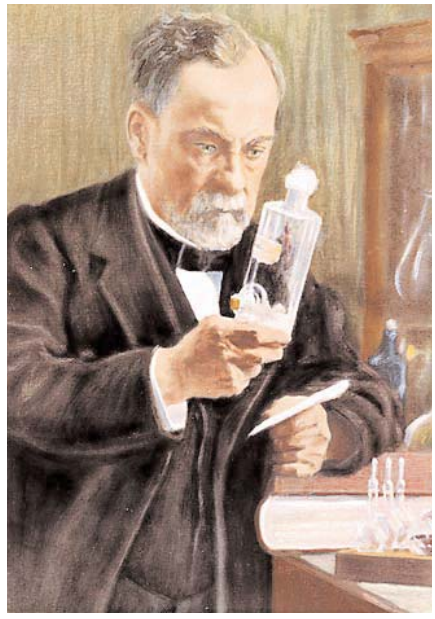
pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

Pasteur traveled to a vineyard to study this problem and was able to demonstrate that **bacteria** and other microscopic organisms were causing the wine to spoil. These were the same types of harmful bacteria that would cause food to spoil and make some people sick.

Pasteur discovered that the tiny organisms in the wine could be destroyed by heat, without damaging the wine. Later, Pasteur demonstrated that his technique could be applied to the preservation of other beverages such as milk and juice, as well as solid foods such as cheese and meat. Using the first form of pasteurization, a food product would have to be heated at 130 degrees Fahrenheit for thirty minutes. However, Pasteur later discovered an easier method in which beverages and foods could be pasteurized for a shorter time at a higher temperature.

When Pasteur died on September 28, 1895, he was named a national hero by the French government for his important contributions to science, health, and food safety. During Pasteur's lifetime, it was not easy for him to convince others of his ideas, which were sometimes seen as controversial in the 1800s. Today, the food industry around the world continues to use the process of pasteurization to ensure that harmful organisms are eliminated from foods. SEE ALSO FOOD SAFETY; ORGANISMS, FOOD-BORNE.

Melissa C. Morris



Hailed as the founder of microbiology, Louis Pasteur contributed immensely to the fields of medicine and food safety. He invented pasteurization, which prevents food spoilage, and he developed the technique of vaccination. *[Bettman/Corbis. Reproduced by permission.]*

bacteria: single-celled organisms without nuclei, some of which are infectious

Internet Resources

Bellis, Mary (2003). "Louis Pasteur." Available from <http://inventors.about.com>

Cohn, David V. (1996). "The Life and Times of Louis Pasteur." Available from <http://louisville.edu/library/>

Pasteur Institute (2003). "Louis Pasteur's Biography (1822–1895)." Available from <http://www.pasteur.fr/>

Pasteurization

Pasteurization, a process discovered by Louis Pasteur (while trying to inactivate spoilage organisms in beer and wine), occurs when a product is heated to a specific temperature for a specified length of time. This process is now applied to a wide array of food products, such as milk, fruit juice, cheese, and water. Milk is heated to 145°F (63°C) for thirty minutes (or to 160°F [71°C] for fifteen seconds) and then rapidly cooled to 50°F (10°C) for storage. In developing countries, heating water to 149°F (65°C) for six minutes will kill enough contaminates to make the water safe to drink. Pasteurization protects consumers from harmful **pathogens** such as Mycobacterium **tuberculosis** and Coxiella Burnetii in milk, and pasteurized products benefit from longer shelf life. SEE ALSO FOOD SAFETY.

Diane L. Golzynski

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

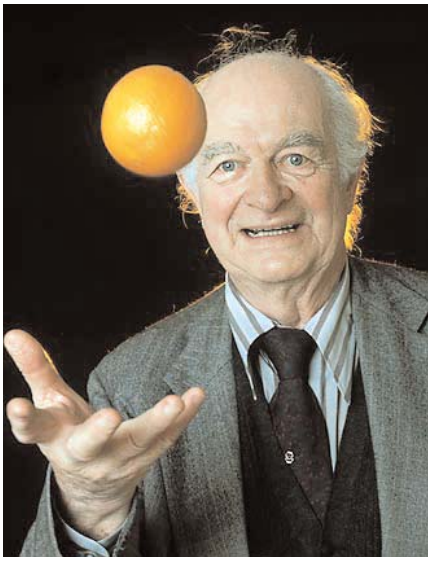
pathogen: organism that causes disease

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

Pauling, Linus

American chemist
1901–1994

Linus Carl Pauling was born in Portland, Oregon, on February 28, 1901, to Herman and Lucy Pauling. Growing up in Oregon, Pauling and his family



Two-time Nobel Prize winner Linus Pauling. Pauling's early work in chemistry earned him the world's respect, but his later work on nutrition was controversial. *[© Roger Ressmeyer/ Corbis. Reproduced by permission.]*

molecule: combination of atoms that form stable particles

nutrition: the maintenance of health through proper eating, or the study of same

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

did not have much in the way of material wealth, especially after his father's death when he was only nine years old. However, Pauling was exceptionally bright and found many ingenious ways to make money, including delivering milk, running film projectors, and working at the local shipyard, to support his mother and two younger sisters.

Pauling was a gifted student and earned a scholarship to Oregon State University where he earned his Bachelor of Science degree and later went on to earn a Ph.D. in chemistry at the California Institute of Technology. As a young scientist, Pauling first became known to the world of chemistry with his use of X-rays to examine the molecular structure of crystals. Pauling later began to focus his research on the way **molecules** bond and his insight led to the creation of many of the medicines, dyes, plastics, and synthetic fibers people continue to use today. His work was so influential that he was recognized in 1954 with the prestigious Nobel Prize for Chemistry. In fact, Pauling is the only person to ever win two unshared Nobel Prizes—he was awarded the Nobel Peace Prize in 1962.

After being awarded his second Nobel Prize, Pauling began to study the role of **nutrition** in fighting disease. Pauling had spoken about the importance of **vitamins** and **minerals** to maintain health in the late 1930s, but he did not pursue research on the subject until almost thirty years later. Pauling proposed that large doses of vitamin C could protect a person from the common cold, and he wrote the book *Vitamin C and the Common Cold* in 1970. It quickly became a bestseller. He also believed in vitamin C's power to combat the flu, certain types of **cancer**, **heart disease**, infections, and even old age. In addition, Pauling suggested that other vitamins, such as vitamin E, and vitamin B also worked to fight disease and prolong life. In fact, Pauling believed that virtually all illnesses could be attributed to some form of vitamin deficiency.

Although Pauling was recognized all over the world for his theory on the power of nutritional medicine, medical doctors and nutrition scientists often criticized his beliefs. Many scientists did not agree with Pauling's ideas about vitamin therapy and the impact of vitamins and minerals on a person's health. They even tried to disprove Pauling's ideas by conducting research studies to show that vitamin C did not prevent colds or cancer. However, many of these studies were flawed, and Pauling was always able to respond with his own research data and logical reasoning to support his beliefs.

Pauling died of cancer at the age of 93 in August 19, 1994, at his ranch near Big Sur on the California coast. Before he died, he said that vitamin C had delayed the cancer's onset for twenty years. Pauling was awarded many prizes and received distinguished honors for his contributions to the fields of chemistry and humanity. He has been recognized as one of the most influential scientists of the twentieth century.

Melissa C. Morris

Internet Resources

Linus Pauling Institute (2003). "Linus Pauling—Scientist for the Ages." Available from <http://lpi.oregonstate.edu/lpbio/lpbio2.html>

Nobel e-Museum (2003). "Linus Pauling—Biography." Available from <http://www.nobel.se/chemistry/laureates/1954/pauling-bio.html>

Pellagra

Pellegra is a disease caused by a dietary deficiency of, or a failure to absorb, **niacin** (vitamin B_3) or the **amino acid** tryptophan, a precursor of niacin. First reported in 1735 by Don Gasper Casal, a Spanish physician, *pellagra* means "rough skin." Primary symptoms include the "3 Ds": **dementia** (mental symptoms), dermatitis (scaly skin sores), and diarrhea. A pellagra epidemic emerged during the 1900s in the United States, when corn (maize) began to replace other sources of dietary **protein** among the rural poor. Niacin in corn is tightly bound to protein, and thus poorly absorbed. Niacin **enrichment** of cereal grains and diets adequate in protein and **calories** eventually eradicated pellagra from the United States. Seasonal epidemics still occur in parts of Southeast Asia and Africa, however.

Kiran B. Misra

This woman's hands show scars from dermatitis, one of the primary symptoms of pellagra. The photo was taken in South Carolina, where thousands of rural poor succumbed to the illness at the start of the twentieth century.

Pemberton, John S.

American pharmacist
1831–1888

John Stith Pemberton was born in Knoxville, Georgia, and spent his childhood in Rome, Georgia. He graduated from Southern Botanico Medical College of Georgia in 1850. Pemberton briefly practiced as a traditional Thomsonian "steam doctor," modeled after Samuel Thomson's *Complete System of Practice* as outlined in his book *New Guide to Health*. Steam doctors used steam baths, herbs, and other products to induce sweating, which they believed would restore the body to proper health. Pemberton later obtained a degree in pharmacy from a school in Philadelphia. In 1855, Pemberton moved to Columbus, Georgia, with his wife, Anna Eliza Clifford Lewis, and their only son, Charles Ney Pemberton. Here, he practiced primarily as a druggist for fourteen years, though he also performed other medical procedures. Pemberton was a member of the first licensing agency for pharmacists in Georgia.

In May 1862, Pemberton enlisted as a first lieutenant in the Confederate Army, and he organized Pemberton's Calvary to guard the town. In Pemberton's last battle he was shot and cut with a saber across the chest. He used morphine for his pain, and eventually became a morphine addict.

For five years after the war, Pemberton worked as a partner with Dr. Austin Walker, a local and wealthy physician. During this time, Pemberton invested all of his money in researching and developing a line of proprietary items, which included perfumes and **botanical** medicines. During this time, there was a large demand for home remedies and tonics in the United States, especially in large cities. In 1869, Pemberton moved to Atlanta, Georgia, to start a lucrative business—he developed, and successfully sold, a drink he called "French Wine Coca." Based on a similar European product called "Vin Mariana," Pemberton's tonic combined wine and the extract from coca leaves, the source of cocaine. Coca extract was commonly used at the time in medicines and "temperance drinks" to increase sexual drive, treat digestive problems, calm nerves, and extend longevity. It also was used to "cure"

niacin: one of the B vitamins, required for energy production in the cell

amino acid: building block of proteins, necessary dietary nutrient

dementia: loss of cognitive abilities, including memory and decision making

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

calorie: unit of food energy

botanical: related to plants

John S. Pemberton's 1886 Coca-Cola recipe contained a highly addictive stimulant extracted from coca leaves. That recipe was replaced in 1905 with one more similar to the modern beverage, which is distributed in 200 countries worldwide. *[© Sergio Dorantes/Corbis. Reproduced by permission.]*

addictions to morphine, nicotine, and alcohol. This was Pemberton's first well-known and widely sold drink. Pemberton himself endorsed his "wine" as a cure for morphine addiction.

In 1885, with talk of Prohibition, Pemberton developed a drink without alcohol. Pemberton added the extract from cola nuts, a strong stimulant containing caffeine, along with the coca, and he replaced the wine with sugar syrup. On May 18, 1886, Pemberton decided on a final formula for his new drink, and Frank Robinson, one of Pemberton's partners and a part owner of his company, came up with the name Coca-Cola and the trademark logo. On June 28, 1887, the Coca-Cola trademark patent was granted. Jacobs Pharmacy, in Atlanta, Georgia, was the first place to serve Coca-Cola from a soda fountain. The cocaine was eventually removed from the drink in 1905.

Pemberton's financial troubles, along with his morphine addiction, led him to sell, trade, and give away portions of his company to various individuals. Coca-Cola eventually became one of the most prosperous businesses in the United States. Pemberton died on August 16, 1888, of stomach **cancer**, leaving behind many unfinished formulas. Pemberton also developed the first state-run laboratory to conduct tests on soil and crop chemicals. The facility is currently run by the Georgia Department of Agriculture.

cancer: uncontrolled cell growth

Delores C. S. James

Bibliography

Pendergrast, Mark (2000). *For God, Country, and Coca-Cola.* New York: Basic Books.

Internet Resources

Britannica.com (2001). "The Coca-Cola Company." Available from <http://www.britannica.com>

Business Heroes Newsletter. "John Pemberton, Inventor of Coca Cola." Available from <http://www.businessheroes.com>

Hayes, Jack (1996). "Dr. John S. Pemberton (Inventor of Coca-Cola)." *Nation's Restaurant News* 30 (February):120–121. Available from <http://memory.loc.gov/ammem/ccmphtml/colainvnt.html>

Pesticides

Pesticide use is widespread in agriculture throughout the world, raising serious questions about the dangers theses substances pose to human health and the **environment**. Pesticides are substances intended to prevent, destroy, or repel injurious plants or animals. The term is frequently defined more broadly to include insecticides, herbicides (used to inhibit the growth and reproduction of certain plants), and fungicides (used to inhibit the growth of molds, mildews, and yeasts).

environment: surroundings

The main argument for pesticides use is an economic one. Pesticides can protect crops against sudden pest outbreaks and allow increased production, and they can ensure the production of more attractive fruits and vegetables. By delaying the rotting of produce, pesticides permit longer shipping times and extend the shelf life of fresh produce.

The dangers of pesticide use can be difficult to pinpoint, since exposure may be small but cumulative. Prolonged pesticide exposure in humans may negatively affect the nervous, reproductive, and immune systems and also raises the possibility of increased risk of some cancers. Their use also leads to the **development** of pesticide-resistant bugs, creating a need for newer and more powerful pesticides. SEE ALSO FOOD SAFETY; ORGANIC FOODS; REGULATORY AGENCIES.

development: the process of change by which an organism becomes more complex

Kim Schenck

Bibliography

Wardlaw, Gordon; Hampl, Jeffrey; and DiSilvestro, Robert (2004). *Perspectives in Nutrition.* New York: McGraw-Hill.

Internet Resources

United States Environmental Protection Agency. "Pesticides." Available from <http://www.epa.gov/pesticides/>

Phenylketonuria (PKU)

Phenylketonuria (fee-nyl-key-ton-uria), or PKU, is an inherited **metabolic** disease that results in severe developmental delay and **neurological** problems when treatment is not started very early and maintained throughout life. The disease is caused by the absence of the **enzyme** phenylalanine hydroxylase, which normally converts the **amino acid** phenylalanine to another amino acid, tyrosine. This results in a build-up of phenylalanine and a low level of tyrosine, which causes a variety of problems, including cognitive decline, learning disabilities, behavior or neurological problems, and skin disorders.

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

metabolic: related to processing of nutrients and building of necessary molecules within the cell

neurological: related to the nervous system

enzyme: protein responsible for carrying out reactions in a cell

amino acid: building block of proteins, necessary dietary nutrient

PKU occurs in about 1 in 10,000 births. It is an autosomal recessive disorder, meaning the affected person inherits two copies of the defective gene, one from each parent. Newborn screening for PKU began in the mid-1960s and is now carried out in every state in the United States, as well as in many other countries.

The treatment for PKU consists of a special phenylalanine-restricted **diet** designed to maintain levels of phenylalanine in the blood between 2 and 6 mg/dl (milligrams per deciliter). All **proteins** are made up of amino acids; therefore, the diet for PKU consists of foods that contain only enough

diet: the total daily food intake, or the types of foods eaten

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

protein to provide the amount of phenylalanine necessary for growth and **development**. Foods allowed are primarily vegetables, fruits, and some cereals and grains. A synthetic formula containing all the amino acids except phenylalanine provides the remaining protein and **calories** for individuals with PKU. SEE ALSO AMINO ACIDS; ARTIFICIAL SWEETENERS; INBORN ERRORS OF METABOLISM.

Patricia D. Thomas

development: the process of change by which an organism becomes more complex

calorie: unit of food energy

Internet Resources

National PKU News. Available from <http://www.pkunews.org>

Phytochemicals

Phytochemicals are naturally occurring chemicals in plants that provide flavor, color, texture, and smell. Phytochemicals have potential health effects, as they may boost **enzyme** production or activity, which may, in turn, block **carcinogens**, suppress **malignant** cells, or interfere with processes that can cause **heart disease** and **stroke**. Phytochemical-rich foods include *cruciferous* vegetables (e.g., broccoli, Brussels sprouts, cauliflower, cabbage), *umbelliferous* vegetables (e.g., carrots, celery, parsley, parsnips), *allium* vegetables (e.g., garlic, onions, leek), berries, citrus fruits, whole grains, and **legumes** (e.g., soybeans, beans, lentils, peanuts). In the early twenty-first century, identification of the role of phytochemicals in health is an emerging area of science, and the global health community does not recommend supplementation with any specific phytochemicals. SEE ALSO ANTIOXIDANTS; FUNCTIONAL FOODS.

M. Elizabeth Kunkel
Barbara H. D. Luccia

phytochemical: chemical produced by plants

enzyme: protein responsible for carrying out reactions in a cell

carcinogen: cancer-causing substance

malignant: spreading to surrounding tissues; cancerous

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

legumes: beans, peas and related plants

Bibliography

Meskin, M. S.; Bidlack, A. J.; and Davies, A. J. (2002). *Phtyochemicals in Nutrition and Health*. Boca Raton, FL: CRC Press.

Pica

Pica is defined as a compulsion to consume nonfood substances. Persons with pica crave items such as dirt, clay, paint chips, plaster, chalk, cornstarch, laundry starch, baking soda, coffee grounds, cigarette ashes, burnt match heads, cigarette butts, and rust. The cause of pica is poorly understood, but this strange behavior is often seen in those who are iron-deficient, particularly pregnant woman, even though none of the craved items contain significant amounts of iron. Pica can be dangerous during pregnancy, since consuming large amounts of some substances may cause **nutrient** deficiencies, intestinal problems, or lead to toxicity, placing both mother and baby at risk. SEE ALSO CRAVINGS; PREGNANCY.

Beth Fontenot

nutrient: dietary substance necessary for health

Plant-Based Diets

Plant-based diets are comprised of meals made predominately from a variety of vegetables, fruits, grains, beans, and nuts, with minimal amounts of

processed foods. Many professional organizations recommend a plant-based **diet** to help prevent **chronic** diseases such as **cancer**, **heart disease**, and **obesity**. This is because such a diet is usually high in **fiber** and low in **fat**.

Many times, modest amounts of meat are included in a plant-based diet, so it is not synonymous with a vegetarian diet. However, the bulk of the diet consists of fruits, vegetables, and whole grains. SEE ALSO MACROBIOTIC DIET; MEAT ANALOGS; VEGAN; VEGETARIANISM.

Lenore Hodges

Internet Resources

American Dietetic Association, Vegetarian Nutrition Practice Group. "Articles on Vegetarian Nutrition." Available from <http://www.vegetariannutrition.net/articles/html>

Seventh-day Adventist Dietetic Association. "Plant-Based Diets: Fact and Fiction." Available from <http:/www.sdada.org/facts&fiction/htm>

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

diet: the total daily food intake, or the types of foods eaten

chronic: over a long period

cancer: uncontrolled cell growth

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

obesity: the condition of being overweight, according to established norms based on sex, age, and height

fiber: indigestible plant material which aids digestion by providing bulk

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Popular Culture, Food and

Food is very much a part of popular culture, and the beliefs, practices, and trends in a culture affect its eating practices. Popular culture includes the ideas and objects generated by a society, including commercial, political, media, and other systems, as well as the impact of these ideas and objects on society.

Current Trends

There has been an increasing trend in the United States toward **consumerism**, a trend that is reflected in more people eating away from home; the use of dietary and **herbal** supplements; foods for specific groups (e.g., dieters, women, athletes, older adults); the use of convenience and **functional foods**; and ethnic diversity in diets. Mainstream populations in developed countries want low-calorie, low-fat foods, as well as simple, natural, and fresh ingredients.

Internationally, there has been an "Americanization" of diets through the growth and use of fast-food restaurants and **convenience foods**. In developing countries there is still a need for some basic foods, and governments and the food industry are working to develop products that can reduce international food shortages and **nutrient** deficiency problems.

consumerism: reliance on buying, rather than making, items necessary for living

herbal: related to plants

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

convenience food: food that requires very little preparation for eating

nutrient: dietary substance necessary for health

Eating Away from Home

Internationally, the proportion of money spent on food eaten away from home, as well as the number of restaurants, has been steadily increasing since the second half of the twentieth century. People may dine at formal, sit-down restaurants, at **fast-food** eateries, at cafes, or they may purchase food from street vendors.

Fast-food restaurants have become very common, and are visited by all types of people. The growth and popularity of fast food has come to be known as the "McDonaldization" of America. In the United States, eating in these restaurants has decreased slightly among heavy users in the 18–34 age group, but has increased among other groups. Their popularity has also increased internationally.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

This simple meal demonstrates the complicated relationship between a culture and its food. In the twentieth century, Americans' preference for quick, portable meals popularized the fast-food burger. Over time the popularity of fast foods in America contributed to an epidemic of obesity. *[Photograph by Lois Ellen Frank. Corbis/Lois Ellen Frank. Reproduced by permission.]*

sedentary: not active

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

obesity: the condition of being overweight, according to established norms based on sex, age, and height

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

binge: uncontrolled indulgence

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

Many eateries now offer the option of larger serving (portion) sizes for a nominal additional fee (a "super size"). Eating away from home, and the shift to a more **sedentary lifestyle**, has been linked to the increasing rates of **obesity** in the United States.

Obesity and Malnutrition

Obesity, a form of malnutrition, is commonly defined as a **body mass index** over 30. Being **overweight** is defined as a body mass index of 25–30. There has been an increasing rate of obesity in the United States, especially among children. Obesity is now considered a national epidemic in many developed countries (such as the United States) but some persons feel that this concern has also caused a stigmatization of the **obese**.

Eating disorders can result in malnutrition. **Bulimia** is a condition marked by periods of **binge** eating followed by purging. This differs from compulsive overeating, or binge eating, which occurs when an individual eats compulsively but does not purge and becomes overweight. Starvation, either from the lack of available food or from self-imposed starvation, as in **anorexia** nervosa, will also cause malnutrition.

Despite a growing rate of obesity in developed countries, **undernutrition** remains the most common nutritional problem in developing nations. The combination of **protein** deficiency and **energy** deficiency is commonly known as *protein-energy malnutrition* (PEM). This form of malnutrition is most common in underveloped and developing countries, but also appears in geographic pockets of developed countries.

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Dieting

About half of all Americans try to lose weight, or maintain their weight, every year. In an effort to lose weight people purchase weight loss pills; special herbal supplements; and formulated weight loss drinks, foods, and **diet** bars. People also join health clubs or spas, or buy special weight loss and exercise equipment, in an effort to lose weight and improve their health.

diet: the total daily food intake, or the types of foods eaten

Among the common types of diets people follow are food-focused, celebrity, exchange, and supplement-based diets. Food-focused plans, such as the grapefruit diet, the banana diet, or a wine drinker's diet, emphasize consumption of only one, or a few, foods. Celebrity plans generally have the backing of a celebrity, and exchange plans lump together into food groups items with similar calories, **carbohydrates**, proteins, and fats. Some diets incorporate a commercial meal, snack bar, food, or beverage that must be purchased.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fortified: altered by addition of vitamins or minerals

phytochemical: chemical produced by plants

microorganisms: bacteria and protists; single-celled organisms

genetic: inherited or related to the genes

calcium: mineral essential for bones and teeth

Supplements

Pills, liquids, or powders that contain nutrients and other ingredients are now readily available in stores. Supplements that contain herbs (or some herbal components) are growing in popularity. However, supplement production and use is not always well regulated, so consumers must be careful about what they purchase and consume.

Convenience Foods

To satisfy individuals who want to eat well at home but are short on time or do not want to prepare elaborate meals, many eateries also offer take-out meals or items. Fully or partially prepared "TOTE" (take-out-to-eat) foods, including home-delivered meals, are generally referred to as *convenience foods.* As more women (the traditional preparers of family meals) enter the labor force, people's desire to save time increases along with the use of convenience foods.

Functional Foods

The term *functional food* is often used in reference to foods that have nutrients (or non-nutrients) that might protect against disease. The term is used when referring to foods that have been **fortified**, have specific **phytochemicals** or active **microorganisms** added, or have been developed using **genetic** engineering techniques. However, all foods can support health in some way, and there is no legal definition of *functional food.* In addition, the actual benefit of these foods, if any, can vary and is open to interpretation. For example, both a candy bar and orange juice may have additional **calcium** added, and can therefore be called functional foods. The consumer must determine the benefit of such items.

The TV Dinner

The "TV Dinner," a registered trademark of the Swanson company, first appeared in the early 1950s as women began leaving the kitchen for work outside the home, changing the way America ate. According to company lore, the product was invented by a sales representative who was left with 270 tons of unsold Thanksgiving turkey after the holiday. Inspired by a food tray with compartments he had seen on an airline, the representative proposed a frozen, prepared dinner for retail sale. The first frozen dinners—featuring turkey, stuffing, gravy, sweet potatoes, and peas—went into production in 1954. The following year, Swanson sold 25 million of them.

—Paula Kepos

Ethnic Foods

People now eat foods with origins in cultures other than their own, especially in the United States, where almost all dishes originated elsewhere but have been modified to suit the tastes and popularity of the mainstream population. Since the late twentieth century, however, there has been an increased incorporation of ethnic **cuisines** into the American diet, including foods from Asia, the Middle East, and Latin America. This trend is part of a larger movement toward diversity in all aspects of life.

cuisine: types of food and traditions of preparation

Although all humans need food to survive, people's food habits (how they obtain, prepare, and consume food) are the result of **learned behaviors**. These collective behaviors, as well as the values and attitudes they reflect, come to represent a group's popular culture. SEE ALSO CONVENIENCE FOODS; DIETING; EATING HABITS; FAST FOODS; FUNCTIONAL FOODS; OBESITY.

learned behaviors: actions that are acquired by training and observation, in contrast to innate behaviors

Judith C. Rodriguez

Bibliography

Carney, George O., ed. (1995). *Fast Foods, Stock Cars, and Rock 'n' Roll: Place and Space in American Pop Culture.* Lanham: Rowman & Littlefield.

Gabaccia, Donna R. (1998). *We Are What We Eat.* Cambridge, MA: Harvard University Press.

Gernmov, John, and Williams, Lauren (1999). *A Sociology of Food and Nutrition.* Oxford: Oxford University Press.

Maltby, Richard, ed. (1989). *Dreams for Sale: Popular Culture in the 20th Century.* London: Harrap.

Mukerji, Chandra, and Schudson, Michael (1991). *Rethinking Popular Culture.* Berkeley: University of California Press.

Scapp, Ron, and Seitz, Brian, eds. (1998). *Eating Culture.* Albany: State University of New York Press.

Schlosser, Eric (2001). *Fast Food Nation: The Darker Side of the All-American Meal.* New York: Houghton Mifflin.

Sizer, Frances, and Whitney, Eleanor (2002). *Nutrition Concepts and Controversies*, 9th edition. Belmont, CA: Wadsworth Thomson Learning.

Warde, Alan, and Martens, Lydia (2000). *Eating Out.* Cambridge, UK: Cambridge University Press.

Internet Resources

National Institutes of Health. "Weight Loss and Control." Available from <http://www.niddk.nih.gov/index.htm>

Pregnancy

Nutrition during the preconception period, as well as throughout a pregnancy, has a major impact on pregnancy outcome. Among prepregnancy considerations, the prepregnancy **Body Mass Index** (BMI), folic acid status, and **socioeconomic status** are the most important.

nutrition: the maintenance of health through proper eating, or the study of same

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

socioeconomic status: level of income and social class

Prepregnancy BMI is an important factor in predicting pregnancy outcome, since both low prepregnancy and high prepregnancy BMI are associated with an increased risk for a negative pregnancy outcome.

Folic acid, a B vitamin, has been shown to prevent birth defects of the brain and spinal cord known as *neural tube defects* (NTDs). The most common NTDs are spina bifida and anencephaly. Folic acid is therefore needed

RECOMMENDED TOTAL WEIGHT-GAIN RANGES FOR PREGNANT WOMEN BY PREPREGNANCY BODY MASS INDEX (BMI)

Weight-for-height category	Recommended total weight gain	
	kg	lb
Low (BMI<19.8)	12.5–18	28–40
Normal (BMI of 19.8 to 26.0)	11.5–16	25–35
High (BMI >26.0 to 29.0)	7–11.5	15–25

Young adolescents and black women should strive for gains at the upper end of the recommended range. Short women (157 cm, or 62 inches) should strive for gains at the lower end of the range. The recommended target weight gain for obese women (BMI >29.0) is at least 6.8 kg (15 lb).

BMI is calculated using metric units.

SOURCE: Institute of Medicine.

both in preconception and early pregnancy. Since studies indicate that most women get less than half the recommended amount of folic acid, the March of Dimes recommends women consider a supplement of 400 micrograms of folic acid preconceptually to prevent the **incidence** of neural tube defects. In addition, it is suggested women capable of becoming pregnant consume a **diet** high in folic acid. Good sources of folic acid include oranges, green leafy vegetables, and **fortified** bread and cereals.

There is also a direct correlation between ethnicity, age, marital status, and educational status with increased negative pregnancy outcomes, such as low birth weight.

incidence: number of new cases reported each year

diet: the total daily food intake, or the types of foods eaten

fortified: altered by addition of vitamins or minerals

Pregnancy Weight Gain

Pregnancy is divided into three trimesters, with each trimester lasting three months, or approximately thirteen weeks (a normal pregnancy lasts 40 weeks). Recommendations for weight gain during pregnancy are based on the Institute of Medicine (IOM) definitions of prepregnancy BMI range. The BMI is defined as weight in pounds, divided by height in inches, divided by height in inches, multiplied by 703 (or weight in kilograms, divided by height in centimeters, divided by height in centimeters, multiplied by ten-thousand). The majority of weight gain should occur in the second and third trimesters. Weight gain can vary greatly in normal pregnancies with normal birth outcomes. Few studies have included women in their first trimester, so the importance of first-trimester weight gain on pregnancy outcome is unclear. However, a slow and steady rate of weight gain is considered ideal. The current recommended weight gain for the BMI ranges are outlined in the accompanying figure.

Poor weight gain during pregnancy is associated with prematurity, low birth weight, and small for gestational age. Among normal-weight women, weight gain above the recommended level corresponds to maternal fat stores and is not of benefit to fetal growth. In other words, fat gain during pregnancy parallels gestational weight gain, and women with greater weight gain also gain more fat. In addition, an inverse relationship exists between pre-pregnancy BMI and weight gain during pregnancy: women with a low pre-pregnancy BMI tend to gain more weight than women with a high pre-pregnancy BMI. On average, **overweight** women gain less weight than their thinner counterparts, though it is not unusual for **obese** women to achieve normal birth outcomes with less than the recommended weight gain.

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

DAILY NUMBER OF SERVINGS SUGGESTED FOR PREGNANCY

(Approximately 2200 calories)

Bread Group (one serving= 1 slice bread, ½ cup cereal, noodles, or rice)	9
Fruit Group (one serving = ½ cup fruit/fruit juice or one medium fruit)	3
Vegetables Group (One serving = ½ cup cooked or one cup raw)	4
Meat Group (one ounce chicken, beef, etc.)	6
Milk Group (one serving = 1 cup milk, 1 ounce cheese)	3
Total Fat (grams)*	73
Total added sugars (teaspoons)*	2

* Values for total fat and added sugars include fat and added sugars that are in food choices from the five major food groups, as well as fat and added sugars from foods in the fats, oils, and sweets group.

SOURCE: USDA Center for Nutrition Policy and Promotion.

In adolescent pregnancies, there are no established BMI recommendations regarding prepregnancy weight and weight gain. Excess weight gain, however, has been associated with postpartum **obesity** in adolescents.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Pregnancy Nutrition Requirements

Traditionally, caloric requirements during pregnancy have been estimated to be around an additional 300 **calories** per day. However, this must be adjusted for physical activity and prepregnancy weight (see accompanying figure) for the recommended number of servings of food groups). To meet weight-gain recommendations, a woman with a low prepregnancy BMI and a high activity level would require more calories than a woman with a high prepregnancy BMI and a **sedentary lifestyle**. A variety of foods from all food groups is important, since foods within the same food group do not contain exactly the same amount of **nutrients**. If increased weight gain is recommended, an emphasis should be placed on high-calorie food group items that contain a higher fat and sugar content. When less weight gain is recommended, women should choose from the lower-calorie food group choices.

calorie: unit of food energy

sedentary: not active

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

nutrient: dietary substance necessary for health

Recommendations regarding sugar intake for pregnant women depend on weight gain and maternal blood **glucose** levels. A high sugar intake would not be advisable for women gaining more than the recommended weight or for those women who are having difficulty controlling normal blood glucose levels, while a high sugar intake would be beneficial for women requiring increased weight gain. A high sugar intake for women who are experiencing excessive weight gain or having difficulty maintaining normal glucose levels could result in increased maternal risk for complications associated with too much weight gain, such as **diabetes**, **hypertension**, premature delivery, and a large for gestational age fetus.

glucose: a simple sugar; the most commonly used fuel in cells

diabetes: inability to regulate level of sugar in the blood

hypertension: high blood pressure

Adequate fluid intake is important to maintain hemodynamics (blood circulation) and **homeostasis** (fluid and tissue balance) and to reduce the risk of urinary tract infections. All pregnant women are encouraged to consume at least 64 ounces of fluid daily. Women at risk of gaining too much weight should be cautioned to limit their intake of sweetened fluids, including juice, and to consume more water. Exercise is considered healthful for most pregnant women, who should be encouraged to continue to exercise at prepregnancy levels. However, women should be cautious about

homeostasis: regulation of the proper internal state

This human fetus is in the second trimester of development, a time when fetal weight gain begins to accelerate. Pregnant women should increase caloric intake by approximately 300 calories per day to account for rapid fetal growth. Calcium and iron supplements may also be necessary. *[Photo Researchers, Inc. Reproduced by permission.]*

beginning any new exercise program during pregnancy, and, if medically advised, should avoid certain activities. Health care providers may recommend bed rest and limiting physical activity (such as work) when preterm labor is present or when weight gain is poor. Increased physical activity will control excess weight gain, in addition to the normal beneficial physical and emotional effects.

Vitamin and Mineral Requirements

Iron is the only recommended nutrient for which requirements cannot be reasonably met by diet alone during pregnancy. Thirty milligrams of ferrous iron is recommended, and iron should be taken on an empty stomach. When more than 30 mg of iron is given to treat **anemia**, it is suggested to also take approximately 15 mg of **zinc** and 2 mg of copper, since iron interferes with **absorption** and utilization of these materials.

iron: nutrient needed for red blood cell formation

anemia: low level of red blood cells in the blood

zinc: mineral necessary for many enzyme processes

absorption: uptake by the digestive tract

According to some studies, caffeine decreases the availability of certain nutrients, such as **calcium**, zinc, and iron. Current recommendations, therefore, include limiting the consumption of caffeinated containing products.

calcium: mineral essential for bones and teeth

Calcium supplementation may be suggested if the average daily intake of calcium is less than 600 mg. Calcium intake is of particular concern among pregnant women under the age of twenty-five, since bone mineral density is still increasing in these women. Calcium supplements, if recommended, should be taken with meals. Additionally, **vitamin D** may be necessary if sunlight exposure is minimal. For vegetarians, the current recommendations also include a daily supplement of 2 mg of Vitamin B_{12}.

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

For women who don't ordinarily consume an adequate diet, or for those in high-risk categories (such as those carrying twins, heavy smokers, and drug abusers) a prenatal vitamin supplement is recommended, beginning in the second trimester. The supplement should contain the following: iron (30 mg); zinc (15 mg); copper (2 mg); calcium (250 mg); vitamin B_6 (62 mg); **folate** (300 mg); vitamin C (50 mg); vitamin D (5 mg).

folate: one of the B vitamins, also called folic acid

Special Nutrition Concerns

Food cravings during pregnancy are common and are not cause for concern, provided other nutrient needs are met and weight gain is in the target range. Pica—the ingestion of nonfood substances of nutritional value—is associated with anemia and can be a source of lead poisoning, bacterial infection, and dental problems. Pregnant women should be encouraged to avoid pica and discuss it with their medical provider.

Gestational diabetes is associated with high prepregnancy BMI and excess pregnancy weight gain. Infants of gestational-diabetic mothers are usually born large for gestational age (macrosomia) and are at higher risk for cesarean delivery and **hypoglycemia** postpartum.

hypoglycemia: low blood sugar level

Symptoms of toxemia of pregnancy, also known as preeclampsia, include swelling (**edema**) and proteinuria (excess **protein** in the urine). The cause of toxemia has not been determined, but the risk is associated with first pregnancies, advanced maternal age, African-American ethnicity, and women with a past history of diabetes, hypertension, or kidney disease. In severe cases, delivery is frequently induced.

edema: accumulation of fluid in the tissues

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Tips for common pregnancy discomforts include avoidance of offending foods (and their odor) when **nausea** and heartburn occur. Many pregnant women find that spicy, fatty foods can increase problems with nausea and heartburn. Frequent, small, and blander meals are often better tolerated. Some women find eating dry crackers before rising from bed in the morning helpful for nausea. However, since nausea and vomiting usually subside by the end of the first trimester, they do not have a significant impact on the final weight gain in most pregnancies. Hyperemesis gravidarum, or intractable vomiting during pregnancy, can rapidly result in **dehydration**, so medical intervention is required.

nausea: unpleasant sensation in the gut that precedes vomiting

dehydration: loss of water

When **constipation** is a concern, increased consumption of whole grains, fruits, and vegetables is advisable, as well as increased fluid intake and physical activity.

constipation: difficulty passing feces

Breastfeeding is the recommended method of infant nutrition, with a few exceptions. It benefits both mother and infant by providing protective **antibodies** to human disease, and breastfed babies are generally healthier and have higher I.Q. levels than bottle-fed babies. The development of jaw alignment problems and **allergies** are also far less likely in breastfed babies, while mothers who breastfeed have less postpartum complications and are considered to be at lower risk for breast **cancer**.

antibody: immune system protein that protects against infection

allergy: immune system reaction against substances that are otherwise harmless

cancer: uncontrolled cell growth

In the United States, women with HIV infection should not breastfeed. This is not a contraindication in developing countries, however, as the benefits may outweigh the possibility of infection. Untreated **tuberculosis** is also a contraindication for breastfeeding, while hepatitis C is currently not a contraindication for breastfeeding.

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

The Women, Infants, and Children (WIC) Program

The WIC program was established in the 1970s as a supplemental food and nutrition-education program. Eligibility requirements include a household income of up to 185 percent of the federal poverty level, as well as nutrition-risk criteria. The WIC program goals include improving pregnancy outcomes

by helping participants achieve recommended weight gain. Nutritional food choices and calorie levels based on recommended weight gain are emphasized. The program has been shown to significantly reduce a number of negative pregnancy outcomes, including low birth weight. SEE ALSO ADOLESCENT NUTRITION; BREASTFEEDING; LOW BIRTH WEIGHT INFANT; PICA; SMALL FOR GESTATIONAL AGE; WOMEN'S NUTRITIONAL ISSUES.

Mary Parke

Bibliography

Edwards, Cecile H. (1994) "African American Women and Their Pregnancies: Research Papers from the Program Project: Nutrition, Other Factors, and the Outcome of Pregnancy." *Journal of Nutrition* 124(6):917s–1027s.

Institute of Medicine, Committee on Nutritional Status during Pregnancy (1990). *Nutrition during Pregnancy.* Washington, DC: National Academy Press.

"Recent Developments in Maternal Nutrition and Their Implications for Practitioners." (1994). *American Journal of Clinical Nutrition* 59(2):437s–545S.

Stevens-Simon, Catherine, and McAarney, Elizabeth R. (1992). "Adolescent Pregnancy: Gestational Weight Gain and Maternal and Infant Outcomes." *American Journal of Diseases of Children* 146:1359–1364.

Suitor, Carol W. (1991). "Perspectives on Nutrition during Pregnancy." *Journal of the American Dietetic Association* 91:96–98.

Internet Resources

March of Dimes. "Folic Acid." Available from <http://www.marchofdimes.com/professionals/690.asp>

March of Dimes. "National Perinatal Statistics." Available from <http://www.marchofdimes.com/professionals/680_1239.asp>

MEDLINEplus Medical Encyclopedia. "Preeclampsia." Available from <http://www.nlm.nih.gov>

National Institute of Child Health and Human Development (2002). "Understanding Gestational Diabetes." Available from <http://www.nichd.nih.gov>

United States Department of Agriculture (USDA) Center for Nutrition Policy. Available from <http://www.usda.gov/cnpp>

Premenstrual Syndrome

Premenstrual syndrome (PMS) is characterized by emotional and physical symptoms that can be troubling and cause moderate discomfort for women the week or two before the onset of their menstrual cycle. PMS is estimated to affect up to 40 percent of reproductive-aged women. Approximately 5 to 10 percent of these women experience symptoms so severe that it totally impairs their everyday **lifestyle**. This severe form of PMS is known as premenstrual dysphoric disorder (PMDD). The precise **etiology** of PMS is still unknown; however, it is increasingly believed that the sensitive equilibrium between female sex **steroids** (the **hormones estrogen** and progesterone) and **neurotransmitters** in the brain is altered in women with PMS.

With a wide range of symptoms, both emotional and physical, the first step in successfully treating PMS is for a woman to recognize the changes in her body and mood. Keeping a close record of symptoms, their severity, and the dates they occur within the menstrual cycle is an important tool. Discussing this with a gynecologist can lead to a very successful treatment plan.

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

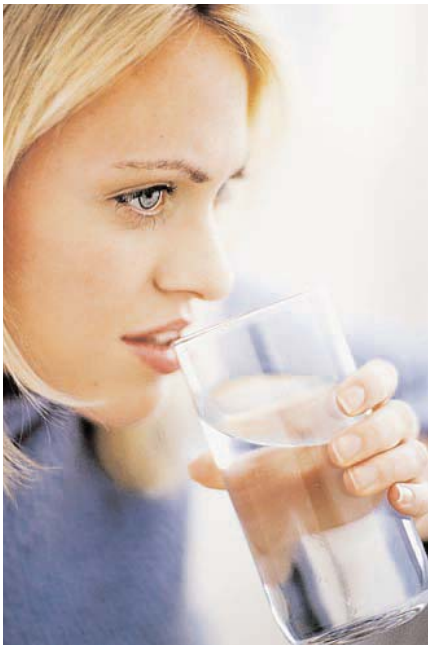
etiology: origin and development of a disease

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic processes

hormone: molecules produced by one set of cells that influence the function of another set of cells

estrogen: hormone that helps control female development and menstruation

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another



Up to 40 percent of reproductive-aged women experience symptoms of premenstrual syndrome (PMS). Eating certain foods and drinking plenty of water may help alleviate some of the discomfort of PMS. *[Photograph by Michael Keller. Corbis. Reproduced by permission.]*

menstrual cycles: the build-up and sloughing off of the lining of the uterus in women commencing at puberty and proceeding until menopause

fatigue: tiredness

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

anxiety: nervousness

fatty acids: molecules rich in carbon and hydrogen; a component of fats

clinical: related to hospitals, clinics, and patient care

calcium: mineral essential for bones and teeth

stress: heightened state of nervousness or unease

aerobic: designed to maintain adequate oxygen in the bloodstream

Symptoms

A woman is diagnosed with premenstrual syndrome if she has at least one emotional and one physical symptom during the five days before the onset of her period for three consecutive **menstrual cycles**. The specific symptom is not as important for diagnosis as is the cyclic fashion in which it appears. Emotional symptoms include minor **fatigue**, **depression**, angry outbursts, irritability, **anxiety**, confusion, social withdrawal, mood swings, and crying spells. Physical symptoms include headaches, bloating, acne, appetite changes and cravings, breast tenderness, and swelling of extremities.

Treatments

Diet.

To help alleviate the symptoms of PMS, many treatments, both traditional and alternative, are being sought by thousands of women daily. According to some experts, the majority of PMS symptoms are a result of hormonal imbalances where there is too much estrogen in the body in comparison with the amount of progesterone. Studies have shown that a number of foods, such as, soy, vegetables and fruit, and nuts and seeds can actually help with hormonal balance. PMS sufferers are advised to increase their intake of fruits, vegetables, whole grains, low-fat dairy products and omega-3 **fatty acids** (mostly found in seafood and nuts). Eating small, frequent meals at the same time each day can help reduce bloating and fullness.

Several **clinical** trials have shown that supplementation of **calcium** and magnesium can play a crucial role in the prevention of PMS. Nine hundred to 1,200 milligrams of calcium per day was found to be effective in reducing food cravings and mood swings, and 200 to 500 milligrams of magnesium reduced bloating and breast tenderness. Studies of vitamin B_6 and vitamin E intake have had varied results. A daily multivitamin-mineral supplement is believed to be beneficial for all PMS sufferers.

Besides additions to the diet, it is suggested that women suffering from PMS should avoid caffeine, in the form of soft drinks, coffee, or chocolate; refined sugars; sodium; and saturated fats. Drinking plenty of water is a complement to cutting back on sodium. The effects of alcohol are usually magnified in premenstrual women, and therefore it is also advised that alcohol consumption be decreased or stopped totally.

Exercise.

Scientific studies have shown that any type of physical exercise can help improve mood, decrease anxiety, and reduce **stress** reactions. As little as twenty to thirty minutes of **aerobic** type exercise three to five times a week, such as brisk walking, has shown to decrease some PMS symptoms. Some studies have also shown that doing nonaerobic exercises may also work, but to a smaller degree.

Complementary Medicine.

Based on some preliminary scientific research, the herb chasteberry, also known as vitex agnus-castus, has been shown to relieve several PMS symptoms. According to a clinical trial, reported in January 2001 in a European scientific journal, more than half the women who received 20-milligram chasteberry tablets had a significant improvement in all their symptoms except bloating. Black cohosh and evening primrose oil are other herbs that are gaining popularity, though studies to date are inconclusive.

Light therapy can help alleviate the symptoms of PMS in some women. The results may be due to the relationship between melatonin, which is produced as a response to changes in visible light, and serotonin, which is a neural transmitter that contributes to a person's emotional outlook. *[Najlah Feanny/Corbis. Reproduced by permission.]*

Some studies have shown that women with PMS who are treated with bright-light therapy can have a substantial improvement in their mood. Bright-light therapy consists of sitting under a bright light of predetermined intensity for thirty minutes for one to two weeks before the onset of a menstrual cycle.

Many other alternative treatments are being explored for relieving PMS symptoms. To date, reflexology, massage therapy, and **acupuncture** are in the forefront of potential alternative treatments; however, future studies are needed to confirm their overall effectiveness.

acupuncture: insertion of needles into the skin at special points to treat disease

Pharmacologic.

Since premenstrual symptoms are thought to be related to the changing levels of estrogen and progesterone, these hormones were among the first to be tested as a possible treatment. Although some early research reported positive findings, more recent studies have revealed that progesterone, whether natural of artificial, is not successful in the management of PMS.

A form of pharmacologic treatment that has shown positive results is the suppression of ovulation, which eliminates both the cyclic rhythm of hormone production and eliminating cyclic mood symptoms. The most common medications used for ovulation suppression are gonadotropin-releasing hormone (GnRH) agonists. Currently, the use of GnRH agonists is experimental; however, studies have shown that 75 percent of women treated with GnRH agonists have experienced reductions in tension, depression, mood swings, and breast tenderness.

Evidence from numerous controlled trials has clearly demonstrated that low-dose selective **serotonin** reuptake inhibitors (SSRIs) also have excellent **efficacy** with minimal side effects in treating women with severe PMS symptoms. SSRIs are a group of medications primarily used in treating depression and anxiety disorders. These medications have been shown to be best taken during the luteal phase of the menstrual cycle only.

serotonin: chemical used by nerve cells to communicate with one another

efficacy: effectiveness

Conclusion

Premenstrual syndrome, and its effect on millions of women, received a lot of attention during the 1990s, and many treatment modalities have emerged. The first step is for a woman to identify her symptoms and seek professional help. Through many available treatments, both traditional and alternative, and lifestyle changes such as diet and exercise, women no longer have to suffer so severely on a monthly basis. Research in this area is still needed, however, and more treatments need to be explored. SEE ALSO CRAVINGS; MOOD-FOOD RELATIONSHIPS; WOMEN'S NUTRITIONAL ISSUES.

Keri M. Gans

Bibliography

Dell, Diana, and Svec, Carol (2003). *The PMDD Phenomenon: Breakthrough Treatments for Premenstrual Dysphoric Disorder (PMDD) and Extreme Premenstrual Syndrome (PMS)*. New York: McGraw-Hill.

Northrup, Christiane (1998). *Women's Bodies, Women's Wisdom*. New York: Bantam.

Internet Resources

American College of Obstetricians and Gynecologists. "Dealing with PMS." *Spotlight on Women's Health*. Available from <http://www.acog.com>

Mayo Clinic. "Premenstrual Syndrome." Available from <http://www.mayclinic.com>

National Association for Premenstrual Syndrome. Available from <http://www.pms.org.uk/>

Nusbaum, Murray, and Schwarz, Richard. "Coping with PMS." American College of Obstetricians and Gynecologists. Available from <http://www.acog.com>

Lichten, Edward M. "Medical Treatment of Premenstrual Syndrome." Available from <http://www.usdoctor.com/pms.htm>

Preschoolers and Toddlers, Diet of

puberty: time of onset of sexual maturity

development: the process of change by which an organism becomes more complex

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

growth spurts: periods of rapid growth

plateaus: periods during which growth is greatly reduced

anxiety: nervousness

nutritional requirements: the set of substances needed in the diet to maintain health

At approximately age one, children enter the latent period of growth. During this period, until the onset of **puberty**, growth and **development** are more gradual than during the first year. Physical growth steadies, and the body begins to look more proportioned as it prepares for an "upright" **lifestyle**.

The immediate stages following infancy are toddlerhood (ages one through three) and the preschool years (ages three through five). Characterized by temper tantrums, exploration, and endless questions, these periods can be trying for parents. Individual children experience **growth spurts** and **plateaus**—during which growth seems to stop completely. Food intake, and a liking of certain foods, may change constantly, causing a great deal of **anxiety** for parents.

Parents need to recognize that these changes are a normal part of development. Understanding the **nutritional requirements** of these age groups may help parents adapt to the new challenges. In addition, parents should be aware of the potential problems associated with feeding young children—and the ways to prevent them.

Nutritional Requirements

nutrient: dietary substance necessary for health

Compared to adults, small children need more **nutrients** in proportion to their body weight. As bones, muscles, teeth, and blood volume are develop-

Former U.S. Secretary of Agriculture Dan Glickman promotes federal food programs at a daycare center while the children behind him enjoy lunch. *[Photograph by Mike Derer. AP/Wide World Photos. Reproduced by permission.]*

ing, nutrient intake needs to be adequate to support this process, and also to keep up with the growing child's increasing activity. A challenge also arises when growth spurts alternate with periods of no growth or slowed growth.

The **Dietary Reference Intakes** (DRIs), which include the **Recommended Dietary Allowances** (RDAs) and **Adequate Intakes** (AIs), should serve as a guide to prevent deficiencies in this age group. However, most of the levels set for preschoolers and toddlers are based on values established for infants and adults. In addition, the DRIs include a built-in margin of safety that exceeds the requirements for most children in the United States. Therefore, an intake that is less than that specified in the DRIs is not necessarily a reason for concern. For parents, a more practical approach to ensuring proper nutrient intake is to use the Food Guide Pyramid for Young Children, devised by the U.S. Department of Agriculture (USDA).0

Most people do not follow the requirements specified in these guides. Although severe nutrient deficiencies are rare in the United States, **calcium**, **iron**, **zinc**, vitamin B6, folic acid, and vitamin A are the nutrients most likely to be low in children as a result of poor dietary habits. Ensuring that children eat the recommended number of servings from each of the food groups in the pyramid is the best way to be certain that all nutritional requirements are met. A good rule of thumb for serving sizes is one tablespoon per year of age.

Energy and Protein Needs.

Basal metabolic rate, growth, and physical activity all affect a child's daily energy. Regardless of the total intake, the composition should resemble the following: 50 to 60 percent of **calories** from **carbohydrates**, 25 to 35 percent of calories from fat, and 10 to

Dietary Reference Intakes: set of guidelines for nutrient intake

Recommended Dietary Allowances: nutrient intake recommended to promote health

adequate intake: nutrient intake that appears to maintain the state of health

calcium: mineral essential for bones and teeth

iron: nutrient needed for red blood cell formation

zinc: mineral necessary for many enzyme processes

basal metabolic rate: rate of energy consumption by the body during a period of no activity

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

fat: type of food molecule rich in carbon and hydrogen, with high energy content

RECOMMENDED DIETARY ALLOWANCES FOR ENERGY AND PROTEIN FOR CHILDREN.

	Kilocalories			Grams of protein	
Age (years)	daily	per kg	per cm	daily	per kg
1–3	1,300	102	14.4	16	1.2
4–6	1,800	80	16.0	24	1.1

SOURCE: Mahan L. Kathleen and Escott-Stump, Sylvia, eds. (2000). *Krause's Food, Nutrition & Diet Therapy,* 10th ed. Philadelphia, PA: W. B. Saunders Company.

15 percent of calories from protein (see accompanying table.) It should be remembered, however, that this is simply an estimate, and intake may need to be adjusted to suit each child.

Protein is a vital dietary component for preschoolers and toddlers, as it is needed for optimal growth. Enough protein should be consumed every day to allow for proper development. Protein deficiencies are rare in the United States, since most U.S. children consume plenty of protein each day. When protein **malnutrition** does occur, it is usually seen in those from low-income homes, those who follow a strict **vegan diet** excluding all animal sources, and those with multiple food **allergies**.

malnutrition: chronic lack of sufficient nutrients to maintain health

vegan: person who consumes no animal products, including milk and honey

diet: the total daily food intake, or the types of foods eaten

allergy: immune system reaction against substances that are otherwise harmless

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

oxygen: O_2, atmospheric gas required by all animals

anemia: low level of red blood cells in the blood

phosphorus: element essential in forming the mineral portion of bone

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

temperate zone: region of the world between the tropics and the arctic or Antarctic

Vitamin and mineral needs.

Iron is a vital component of **hemoglobin**, the carrier of **oxygen** in the blood. As a young child grows, blood volume increases, and so does the need for iron. Preschoolers and toddlers typically eat less iron-rich foods than they did in infancy. In addition, the iron that children get is usually non-heme iron (from plant sources), which has a lower availability than heme iron (from animal sources). As a result, children up to three years of age are at high risk for iron-deficiency **anemia**. The RDA for iron for both toddlers and preschoolers is ten milligrams (mg) per day.

Calcium is needed for bone and teeth mineralization and maintenance. The amount of calcium a child needs is determined in part by the consumption of other nutrients, such as protein, **phosphorus** and **vitamin D**, as well as the child's rate of growth. During this period of development, children need two to four times as much calcium per kilogram of body weight as adults do. The AI for toddlers is 500 mg/day, while for preschoolers it is 800 mg/day. Since dairy foods are the primary source of calcium, children who do not consume enough dairy or have an aversion to dairy products may be at risk for calcium deficiency.

The body can produce vitamin D in the skin in response to sun exposure. The amount of vitamin D needed daily thus depends mainly on how much time a child spends outside and on geographical location. The RDA for children living in tropical areas is between zero and 2.5 micrograms (μg) per day, depending on the amount of sun exposure. For those living in **temperate zones**, the RDA increases to 10 mc/day. Vitamin D–fortified milk is the best source.

Zinc is essential for proper development. It is needed for wound healing, proper sense of taste, proper growth, and normal appetite. Preschoolers and toddlers are sometimes at risk for marginal zinc deficiencies because the best sources are meats and seafoods, foods they may not eat regularly. The recommended intake of zinc is 10 mg/day.

Vitamin and mineral supplements are popular with more than 50 percent of parents of preschoolers and toddlers. Most use a multivitamin/mineral supplement with iron. Parents should be aware, however, that such supplements do not necessarily fulfill the needs for marginal or deficient nutrients. For example, although calcium is often a nutrient that is low in children, most multivitamin/mineral supplements do not include it, or include it in very low doses. The American Academy of Pediatrics does not support routine supplementation for normal, healthy kids. Although there is no harm in giving children a standard children's supplement, megadoses should always be avoided, and caution should be used when supplementing the fat-soluble **vitamins** (vitamins A, D, E, and K).

Potential Feeding Problems

As young children develop their likes and dislikes and learn to feed themselves, parents need to allow them to become more independent. As a result of these changes, potential concerns arise. Common feeding problems among preschoolers and toddlers are: **obesity**, nursing bottle mouth syndrome, food jags, and iron-deficiency anemia.

According to the national Pediatric Nutrition Surveillance System, 10.2 percent of children in the United States under the age of five were **overweight** in 1998. These rates have been increasing steadily since the 1960s. Prevention education is the key to lowering the **incidence** of obesity in children. Success has been shown in programs that include family involvement, nutritional information and modification, activity planning, and behavior therapy.

Most often seen in children under age three, nursing bottle mouth syndrome (or baby bottle tooth decay) results from extended bottle feeding. It occurs when a child is routinely given a bottle with sweetened beverages (such as milk or juice) at bedtime. As the child sleeps, the liquid pools around the teeth. The result is severe **caries** on the **incisors** and cheek surfaces of **molars**. Parents should avoid giving a bottle at bedtime and begin serving beverages in a cup as early as possible.

Most children undergo a normal part of development know as a *food jag*. Food jags occur when children either refuse to eat a previously accepted food, or when they insist on eating one particular food all the time. A food jag is generally a case of a child testing his or her independence. Although annoying for most parents, food jags are rarely a reason for concern. The best strategy is to continue offering a variety of foods every day, while keeping the favorite food available. Most children will eventually return to a normal eating pattern. Letting a food jag take its course is the best plan of action; force will accomplish little.

Despite the wide availability of iron-rich foods, iron-deficiency anemia is the most common nutrient deficiency in the world. Reasons for this deficiency in toddlers may be the consumption of large quantities of milk, and thus limited intake of solids and iron-fortified foods. In addition, many young children do not like the best sources of iron, such as meats and seafoods. Parents should pay special attention to include good dietary sources of iron in their children's diet. When meat or seafood sources are limited, the availability of iron from plant sources can be increased with the consumption of ascorbic acid (vitamin C).

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

obesity: the condition of being overweight, according to established norms based on sex, age, and height

overweight: weight above the accepted norm based on height, sex, and age

incidence: number of new cases reported each year

caries: cavities in the teeth

incisor: chisel-shaped tooth used for cutting; one of the types of primary teeth

molar: grinding tooth toward the rear of the mouth

Feeding Strategies for Parents

- Allow kids to eat five to six small meals per day.
- Allow them to eat when they are hungry and do not force them to eat when they are not.
- Do not use food as a reward or punishment.
- Be aware of the risk of choking in these age groups. Avoid foods that are round, hard, or do not easily dissolve in saliva (such as hot dogs, grapes, raw vegetables, popcorn, nuts, peanut butter, and hard candy).
- Avoid feeding too many sweetened beverages (especially in the bottle); encourage them to drink plenty of water.

The preschool and toddler years often create anxiety in parents as food likes, dislikes, and requirements may change continuously. Understanding that these changes are a normal part of development, and understanding the nutritional requirements for this age group, will help parents make educated decisions. Parents should also be aware of the potential feeding problems of this group, and of the ways to prevent them. SEE ALSO BABY BOTTLE TOOTH DECAY; CHILDHOOD OBESITY.

Kirsten Herbes

Bibliography

Ballabriga, Angela, ed. (1996) *Feeding from Toddlers to Adolescence.* Philadelphia, PA: Lippincott-Raven.

Duyff, Roberta L. (1998). *The American Dietetic Association's Complete Food & Nutrition Guide.* Minneapolis, MN: Chronimed Publishing.

Herbest, Victor, and Subak-Sharpe, Genell J., eds. (1995). *Total Nutrition: The Only Guide You'll Ever Need.* New York, NY: St. Martin's Griffin.

Hovasi Cox, Jance, ed. (1997) *Nutrition Manual for At-Risk Infants and Toddlers.* Chicago, IL: Precept Press.

Mahan, L. Kathleen, and Escott-Stump, Sylvia, eds. (2000). *Krause's Food, Nutrition, and Diet Therapy*, 10th ed. Philadelphia, PA: W. B. Saunders Company.

McWilliams, Margaret (1986). *Nutrition for the Growing Years.* New York, NY: Macmillan Publishing Company.

Queen Samor, Patricia; King Helm, Kathy; and Lang, Carol E. (1999). *Handbook of Pediatric Nutrition*, 2nd ed. Gaithersburg, MD: Aspen Publishers, Inc.

Tamborlane, William V., ed. (1997). *The Yale Guide to Children's Nutrition.* New Haven, CT: Yale University Press.

Wardlaw, Gordon M. (1999). *Perspectives in Nutrition*, 4th ed. New York, NY: WCB/McGraw-Hill.

Internet Resources

American Dietetic Association. "Child Feeding." American Dietetic Association. Available from <http://www.eatright.com/healthy/child/>

American Dietetic Association. "Position of the ADA: Dietary Guidance for Healthy Children Aged 2 to 11 years." Available from <http://www.eatright.com/adap0199.html>

American Dietetic Association. "Food Guide Pyramid for Young Children." Available from <http://www.usda.gov/cnpp/kidspyra>

nonpathogenic: not promoting disease

microorganisms: bacteria and protists; single-celled organisms

gastrointestinal: related to the stomach and intestines

microflora: microscopic organisms present in small numbers

allergy: immune system reaction against substances that are otherwise harmless

eczema: skin disease causing itching and flaking

candidal: related to the yeast Candida

cancer: uncontrolled cell growth

gastric: related to the stomach

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

bile: substance produced in the liver which suspends fats for absorption

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

Probiotics

Probiotics are live, **nonpathogenic microorganisms** that may interact with **gastrointestinal** and vaginal **microflora**. Clinical studies indicate that certain probiotics may be useful in treating some diarrheal disorders, respiratory **allergies**, and **eczema**, as well as in controlling inflammation and reducing the risk of **candidal** vaginitis and colon **cancer**.

Dietary sources of probiotics are usually found in dairy products. Yogurt, for example, contains intestinal species of lactobacilli and bifidobacteria, two groups of probiotic bacteria. **Gastric** survival rates of probiotics are estimated at 20 to 40 percent, with the main obstacles to survival being gastric **acidity** and the action of **bile** salts. Investigations into different modes of administering probiotics may expand their applications in **functional foods**. SEE ALSO FUNCTIONAL FOODS.

M. Elizabeth Kunkel
Barbara H. D. Luccia

Bibliography

Gibson, G. R., and Roberfroid, Marcel B. (1999). *Colonic Microbiota, Nutrition, and Health*. Boston: Kluwer Academic.

Protein

Proteins are compounds composed of carbon, hydrogen, **oxygen**, and **nitrogen**, which are arranged as strands of **amino acids**. They play an essential role in the cellular maintenance, growth, and functioning of the human body. Serving as the basic structural molecule of all the tissues in the body, protein makes up nearly 17 percent of the total body weight. To understand protein's role and function in the human body, it is important to understand its basic structure and composition.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

oxygen: O_2, atmospheric gas required by all animals

nitrogen: essential element for plant growth

amino acid: building block of proteins, necessary dietary nutrient

Amino Acids

Amino acids are the fundamental building blocks of protein. Long chains of amino acids, called *polypeptides*, make up the multicomponent, large complexes of protein. The arrangement of amino acids along the chain determines the structure and chemical properties of the protein. Amino acids consist of the following elements: carbon, hydrogen, oxygen, nitrogen, and, sometimes, sulfur. The general structure of amino acids consists of a carbon center and its four substituents, which consists of an amino group (NH_2), an organic acid (carboxyl) group (COOH), a hydrogen atom (H), and a fourth group, referred to as the R-group, that determines the structural identity and chemical properties of the amino acid. The first three groups are common to all amino acids. The basic amino acid structure is R-CH(NH2)-COOH.

There are twenty different forms of amino acids that the human body utilizes. These forms are distinguished by the fourth variable substituent, the R-group, which can be a chain of different lengths or a carbon-ring structure. For example, if hydrogen represents the R-group, the amino acid is known as *glycine*, a **polar** but **uncharged** amino acid, while methyl (CH_3) group is known as *alanine*, a **nonpolar** amino acid. Thus, the chemical components of the R-group essentially determine the identity, structure, and function of the amino acid.

polar: containing regions of positive and negative charge; likely to be soluble in water

uncharged: neither positively nor negatively charged

nonpolar: without a separation if charge within the molecule; likely to be hydrophobic

The structural and chemical relatedness of the R-groups allows classification of the twenty amino acids into chemical groups. Amino acids can be classified according to optical activity (the ability to polarize light), **acidity** and basicity, polarity and nonpolarity, or hydrophilicity (water-loving) and hydrophobicity (water-fearing). These categories offer clues to the function and **reactivity** of the amino acids in proteins. The **biochemical** properties of amino acids determine the role and function of protein in the human body.

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

reactivity: characteristic set of reactions undergone due to chemical structure

biochemical: related to chemical processes within cells

Of the twenty amino acids, eleven are considered *nonessential* (or *dispensable*), meaning that the body is able to adequately synthesize them, and nine are *essential* (or *indispensable*), meaning that the body is unable to adequately synthesize them to meet the needs of the cell. They must therefore be supplied through the **diet**. Foods that have protein contain both nonessential and essential amino acids, the latter of which the body can use to synthesize some of the nonessential amino acids. A healthful diet, therefore, should

diet: the total daily food intake, or the types of foods eaten

THE TWENTY AMINO ACIDS

Name	Abbreviation	Linear structure formula (atom composition and bonding)
Alanine	ala	CH_3-CH(NH_2)-COOH
Arginine	arg	HN=C(NH_2)-NH-(CH_2)3-CH(NH_2)-COOH
Asparagine	asn	H_2N-CO-CH_2-CH(NH_2)-COOH
Aspartic acid	asp	HOOC-CH_2-CH(NH_2)-COOH
Cysteine	cys	HS-CH_2-CH(NH_2)-COOH
Glutamine	gln	H2N-CO-(CH_2)2-CH(NH_2)-COOH
Glutamic acid	glu	HOOC-(CH_2)2-CH(NH_2)-COOH
Glycine	gly	NH_2-CH_2-COOH
Histidine	his	NH-CH=N-CH=C-CH_2-CH(NH_2)-COOH |_____| (nitrogen bonded to carbon)
Isoleucine	ile	CH_3-CH2-CH(CH_3)-CH(NH_2)-COOH
Leucine	leu	(CH_3)2-CH-CH_2-CH(NH_2)-COOH
Lysine	lys	H_2N-(CH_2)4-CH(NH_2)-COOH
Methionine	met	CH_3-S-(CH_2)2-CH(NH_2)-COOH
Phenylalanine	phe	Ph-CH_2-CH(NH_2)-COOH
Proline	pro	NH-(CH_2)3-CH-COOH |_____|
Serine	ser	HO-CH_2-CH(NH_2)-COOH
Threonine	thr	CH_3-CH(OH)-CH(NH_2)-COOH
Tryptophan	trp	Ph-NH-CH=C-CH_2-CH(NH_2)-COOH |_____|
Tyrosine	tyr	HO-Ph-CH_2-CH(NH_2)-COOH
Valine	val	(CH_3)2-CH-CH(NH_2)-COOH

SOURCE: Institute for Chemistry

consist of a sufficient and balanced supply of both essential and nonessential amino acids in order to ensure high levels of protein production.

Protein Quality: Nutritive Value

The quality of protein depends on the level at which it provides the nutritional amounts of essential amino acids needed for overall body health, maintenance, and growth. Animal proteins, such as eggs, cheese, milk, meat, and fish, are considered *high-quality*, or *complete*, *proteins* because they provide sufficient amounts of the essential amino acids. Plant proteins, such as grain, corn, nuts, vegetables and fruits, are *lower-quality*, or *incomplete*, *proteins* because many plant proteins lack one or more of the essential amino acids, or because they lack a proper balance of amino acids. Incomplete proteins can, however, be combined to provide all the essential amino acids, though combinations of incomplete proteins must be consumed at the same time, or within a short period of time (within four hours), to obtain the maximum nutritive value from the amino acids. Such combination diets generally yield a high-quality protein meal, providing sufficient amounts and proper balance of the essential amino acids needed by the body to function.

Protein Processing: Digestion, Absorption, and Metabolism

Protein digestion begins when the food reaches the stomach and stimulates the release of hydrochloric acid (HCl) by the parietal cells located in the **gastric mucosa** of the GI (**gastrointestinal**) tract. Hydrochloric acid provides for a very acidic **environment**, which helps the protein digestion process in two ways: (1) through an acid-catalyzed *hydrolysis* reaction of breaking peptide bonds (the chemical process of breaking peptide bonds is referred to as a hydrolysis reaction because water is used to break the bonds); and (2) through conversion of the gastric **enzyme** pepsinogen (an inactive precursor) to pepsin (the active form). Pepsinogen is stored and secreted by the "chief cells" that line the stomach wall. Once converted into the active form, pepsin attacks the peptide bonds that link amino acids together, breaking the long polypeptide chain into shorter segments of amino acids known as dipeptides and tripeptides. These protein fragments are then further broken down in the duodenum of the small **intestines**. The *brush border enzymes*, which work on the surface of **epithelial cells** of the small intestines, **hydrolyze** the protein fragments into amino acids.

gastric: related to the stomach

mucosa: moist exchange surface within the body

gastrointestinal: related to the stomach and intestines

environment: surroundings

enzyme: protein responsible for carrying out reactions in a cell

intestines: the two long tubes that carry out the bulk of the processes of digestion

epithelial cell: sheet of cells lining organs throughout the body

hydrolyze: to break apart through reaction with water

The cells of the small intestine actively absorb the amino acids through a process that requires **energy**. The amino acids travel through the hepatic portal vein to the liver, where the **nutrients** are processed into **glucose** or **fat** (or released into the bloodstream). The tissues in the body take up the amino acids rapidly for glucose production, growth and maintenance, and other vital cellular functioning. For the most part, the body does not store protein, as the metabolism of amino acids occurs within a few hours.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

nutrient: dietary substance necessary for health

glucose: a simple sugar; the most commonly used fuel in cells

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Amino acids are metabolized in the liver into useful forms that are used as building blocks of protein in tissues. The body may utilize the amino acids for either **anabolic** or *catabolic reactions.* Anabolism refers to the chemical process through which digested and absorbed products are used to effectively build or repair bodily tissues, or to restore vital substances broken down through metabolism. **Catabolism**, on the other hand, is the process that results in the release of energy through the breakdown of nutrients, stored materials, and cellular substances. Anabolic and catabolic reactions work hand-in-hand, and the energy produced in catabolic processes is used to fuel essential anabolic processes. The vital biochemical reaction of **glycolysis** (in which glucose is oxidized to produce carbon dioxide, water, and cellular energy) in the form of adenosine triphosphate, or ATP, is a prime example of a catabolic reaction. The energy released, as ATP, from such a reaction is used to fuel important anabolic processes, such as protein synthesis.

anabolic: promoting building up

catabolism: breakdown of complex molecules

glycolysis: cellular reaction that begins the breakdown of sugars

The metabolism of amino acids can be understood from the dynamic catabolic and anabolic processes. In the process referred to as **deamination**, the nitrogen-containing amino group (NH_2) is cleaved from the amino acid unit. In this reaction, which requires vitamin B6 as a cofactor, the amino group is transferred to an acceptor **keto-acid**, which can form a new amino acid. Through this process, the body is able to make the nonessential amino acids not provided by one's diet. The keto-acid intermediate can also be used to synthesize glucose to ultimately yield energy for the body, and the cleaved nitrogen-containing group is transformed into urea, a waste product, and excreted as urine.

deamination: removal of an NH2 group from a molecule

keto-acid: an acid compound containing the reactive CO group

Vital Protein Functions

Proteins are vital to basic cellular and body functions, including cellular regeneration and repair, tissue maintenance and regulation, **hormone** and enzyme production, fluid balance, and the provision of energy.

hormone: molecules produced by one set of cells that influence the function of another set of cells

Cellular and tissue provisioning. Protein is an essential component for every type of cell in the body, including muscles, bones, organs, tendons, and ligaments. Protein is also needed in the formation of enzymes, **antibodies**, hormones, blood-clotting factors, and blood-transport proteins. The body is constantly undergoing renewal and repair of tissues. The amount of protein needed to build new tissue or maintain structure and function depends on the rate of renewal or the stage of growth and **development**. For example, the intestinal tract is renewed every couple of days, whereas blood cells have a life span of 60 to 120 days. Furthermore, an infant will utilize as much as one-third of the dietary protein for the purpose of building new connective and muscle tissues.

antibody: immune system protein that protects against infection

development: the process of change by which an organism becomes more complex

Hormone and enzyme production. Amino acids are the basic components of hormones, which are essential chemical signaling messengers of the body. Hormones are secreted into the bloodstream by endocrine glands, such as the thyroid gland, adrenal glands, pancreas, and other ductless glands, and regulate bodily functions and processes. For example, the hormone **insulin**, secreted by the pancreas, works to lower the blood glucose level after meals. Insulin is made up of forty-eight amino acids.

insulin: hormone released by the pancreas to regulate level of sugar in the blood

Enzymes, which play an essential **kinetic** role in **biological** reactions, are composed of large protein **molecules**. Enzymes facilitate the rate of reactions by acting as *catalysts* and lowering the activation energy barrier between the reactants and the products of the reactions. All chemical reactions that occur during the digestion of food and the **metabolic** processes in tissues require enzymes. Therefore, enzymes are vital to the overall function of the body, and thereby indicate the fundamental and significant role of proteins.

kinetic: related to speed of reaction

biological: related to living organisms

molecule: combination of atoms that form stable particles

metabolic: related to processing of nutrients and building of necessary molecules within the cell

Fluid balance. The presence of blood protein molecules, such as *albumins* and *globulins*, are critical factors in maintaining the proper fluid balance between cells and extracellular space. Proteins are present in the capillary beds, which are one-cell-thick vessels that connect the arterial and venous beds, and they cannot flow outside the capillary beds into the tissue because of their large size. Blood fluid is pulled into the capillary beds from the tissue through the mechanics of oncotic pressure, in which the pressure exerted by the protein molecules counteracts the **blood pressure**. Therefore, blood proteins are essential in maintaining and regulating fluid balance between the blood and tissue. The lack of blood proteins results in clinical **edema**, or tissue swelling, because there is insufficient pressure to pull fluid back into the blood from the tissues. The condition of edema is serious and can lead to many medical problems.

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

edema: accumulation of fluid in the tissues

Energy provision. Protein is not a significant source of energy for the body when there are sufficient amounts of **carbohydrates** and fats available, nor is protein a storable energy, as in the case of fats and carbohydrates. However, if insufficient amounts of carbohydrates and fats are ingested, protein is used for energy needs of the body. The use of protein for energy is

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

PROTEIN CONTENT OF REPRESENTATIVE FOODS IN THE HUMAN DIET

Food	Protein (grams)
Milk, 244 g (8 oz)	8.0
Cheddar Cheese, 84 g (3 oz)	21.3
Egg, 50 g (1 large)	6.1
Apple, 212 g (1, 3 ¼ in. diameter)	0.4
Banana, 74 g (1, 8 ¾ in. long)	1.2
Potato, cooked, 136 g (1 potato)	2.5
Bread, white, slice, 25 g	2.1
Fish, cod, poached, 100 g (3 ½ oz)	20.9
Oyster, 100 g (3 ½ oz)	13.5
Beef, pot roast, 85 g (3 oz)	22.0
Liver, pan fried, 85 g (3 oz)	23.0
Pork chop, bone in, 87 g (3.1 oz)	23.9
Ham, boiled, 2 pieces, 114 g	20.0
Peanut butter, 16 g (1 tablespoon)	4.6
Pecans, 28 g (1 oz)	2.2
Snap beans, 125 g (1 cup)	2.4
Carrots, slicked, 78 g (½ cup)	0.8

SOURCE: U.S. Department of Agriculture

not necessarily economical for the body, because tissue maintenance, growth, and repair are compromised to meet energy needs. If taken in excess, protein can be converted into body fat. Protein yields as much usable energy as carbohydrates, which is 4 kcal/gm (kilocalories per gram). Although not the main source of usable energy, protein provides the essential amino acids that are needed for adenine, the nitrogenous base of ATP, as well as other nitrogenous substances, such as creatine phosphate (nitrogen is an essential element for important compounds in the body).

Protein Requirement and Nutrition

The recommended protein intake for an average adult is generally based on body size: 0.8 grams per kilogram of body weight is the generally recommended daily intake. The recommended daily allowances of protein do not vary in times of strenuous activities or exercise, or with progressing age. However, there is a wide range of protein intake which people can consume according to their period of development. For example, the recommended allowance for an infant up to six months of age, who is undergoing a period of rapid tissue growth, is 2.2 grams per kilogram. For children ages seven through ten, the recommended daily allowance is around 36 total grams, depending on body weight. Pregnant women need to consume an additional 30 grams of protein above the average adult intake for the nourishment of the developing fetus.

Sources of protein.

Good sources of protein include high-quality protein foods, such as meat, poultry, fish, milk, egg, and cheese, as well as prevalent low-quality protein foods, such as **legumes** (e.g., navy beans, pinto beans, chick peas, soybeans, split peas), which are high in protein.

legumes: beans, peas and related plants

Protein–Calorie Malnutrition

The nitrogen balance index (NBI) is used to evaluate the amount of protein used by the body in comparison with the amount of protein supplied from daily food intake. The body is in the state of nitrogen (or protein) equilibrium

when the intake and usage of protein is equal. The body has a *positive nitrogen balance* when the intake of protein is greater than that expended by the body. In this case, the body can build and develop new tissue. Since the body does not store protein, the overconsumption of protein can result in the excess amount to be converted into fat and stored as **adipose tissue**. The body has a *negative nitrogen balance* when the intake of protein is less than that expended by the body. In this case, protein intake is less than required, and the body cannot maintain or build new tissues.

adipose tissue: tissue containing fat deposits

A *negative nitrogen balance* represents a state of protein deficiency, in which the body is breaking down tissues faster than they are being replaced. The ingestion of insufficient amounts of protein, or food with poor protein quality, can result in serious medical conditions in which an individual's overall health is compromised. The **immune system** is severely affected; the amount of blood **plasma** decreases, leading to medical conditions such as **anemia** or edema; and the body becomes vulnerable to **infectious diseases** and other serious conditions. Protein malnutrition in infants is called **kwashiorkor**, and it poses a major health problem in developing countries, such as Africa, Central and South America, and certain parts of Asia. An infant with kwashiorkor suffers from poor muscle and tissue development, loss of appetite, mottled skin, patchy hair, diarrhea, edema, and, eventually, death (similar symptoms are present in adults with protein deficiency). Treatment or prevention of this condition lies in adequate consumption of protein-rich foods. SEE ALSO AMINO ACIDS.

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

plasma: the fluid portion of the blood, distinct from the cellular portion

anemia: low level of red blood cells in the blood

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

Jeffrey Radecki
Susan Kim

Bibliography

Berdanier, Carolyn D. (1998). *CRC Desk Reference for Nutrition.* Boca Raton, FL: CRC Press.

Briggs, George M., and Calloway, Doris Howes (1979). *Bogert's Nutrition and Physical Fitness*, 10th edition. Philadelphia, PA: W. B. Saunders.

Johnston, T. K. (1999). "Nutritional Implications of Vegetarian Diets." In *Modern Nutrition in Health and Disease*, 9th edition. M. E. Shills, et al, eds. Baltimore, MD: Williams & Wilkins.

Robinson, Corrinne H. (1975). *Basic Nutrition and Diet Therapy.* New York: Macmillan.

U.S. Department of Agriculture (1986). *Composition of Foods.* (USDA Handbooks 8–15.) Washington, DC: U.S. Government Printing Office.

Wardlaw, Gordon M., and Kesse, Margaret (2002). *Perspectives in Nutrition*, 5th edition. Boston: McGraw-Hill.

Internet Resources

Institute for Chemistry. "Amino Acids." Available from <http://www.chemie.fuberlin.de>

Quackery

Quackery is a type of health fraud that promotes products and services that have questionable and unproven scientific bases. Quackery is short for quacksalver, which is derived from two Middle Dutch terms that mean "healing with unguents." However, quacken means "to boast," so a kwakzalver might be a healer who boasts about his power or products.

Quacks, the people who promote these products, have been around for years. One of the most enduring images of nineteenth-century medicine is the charlatan or quack. These individuals sold primarily patent medicines that promised to cure everything from **cancer** to the common cold. Patent medicines were concoctions (elixirs, salves, balms, etc.) for which individuals received exclusive rights to sell for a given period of time. Patent medicines were available by mail or over the counter at chemists' shops, general stores, and even seed stores. Most patent medicines contained alcohol, and many also contained opium or morphine. Virtually none contained the "healing" ingredients they claimed to have, and none healed.

Some quacks were called "snake oil" salesmen. These individuals traveled from town to town, sometimes with a carnival, selling their products. Today, quacks have more sophisticated ways to sell their products. The products are now promoted on the Internet, TV, and radio; in magazines, newspapers, and infomercials; by mail; and even by word-of-mouth. Many consider quackery to be a pejorative term and now use the term *alternative medicine*. However, this term is used in a variety of ways. The physician Stephen Barrett suggests that "alternative" methods be classified as genuine, experimental, or questionable, whereas *quackery* refers solely to questionable and unproven methods.

Garlic is frequently touted as a remedy for high blood pressure, blood sugar imbalances, and arterial plaque. Some advocates even claim that garlic can prevent or cure cancer. But according to the National Center for Complimentary and Alternative Medicine, although garlic may have some health benefits, its reputation as a miracle remedy is not supported by available research. *[Octane Photographic. Reproduced by permission.]*

Claims and Promises

Fraudulent products are designed solely to make money. They often use paid actors in the infomercials and advertisements to make their products sound and look convincing. They also may use celebrities to endorse the products. Fraudulent products usually:

- Promise quick, painless cures or results.
- Claim to be effective for a wide range of ailments.
- Promise weight loss without dieting or exercise.
- Claim to be made from a special, secret ingredient.
- Guarantee all results.
- Use testimonials or undocumented case histories from satisfied patients.
- Offer an additional amount of the product as a "special promotion."

cancer: uncontrolled cell growth

Nutrition Quackery

Nutrition quackery is one of the most profitable types of quackery. Dietary supplements, weight loss products, **herbal** remedies, and "sports" foods are not registered with the Food and Drug Administration (FDA). Federal law allows certain claims to be made on the labels of food and dietary supplements. These include claims that show a strong scientific link between a food substance and a disease or health condition. These approved claims can state only that the product may reduce the risk of certain health problems, not cure them. The labels of dietary supplements must state that the claim "has not been evaluated by the FDA," and that the "product is not intended to diagnose, treat, cure, or prevent any disease." Yet, the infomercials and ads for many products do not include these warnings.

herbal: related to plants

One of the basic premises of many dietary supplements is that most individuals have vitamin and mineral deficiencies. In addition, the promoters of supplements often assert that the soil in which food is grown is often

Patent Medicines

The term "patent medicine" originated before the American Revolution, when members of European royal families granted "letters patent" allowing the use of their endorsements to advertise products. As patent medicines became increasingly popular during the nineteenth century, traveling "medicine shows," featuring musclemen and other entertainers, were organized to pitch products that were alleged to miraculously cure cancer, venereal disease, tuberculosis, cholera, leprosy, arthritis, or other ailments. The pitchmen touted their products' exotic origins (such as "Kickapoo Indian Sagwa," supposedly based on a Native American recipe) or their basis in scientific breakthroughs (such as "Bonnore's Electro Magnetic Bathing Fluid" and products containing radium and uranium). The medicines, which frequently combined narcotics such as cocaine in an alcohol base, were both toxic and addictive. During the early twentieth century, newspapers began to publicize the hazards of patent medicines. In 1906 Congress took the first steps toward outlawing the most fradulent and dangerous claims by passing the Pure Food and Drug Act, and in 1938 patent medicines were prohibited entirely.

—Paula Kepos

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

nutritional deficiency: lack of adequate nutrients in the diet

diet: the total daily food intake, or the types of foods eaten

fortified: altered by addition of vitamins or minerals

nutrient: dietary substance necessary for health

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

fiber: indigestible plant material which aids digestion by providing bulk

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

arthritis: inflammation of the joints

nutritionally depleted in **vitamins** and **minerals**, and that the food supply cannot, therefore, adequately nourish the population. However, very few individuals in industrially developed countries suffer from specific vitamin and mineral deficiencies. They are more likely to suffer from **heart disease**, **hypertension**, **obesity**, and other **chronic** diseases. In lesser-developed countries, deficiencies are due to inadequate food intake. **Nutritional deficiencies** can be corrected with a well-balanced **diet**. In addition, most manufactured products are **fortified** with specific vitamins and minerals. The body recognizes and utilizes these **nutrients** as effectively as the ones sold in health food stores, though **processed foods** can be lacking in other nutrients, such as **fiber**.

Another claim is that **food additives** and pesticide residues are poisoning the food supply. This claim is usually used to promote organic and other "health" foods. The United States government has very strict standards for the use of additives, preservatives, and pesticide residues. The United States Department of Agriculture has approved standards for organic foods, but it makes no claim that organic foods are safer or more nutritious than conventionally grown foods.

Victims

Quacks primarily target older adults, the health conscious, the beauty conscious, and those with chronic diseases such as cancer and AIDS. Older people have more chronic illnesses than younger people, so they are likely targets for fraud. Most people are susceptible to quackery because they are frightened, in pain, and desperate for relief. Common products that are targeted to these populations include:

- *Anti-aging products.* In a youth-oriented society, a wide variety of products are advertised. No product can stop the aging process, however, and any "results" that are seen are temporary.
- ***Arthritis** remedies.* There is no cure for most forms of arthritis, but some products can temporarily reduce pain and increase flexibility.

A 1920s advertisement for weight-loss soap promises quick, painless results and offers a money-back guarantee. Both claims are frequently made by quacks about the fraudulent health products or services they sell. *[Bettmann/Corbis. Reproduced by permission.]*

- *Cancer cures.* Quacks prey on people's fear of cancer. Cancer treatment is specific for the type of cancer, and common treatments include surgery, radiation, and chemotherapy. Some cancers go into remission and reappear later. No food or supplements have been proven to "cure" cancer.
- *HIV/AIDS cures.* There is no known cure for this disease. Legitimate scientific treatments can, however, extend life and improve the quality of life for people with AIDS.

Quackery is big business. Individuals spend billions of dollars every year looking for the next miracle cure. Consumers must learn to protect themselves by questioning what they see or hear in ads. The media that promote these products usually do not regularly screen their ads for truth or accuracy. Prescription **drugs** undergo rigorous testing for safety and effectiveness before they are sold, and **over-the-counter** medicines also are subject to a drug review process. Dietary supplements are not required to undergo government testing or review before they are marketed, yet these products may have harmful effects that could present risks for people on certain

drugs: substances whose administration causes a significant change in the body's function

over-the-counter: available without a prescription

medicines or with certain medical conditions. Individuals who are aware of a questionable health product can contact the Federal Trade Commission or their state attorney general's office. SEE ALSO ALTERNATIVE MEDICINES AND THERAPIES; CANCER; DIETARY SUPPLEMENTS; FAD DIETS; HIV/AIDS; WEIGHT LOSS DIETS.

Delores C. S. James

Internet Resources

National Institute on Aging. "Health Quackery: Spotting Health Scams." Available from <http://www.nia.nih.gov/health/agepages/healthqy.html/>

Barrett, Stephen. "Be Wary of Alternative Health Methods." Available from <http://www.quackwatch.org/01QuackeryRelatedTopics/altwary.html>

Federal Trade Commission. "Medical Health Claims: Add a Dose of Skepticism." Available from <http://www.ftc.gov/bcp/conline/pubs/health/frdheal.htm>

James Cook University, Multimedia and Print Services. "Pictures of Health: Quack and Quackery." Available from <http://www.maps.jcu.edu.au/hist/quack>

Recommended Dietary Allowances

Recommended Dietary Allowances: nutrient intake recommended to promote health

nutrient: dietary substance necessary for health

Dietary Reference Intakes: set of guidelines for nutrient intake

chronic: over a long period

The **Recommended Dietary Allowances** (RDAs) are **nutrient** intake levels that meet the needs of most healthy Americans. They were originally developed by the National Academy of Sciences, and were based on nutrient levels that would prevent nutrient deficiencies. Since the mid-1990s, RDAs have been developed as one component of nutrient intake standards called **Dietary Reference Intakes** (DRIs). RDAs, developed as part of DRIs, target nutrient levels needed not only to prevent nutrient deficiencies, but also to reduce the risk of **chronic** disease. They are meant to be intake goals averaged over several days, rather than daily requirements. RDAs can help people establish eating habits that promote health and reduce disease risk. SEE ALSO DIETARY REFERENCE INTAKE (DRI); NATIONAL ACADEMY OF SCIENCES (NAS).

Linda Benjamin Bobroff

Bibliography

Insel, Paul; Turner, R. Elaine; and Ross, Don (2001). *Nutrition.* Sudbury, MA: Jones and Bartlett.

National Research Council (1989). *Recommended Dietary Allowances*, 10th edition. Washington, DC: National Academy Press.

Internet Resources

U.S. Department of Agriculture. "Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA)." Available from <http://www.nal.usda.gov/fnic>

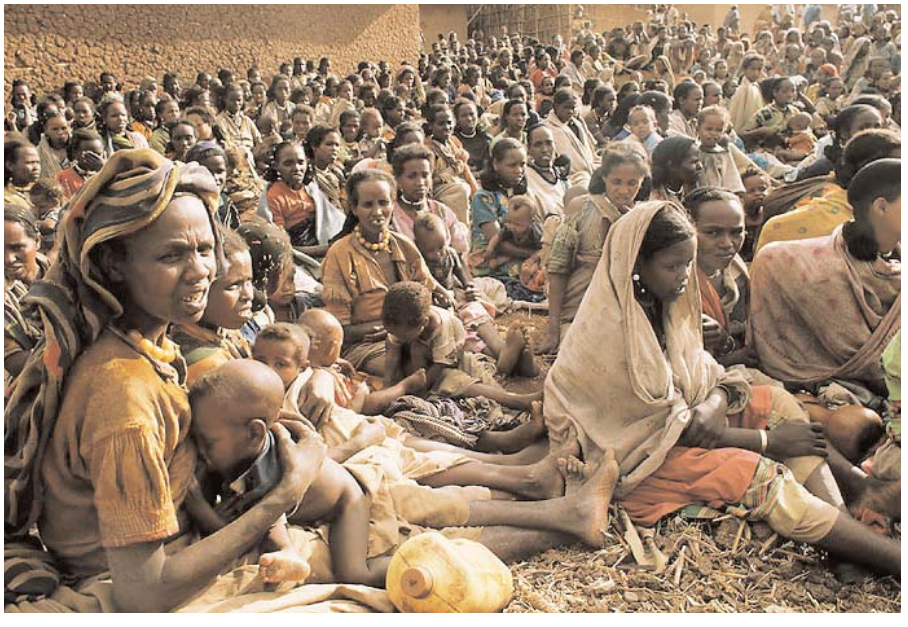
Refugee Nutrition Information System

Every year, thousands of individuals are displaced from their homes and homelands because of wars, political conflicts, and natural disasters. The Refugee Nutrition Information System (RNIS) was established in 1993 to collect data and report on the nutrition, health, and survival status of the most nutritionally vulnerable people in the world, including refugees, internally displaced populations, and those who are forced to migrate.

These girls are among more than four million Palestinian refugees in Gaza Strip and the West Bank. A recent report from the Refugee Nutrition Information System found Palestinian refugees to be satisfactorily coping with the nutritional impacts of the latest Intifada. *[Corbis. Reproduced by permission.]*

The RNIS publication, *Report on the Nutrition Situation of Refugees and Displaced Populations*, is published every three months, with interim updates as needed. The United Nations (UN) Administration Committee on Coordination Sub Committee on Nutrition (ACC/SCN) compiles this report. Information is obtained from a variety of UN agencies and nongovernmental organizations.

The report focuses primarily on sub-Saharan Africa, with some information provided on Asia. The report gives an estimate of the total number of refugees and displaced persons, and of the returning population, broken down by risk category. Refugees and displaced populations are classified by country of origin and country of asylum. The report also shows trends over time in total numbers and risk categories.



These refugees were displaced by years of warfare in their own countries. In the 1980s they came to Sudan from Ethiopia and Chad, only to find a famine awaiting them. *[Photograph by Chris Rainier. Chris Rainier/Corbis-Bettmann. Reproduced by permission.]*

The report is organized by "situation," a category that crosses national boundaries, and it includes a section that highlights the most pressing humanitarian needs. Recommendations are made by agencies or individuals directly involved in assessments or humanitarian response. Nutritional surveys are used to assess populations that are in a critical situation. Populations at high risk are identified either on the basis of indicators that are approaching crisis levels or through subjective information collected when security and logistical issues prevent rigorous data collection. SEE ALSO DISASTER RELIEF ORGANIZATIONS.

Delores C. S. James

Internet Resources

United Nations (2000). "About RNIS." Available from <http://www.unsystem.org/accscn/page6.html>

World Health Organization. "Nutrition in Emergencies." Available from <http://www.who.int/nut/index.htm>

Regional Diet, American

It is quite clear that nutritional intake is associated with common health conditions such as **obesity**, **hypertension** (**high blood pressure**), **cancer**, **diabetes** (high blood sugar), and **cardiovascular** disease. People in the United States make daily decisions related to grocery purchases, meal choices, food preparation, and other factors influencing their consumption of food and **nutrients**, and, thus, likely affecting their health. However, much of the current knowledge and most published works are based on studies or other information that concern the general population. This information is important in influencing dietary patterns, but additional information is needed regarding specific regional and minority populations. Additionally, more detailed information is necessary to determine if there are any differences or similarities between these subpopulations. What follows is a general literature review related to minority groups in the United States.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

cancer: uncontrolled cell growth

diabetes: inability to regulate level of sugar in the blood

cardiovascular: related to the heart and circulatory system

nutrient: dietary substance necessary for health

African-American Influences

As might be surmised, the daily **diet** can be greatly influenced by cultural variables related to a specific ethnic group, as well as differences within an ethnic group. The **socioeconomic status** of a group is also relevant when considering decisions about dietary intake.

diet: the total daily food intake, or the types of foods eaten

socioeconomic status: level of income and social class

prevalence: describing the number of cases in a population at any one time

The **prevalence** of hypertension, cardiovascular disease, and diabetes is greater among African Americans than other groups. Dietary intake has been strongly associated with both of these conditions for many years. Therefore, it seems prudent to focus on diet in an attempt to reduce the number of premature disabilities and deaths as the result of these conditions.

However, the researchers Christian Lindquist, Barbara Gower, and Michael Goran found that African-American children and white children had similar dietary intake patterns. The small differences in consumption were found to be more favorable for African-American children. The researchers found, for example, that African-American children ate more fruits and vegetables than white children. Both groups, however, do not meet the national

U.S. Regional Cooking

Regional cuisine in the United States has been influenced by the ingredients native to each region as well as by the culinary heritage of the groups that first settled there. Characteristic ingredients of New England cooking include seafood, cranberries, rhubarb, and apples. Heavily influenced by British settlers, cooking techniques in New England rely on roasting and boiling to produce such dishes as clam chowder, baked beans, and salt cod. The Southern states were influenced by French, English, and Spanish colonists and by African slaves, who often served as household cooks and who introduced okra, black-eyed peas, and eggplant to the menu. The region is fertile ground for rice, which is featured in the classic Southern rice pudding; other typical dishes include fried green tomatoes, squash casserole, fried chicken, cornbread, and grits. The Midwest is known for corn, beef, and dairy products, and the region's cooking techniques reflect the influence of German and Scandinavian settlers. Traditional dishes include beef pot roast, bratwurst, sauerkraut, and corn on the cob. In the Southwest, where Spanish and Mexican influences predominate, typical ingredients include chiles, cumin, cinnamon, tortillas, and tomatoes. Barbecuing is the best-known cooking technique, and common dishes include chili, burritos, flan, and other Tex-Mex interpretations of Mexican cooking. The Pacific Northwest is known for seafood, game, and berries. Dishes identified with the Pacific Northwest include salmon, venison, pumpkin soup, and gooseberry relish.

—Paula Kepos

standards for recommended daily intake. African-American children have a lower **insulin** sensitivity and higher **acute** insulin response than white children, suggesting a higher risk of diabetes.

insulin: hormone released by the pancreas to regulate level of sugar in the blood

acute: rapid-onset and short-lived

Socioeconomic status (SES) has been connected to diabetes. African-American women are more likely to be diabetic if they have low SES. This association was not found to be evident in African-American men, however. While it is possible that a condition such as diabetes causes a reduction in or loss of income, and thus has a negative impact on SES, there is little evidence to support this theory.

Diets with a high **fat** content have been associated with various cancers. Brown and colleagues found that African Americans have higher frequency of being **overweight** and **obese** (20 percent or more above the recommended weight), while Caucasians use more vitamin C supplements. This may explain part of the higher **incidence** of multiple myeloma, a type of cancer, in African Americans. It is also congruent with literature that suggests vitamin C consumption may decrease the risk of some cancers.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

incidence: number of new cases reported each year

African Americans generally have greater rates of hypertension and the associated complications, such as cerebrovascular accidents (**strokes**) and renal (kidney) disease. In 1996, Frederick Brancati and colleagues found that potassium supplements reduce **blood pressure** in African Americans who eat foods low in potassium. This phenomenon could be due to a distinct sensitivity to potassium, or because the diets are low in potassium, or a combination of both.

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

From a sociological standpoint, Kaja Perina reported in 2001 that African-American television stations show more food (especially junk food) and beverage commercials during prime time than other stations. To compound the emphasis on weight management, Perina highlights that 27 percent of

actors on African American networks are overweight, compared to 2 percent of actors on other networks.

nutrition: the maintenance of health through proper eating, or the study of same

Another obstacle to satisfactory daily **nutrition** may be the inability to access ethnic foods in the inner city. Monique Brown suggests that quality comprehensive grocery stores are frequently missing from African American communities. Instead, smaller convenience marts provide limited foods and goods, severely limiting dietary choices, in addition to being more expensive than supermarkets.

calorie: unit of food energy

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

calcium: mineral essential for bones and teeth

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

iron: nutrient needed for red blood cell formation

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

The elderly population in the United States does not regularly follow dietary recommendations. Typically, not enough **calories** are consumed, as well as inadequate amounts of some **vitamins** and nutrients. Insufficient income, disability, inadequate knowledge, and lack of transportation contribute to poor dietary habits. The diets of elderly African Americans have been found to be deficient in **energy**, **calcium**, and vitamin B_6, **protein**, thiamine, riboflavin, and **iron**. Black men tend to consume more energy, fat, and **cholesterol** than black women, but less vitamins C, B_6, and thiamine.

Hispanic Influences

Mexican-American children who participated in a San Diego study related to children's activity and nutrition were more likely than non-Hispanic white children to be overweight, to eat more fat, and to exercise less. Those who watched more television were more likely to consume excess fat. However, children who ate less sodium were more knowledgeable about food and more likely to avoid fat consumption. Study participants who were identified as being in lower socioeconomic levels tended to consume more sodium. Accordingly, education has been a valuable tool in behavior modification programs for a variety of different target areas related to health.

Likewise, there is some evidence that Mexican-American children over fifteen years of age have smaller statures, but weigh more, than white children. This may have a negative effect on future health risks related to diabetes, cancer, and cardiovascular disease.

The economics of a family greatly influence choices related to food intake. If one family of four allocates $150 per week for groceries and another budgets $100, there is a wide disparity in the quantity of food eaten by these two families. Economically disadvantaged Hispanics in twelve counties in southern Colorado were found to focus on their children's nutritional habits and on avenues to preparing quick, healthy menus. Socioeconomic status and geographic isolation due to the mountains have a negative effect on the food availability of this cultural group, who frequently earn a living as migrant farm workers. Barriers to changing eating habits included lack of finances, limited education and cooking abilities, customs, and confusion related to communication from nutrition professionals.

Research by Judith A. Beto, Gopali Sheth, and Patricia Rewers suggests that a broad supply of basic foods are readily available to low-income families. For example, sugar, flour, eggs, pasta, and vegetables are commonly eaten by such families. However, the way in which the food is prepared varies, accounting for a wide difference in fat consumption. This data implies that education related to healthful food preparation can assist in reducing fat intake.

In addition to studies that investigate the Hispanic population in general, there are also some reports concentrating on nutrition that investigate individual sectors of this population. Indeed, researchers Carlos Crespo, Catherine Loria, and Vicki Burt note that Hispanics have lower or equal rates of hypertension, but higher prevalence rates of obesity and diabetes than non-Hispanic whites. Hispanic females appear to have increased awareness of treatment and control of hypertension than Hispanic males. In addition, Cuban-American women were more aware of their hypertensive state than Mexican-American and Puerto Rican females. The vast majority of Hispanic men with high blood pressure do not keep it under control. Moreover, Mexican-American and Puerto Rican women have higher rates of being overweight than other female and male Hispanics. In addition, people who are overweight are commonly diagnosed with hypertension.

Food purchasing practices also affect dietary intake. Geoffrey Paulin found that there are differences in the purchasing power of Hispanics compared to other groups, as well as within the subpopulations of the general group. Hispanics only have about two-thirds the income of non-Hispanics, and they are more likely to have participated in a food stamp program. Furthermore, Hispanics have fewer years of education and are less likely to live in rural areas. Hispanics usually purchase more meats, fruits, and vegetables than non-Hispanics, while purchasing fewer potatoes, sweets, and dairy products. This food purchasing pattern may reflect the origin of certain immigrant groups. For example, citrus fruits are commonly grown in Mexico, and bananas are grown in Central and South America. It is also noted that Hispanics spend less on snack foods, such as potato chips, candy, and cakes, and may view these foods as unnecessary or as a luxury.

There are also important differences within the specific Hispanic population. For example, Cubans spend twice as much money on coffee as Mexicans do. Such spending differences suggest that consumption habits are also different within Hispanic subpopulations.

There may also be changes in diets as the result of relocation. For example, Laura McArthur, Ruben Anguiano, and Diego Nocetti studied Hispanic immigrants in North Carolina who had resided in the United States for 10 years or less. They found that these immigrants did not generally maintain their dietary habits. Children were found to be greatly influenced by school meals. Foods high in fat and sugar were consumed in larger quantities than in the countries of origin of these immigrants. This type of change due to relocation is known as *acculturation* and is common in immigrant groups.

The need for continued research related to dietary intake patterns and influences is apparent. The majority of studies have historically investigated dietary behavior within the general population. However, it appears that cultural differences can affect the daily diet, and, thus, impact certain health conditions. SEE ALSO DIETARY TRENDS, AMERICAN.

Katherine E. W. Will

Bibliography

Beto, Judith A.; Sheth, Gopali; and Rewers, Patricia (1997). "Assessing Food Purchase Behavior among Low-Income Black and Hispanic Clients Using a Self-Reported Shelf Inventory." *Journal of American Dietetic Association* 97(1):69–70.

Brancati, Frederick L.; Appel, Lawrence J.; Seidler, Alexander J.; and Whelton, P. K. (1996). "Effect of Potassium Supplementation on Blood Pressure in African Americans on a Low-Potassium Diet." *Archives of Internal Medicine* 156(1):61–67.

Brown, Linda M.; Gridley, Gloria; Pottern, Linda; et al. (2001). "Diet and Nutrition as Risk Factors for Multiple Myeloma among Blacks and Whites in the United States." *Cancer Causes and Control* 12(2):117–125.

Brown, Monique R. (1999). "Supermarket Blackout: There Are Few Supermarkets in Cities, Meaning That Blacks Pay More for Food, Lose Out on Jobs and Go Elsewhere for Quality Goods." *Black Enterprise* 29(12): 81–94.

Cohen, Nancy L.; Ralston, Penny A.; Laus, Mary J.; et al. (1998). "Food Practices, Service Use, and Dietary Quality in Elderly Blacks." *Journal of Nutrition for the Elderly* 17(4):17–34.

Crespo, Carlos J.; Loria, Catherine M.; and Burt, Vicki L. (1996). "Hypertension and Other Cardiovascular Disease Risk Factors among Mexican Americans, Cuban Americans, and Puerto Ricans from the Hispanic Health and Nutrition Examination Survey." *Public Health Reports*, 3(2):7–10.

Lindquist, Christine H.: Gower, Barbara A.; and Goran, Michael I. (2000). "Role of Dietary Factors in Ethnic Differences in Early Risk of Cardiovascular Disease and Type 2 Diabetes." *American Journal of Clinical Nursing* 71(3):725–732.

McArthur, Laura H.; Anguiano, Ruben P; and Nocetti Diego (2001). "Maintenance and Change in the Diet of Hispanic Immigrants in Eastern North Carolina." *Family and Consumer Sciences Journal* 29(4):307–335.

Palmeri, Denise; Auld, Gary W.; Taylor, T.; et al. (1998). "Multiple Perspectives on Nutrition Education Needs of Low-Income Hispanics." *Journal of Community Health* 23(4):301-316.

Paulin, Geoffrey D. (2001). "Variation in Food Purchases: A Study of Inter-Ethnic and Intra-Ethnic Group Patterns Involving the Hispanic Community." *Family and Consumer Sciences Research Journal* 29(4):336–381.

Perina, Kaja (2001). "Obesity: Watch What You Watch." *Psychology Today* 34(5):32.

Robbins, Jessica; Vaccarino, Viola; Zhang, Heping; and Kasl, Stanislav V. (2001). "Socioeconomic Status and Type 2 Diabetes in African American and Non-Hispanic White Women and Men: Evidence from the Third National Health and Nutrition Examination Survey." *American Journal of Public Health* 91(1):76–83.

Ryan, Alan. S.; Roche, Alex F.; and Kuczmarski, Robert J. (1999). "Weight, Stature, and Body Mass Index Data for Mexican Americans from the Third National Health and Nutrition Examination Survey (NHANES III, 1988–1994)." *American Journal of Human Biology* 11:673–686.

Zive, Michelle M.; Frank-Spohrer, Gail C.; Sallis, James F.; et al. (1998). "Determinants of Dietary Intake in a Sample of White and Mexican-American Children." *Journal of American Dietetic Association* 98(11):1282–1289.

Regulatory Agencies

incidence: number of new cases reported each year

At the beginning of the twenty-first century, increased levels of terrorist activities and a higher **incidence** of food-borne illness made regulation and protection of the food supply a worldwide concern. The goal of food regulatory agencies is to ensure that the public food supply is safe from disease caused by infection from human handling or by contamination from chemical or other hazardous substances. Such contamination can occur during all phases of food production, including cultivation, harvesting, processing, packaging, storage, and cooking.

United States Agencies

In the United States, the regulation and safety of the food supply has received attention since the mid-nineteenth century. Today, many of the U.S. federal agencies serve as regulators or advisors for the food supply in the United States and throughout the world. There are four major U.S. federal agencies involved in food regulation and safety.

USDA staff working in the Food Safety and Inspection Service inspect more than eight billion birds annually. They ensure that raw meats are processed according to health standards, and help prevent and investigate outbreaks of food-borne illness. *[USDA. Reproduced by permission.]*

The U.S. Department of Agriculture (USDA) is the oldest federal agency that monitors the food supply in the United States; it was established in 1862 by President Abraham Lincoln. In its earlier years, the agency worked with farmers, who were the country's main source of food. Today, the mission of the USDA includes a goal that ensures people a safe, affordable, nutritious, and accessible food supply. USDA accomplishes this goal through the administration of a variety of food-related programs, all of which either assist suppliers or protect consumers.

Consumers are protected by USDA programs that regulate and monitor soil, water, and wildlife on privately owned property; drinking water for rural Americans; and meat, poultry, and egg products for all Americans. Federal antihunger efforts, such as the Food Stamp Program, the National School Lunch Program, the School Breakfast Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) also serve a regulatory purpose by providing recipients access to safe food products. Other USDA services include programs for food suppliers, such as small-business owners and farmers, who can receive assistance in growing and merchandising safe foods. The USDA also runs the Food and Nutrition Information Center, which provides information to the public on a variety of topics related to food safety and healthy food choices.

The Food and Drug Administration (FDA) is an operating division of the U.S. Department of Health and Human Services (DHHS). While the responsibility of DHHS is to protect the overall health of Americans, the FDA has a more specialized role in the oversight of food, **drugs**, and related products. The FDA was established after the passage of the Pure Food and Drugs Act of 1906. This act was the first nationwide consumer protection law, and it made the distribution of misbranded or adulterated foods, drinks, and drugs across state lines illegal. Today, the FDA is mandated by federal law to protect public health by ensuring the safety of the

drugs: substances whose administration causes a significant change in the body's function

production, processing, packaging, storing, and holding of all domestic and imported foods, except for those products that are under the jurisdiction of the U.S. Department of Agriculture. FDA is also responsible for safeguarding all ingredients used in food products, approving new **food additives**, monitoring ingredients and foods to see that they are contaminant free, and monitoring dietary supplements, infant formulas, and medical foods for safety. The FDA oversees food labeling and requires that food product labels be informative, truthful, and useful to the consumer. The Hazard Analysis Critical Control Point (HACCP) system, one of the most well-known food safety monitoring programs in use today in the United States, is also sponsored by the FDA.

food additive: substance added to foods to improve nutrition, taste, appearance or shelf-life

In July 2003, the FDA submitted a ten-point program to DHHS that would ensure the safety and security of the nation's food supply. Under this program, the FDA will work with the Department of Homeland Security (DHS) to add more staff, develop bioterrorism regulations, assess threats to the food supply, and train food service workers and the public in emergency preparedness and how to respond to a crisis.

Another operating division of DHHS is the Centers for Disease Control and Prevention (CDC). Established in 1946, the CDC collaborates with state agencies, private organizations, and other federal agencies such as the FDA, the Environmental Protection Agency (EPA), and the USDA to provide credible health information, primarily in the area of disease prevention. CDC's Food Safety Initiative Activity focuses solely on the prevention of food-borne illness by improving systems for disease surveillance and outbreak response, as well as through research, training, and education.

The Environmental Protection Agency (EPA) is a separate agency dedicated to the regulation of pesticide usage and the establishment of water quality standards for the United States. The agency has been in existence since 1970 and it develops and enforces regulations that implement federal laws written to protect the **environment**. The agency accomplishes this by collaborating with the states and Native American tribes, which have been given the responsibility for monitoring and enforcing compliance, and by issuing sanctions if the regulations are not followed. The EPA also provides financial assistance to states, nonprofit organizations, educational institutions, and small businesses to support research, education, and public awareness programs. Voluntary efforts, cosponsored by industries, businesses, nonprofit organizations, and state and local governments can also receive assistance from the EPA.

environment: surroundings

Worldwide Agencies

Although not a regulator in the truest sense, the World Health Organization (WHO) establishes policy and makes recommendations regarding the safety of the world food supply through its Food Safety Department (FOS). A primary focus of the FOS is the reduction of the negative impact of food-borne disease worldwide. Recently, a resolution was adopted by WHO to recognize food safety as an essential public health function, and to develop a global strategy to reduce the burden of food-borne diseases. Because the responsibility for food safety is often divided among several agencies with overlapping authority, there have been many challenges in solving the problems of worldwide food-borne disease. To address these challenges, the FOS

is developing an integrated production-to-consumption approach to food safety for its 192 member states. The approach is patterned after the FDA-sponsored HACCP program.

Other activities of the FOS include monitoring food, air, and water-supply pollution; observing food manufacturing and processing for the presence of additives and contaminants; conducting research on the safety of genetically modified foods; amassing larger food and supply inventories for countries to access in times of disaster; and assisting with the management of malicious contamination of food for terrorist purposes.

Other international agencies include:

- The Food and Agriculture Organization of the United Nations (FAO)
- The World Health Organization (WHO)
- The Codex Alimentarius Commission
- European Union Food Safety Policy Committee
- The World Food Safety Organization.

In conclusion, various aspects of the U.S. food supply are monitored by the USDA, FDA, CDC, and EPA. These federal agencies collaborate with state and local governments, as well as with nonprofit organizations, private businesses, and individuals to oversee the safety of the food supply for the United States. While each of these agencies also works with foreign countries to assist in the quest for a safe food supply worldwide, the WHO functions in a policymaking capacity for its 192 members, and provides a greater overall international presence in this effort. The importance of securing the safety and security of food for all countries of the world will continue to be of great importance, as commerce becomes more global and more new products are introduced through bioengineering and other means. The regulation and monitoring of the continuum from grower to consumer will require a great deal of collaboration among all countries of the world in order to be successful. SEE ALSO FOOD SAFETY; HEALTH CLAIMS.

Claire D. Schmelzer

Internet Resources

Centers for Disease Control and Prevention. "About CDC." Available from <http://www.cdc.gov/>

Centers for Disease Control and Prevention. "Food Safety Office." Available from <http://www.cdc.gov/foodsafety>

U.S. Department of Agriculture. "Welcome to the United States Department of Agriculture." Available from <http://www.usda.gov/>

U.S. Department of Agriculture, National Agriculture Library. "Food and Nutrition Information Center." Available from <http://www.nal.usda.gov/fnic/>

U.S. Department of Health and Human Services. "HHS: What We Do." Available from <http://www.hhs.gov/>

U.S. Environmental Protection Agency. "About EPA." Available from <http://www.epa.gov/>

U.S. Food and Drug Administration. "About the U.S. Food and Drug Administration." Available from <http://www.fda.gov/>

U.S. Food and Drug Administration (2003). "Progress Report to Secretary Tommy G. Thompson: Ensuring the Safety and Security of the Nation's Food Supply." Available from <http://www.fda.gov/>

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. "Hazard Analysis Critical Control Point." Available from <http://www.cfsan.fda.gov/>

World Health Organization. "Food Safety." Available from http://www.who.int/foodsafety/en/>

Religion and Dietary Practices

Since the beginning of time, dietary practices have been incorporated into the religious practices of people around the world. Some religious sects abstain, or are forbidden, from consuming certain foods and drinks; others restrict foods and drinks during their holy days; while still others associate dietary and food preparation practices with **rituals** of the faith. The early biblical writings, especially those found in Leviticus, Numbers, and Deuteronomy of the Old Testament (and in the Torah) outlined the dietary practices for certain groups (e.g., Christians and Jews), and many of these practices may still be found among these same groups today. Practices such as fasting (going without food and/or drink for a specified time) are described as tenets of faith by numerous religions.

ritual: ceremony or frequently repeated behavior

Religious Belief Expressed as Food Customs

To understand the reasons for nutritional and dietary customs in any religion requires a brief orientation of the rationale for such practices and laws. Many religious customs and laws may also be traced to early concerns for health and safety in consuming foods or liquids. In the past, preservation techniques for food were limited. Modern conveniences such as electricity were unavailable, and the scholars of the day did not understand theories of health promotion, disease prevention, and illness as they do today.

Therefore, religious leaders of the day developed rules about the consumption of foods and drinks, and religious practices, restrictions, and laws evolved. Specific laws about what can be consumed remain in most religions today. The lack of mechanisms to refrigerate or preserve foods led to certain rituals, such as the draining of blood from slaughtered animals, while restrictions on the eating of foods known to spoil easily, such as eggs, dairy products, and meats, were devised for safety reasons.

Attention to specific eating practices, such as overeating (gluttonous behaviors), use of strong drink or oral stimulants, and vegetarian diets, were also incorporated into the doctrine of religious practice. In addition to laws about the ingestion of foods or drinks, the practice of fasting, or severely restricting intake of food and/or drink, became prevalent, and is still practiced by many religions today.

The Role of Fasting

Many religions incorporate some element of fasting into their religious practices. Laws regarding fasting or restricting food and drink have been described as a call to holiness by many religions. Fasting has been identified as the mechanism that allows one to improve one's body (often described as a "temple" created by God), to earn the approval of Allah or Buddha, or to understand and appreciate the sufferings of the poor.

Fasting has also been presented as a means to acquire the discipline required to resist temptation, as an act of atonement for sinful acts, or as

the cleansing of evil from within the body. Fasting may be undertaken for several hours, at a specified time of the day (e.g., from sunrise to sunset, as practiced by modern Jews), for a specified number of hours (e.g., twelve, twenty-four, or more, as observed by Catholics or Mormons who fast on designated days), or for consecutive days, such as during the month of Ramadan for certain Muslims. Regardless of the time frame or rationale, religious groups observe the practice of fasting worldwide.

Health Benefits and Risks Associated with Specific Practices

Certain groups of people must necessarily be excused from fasting and restrictive practices. These groups include pregnant or nursing women; individuals with **diabetes** or other **chronic** disorders; those engaged in very strenuous work; **malnourished** individuals; young children; and frail elderly or disabled persons. Recognition of these exceptions has been addressed by each religious group. Most fasting practices allow certain intakes of liquid, particularly water. In fasting regimes where water is restricted, a danger of **dehydration** exists, and those fasting should be monitored.

diabetes: inability to regulate level of sugar in the blood

chronic: over a long period

malnourished: lack of adequate nutrients in the diet

dehydration: loss of water

Those who fast without liquids increase their risk of a number of health problems. Symptoms of dehydration include headache, dry mouth, **nausea**, fever, sleepiness, and, in extreme cases, coma. When these symptoms occur, it is important to end the fast or add water to the fast. Depending on the extent of the symptoms, ending the fast may be the only alternative. In severe dehydration cases, medical care should be sought as soon as possible to restore proper health.

nausea: unpleasant sensation in the gut that precedes vomiting

Some negative health consequences have been observed as a result of fasting practices, however, especially those carried out over longer periods, such as the Muslim fast during Ramadan. For example, excess acids can build up in the digestive system during a prolonged fast. This **gastric acidity** results in a sour taste in the mouth, a burning in the stomach, and other symptoms of illness.

gastric: related to the stomach

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

The structure and outward appearance of each person's body is, in part, a reflection of the food and drink he or she consumes. All the organs of the body, as well as the skin, bones, muscles, and nerves, need **nutrition** to survive, regenerate, maintain function, and develop structural foundations. The vital organs, such as the liver, heart, brain, and kidneys, depend upon essential **nutrients** from food and drink to sustain life, increase strength, and improve health. Throughout life, the body constantly breaks down the food products that are ingested, using some components to rebuild the tissues that contribute to good health. Similarly, the body also disposes of the waste products of food through excretory processes or in storage centers (**fat** deposits, for instance) in the body.

nutrition: the maintenance of health through proper eating, or the study of same

nutrient: dietary substance necessary for health

fat: type of food molecule rich in carbon and hydrogen, with high energy content

The restriction of, or abstention from, certain foods may have a direct impact on the health of those engaged in such practices. Some effects have been found to be positive, as in the case of vegetarian diets, which are eaten by many Seventh-day Adventists, Hindus, Buddhists, and Rastafarians. Research results have documented a 50 percent reduction in **heart disease** and longer life expectancy in people who eat a well-planned vegetarian **diet**. There are a number of religious rationales for a vegetarian diet. According to the Book of Genesis in the Bible, humans were given a plant-based diet

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diet: the total daily food intake, or the types of foods eaten

An archbishop leads communion at a Catholic mass. The importance of the ceremony, which calls for ritual consumption of bread and wine, shows how food traditions and religion have evolved together. *[Photograph by Stephen Senne. AP/Wide World Photos. Reproduced by permission.]*

nervous system: the brain, spinal cord, and nerves that extend throughout the body

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

drugs: substances whose administration causes a significant change in the body's function

malignant: spreading to surrounding tissues; cancerous

cancer: uncontrolled cell growth

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

proscription: prohibitions, rules against

wellness: related to health promotion

at the creation of the world. There are also ethical issues that involve the killing of animals for food, and environmental issues regarding the raising of livestock and the safety of the food supply.

Use of, and Abstention from, Stimulants

A stimulant is a product, food, or drink that excites the **nervous system** and changes the natural **physiology** of the body, such as **drugs** and consumable products that contain caffeine, such as tea, coffee, or chocolate. The use of caffeine is prohibited or restricted by many religions because of its addictive properties and harmful physical effects. Many also restrict spices and certain condiments, such as pepper, pickles, or foods with preservatives, because they are injurious by nature and flavor the natural taste and effect of foods.

The use of wine in religious ceremonies is regarded as acceptable by certain groups. For example, Roman Catholics, Eastern Orthodox Christians, and certain Protestant denominations use wine as a sacramental product to represent the blood of Christ in communion services. According to the writings of the apostle Paul, wine used in moderation may be consumed for the soothing effect it has upon an upset stomach. Mormons, however, specifically forbid wine or any alcoholic drinks because of their stimulant properties. Jews regard grapes as a fruit of idolatry, and therefore forbid the use of wine or products made from grapes except under special conditions.

Many religious leaders and health care experts regard tobacco, another stimulant, as a **malignant** poison that affects the health of its users. Research continues to support the harmful and deleterious effects of the use of cigarettes and tobacco products. **Cancer**, **high blood pressure**, and heart disease have all been linked to tobacco use.

Although marijuana has been shown to control pain in advanced diseases such as cancer, it has been considered a restricted drug by all but those practicing Rastafarianism. Rastafarians introduced marijuana into their religious rites because they consider it the "weed of wisdom," and because they believe it contains healing ingredients.

Major Religions with Food Proscriptions

Although no two religions hold exactly the same ideology about diet, health, and spiritual **wellness**, many do embrace similar practices.

Buddhism.

Many Buddhists are vegetarians, though some include fish in their diet. Most do not eat meat and abstain from all beef products. The birth, enlightenment, and death of Buddha are the three most commonly recognized festivals for feasting, resting from work, or fasting. Buddhist monks fast completely on certain days of the moon, and they routinely avoid eating any solid foods after the noon hour.

Eastern Orthodox Christianity.

An essential element of practicing an Orthodox life includes fasting, since its intrinsic value is part of the development of a spiritual life. To practicing Orthodox believers, fasting teaches self-restraint, which is the source of all good.

Hinduism.

Hindus do not consume any foods that might slow down spiritual or physical growth. The eating of meat is not prohibited, but pork, fowl, ducks, snails, crabs, and camels are avoided. The cow is sacred to Hindus,

Many Hindus are strict vegetarians. Those who do eat meat are forbidden from eating beef, because cows occupy a sacred place in the Hindu religion. *[Photograph by Craig Lovell. Corbis. Reproduced by permission.]*

and therefore no beef is consumed. Other products from the cow, however, such as milk, yogurt, and butter are considered innately pure and are thought to promote purity of the mind, spirit, and body.

Many devout Hindus fast on the eighteen major Hindu holidays, as well as on numerous personal days, such as birthdays and anniversaries of deaths and marriages. They also fast on Sundays and on days associated with various positions of the moon and the planets.

Islam. To the Muslims, eating is a matter of faith for those who follow the dietary laws called *Halal*, a term for all permitted foods. Those foods that are prohibited, such as pork and birds of prey, are known as *Haram*, while the foods that are questionable for consumption are known as *Mashbooh*. Muslims eat to preserve their good health, and overindulgence or the use of stimulants such as tea, coffee, or alcohol are discouraged. Fasting is practiced regularly on Mondays and Thursdays, and more often for six days during Shawwal (the tenth month of the Islamic year) and for the entire month of Ramadan (the ninth month). Fasting on these occasions includes abstention from all food and drink from sunrise to sunset.

Judaism. The Jewish dietary law is called *Kashrut*, meaning "proper" or "correct." The term *kosher* refers to the methods of processing foods according to the Jewish laws. The processing laws and other restrictions regarding to the preparation of food and drink were devised for their effects on health. For example, rules about the use of pans, plates, utensils, and separation of meat from dairy products are intended to reduce contamination. Other rules include:

1. A Jewish person must prepare grape products, otherwise they are forbidden.
2. Jewish laws dictate the slaughter and removal of blood from meat before it can be eaten.
3. Animals such as pigs and rabbits and creatures of the sea, such as lobster, shrimp, and clams, may not be eaten.

Ramadan

In the Muslim faith, the holy month of Ramadan is the ninth month of the Islamic year and is devoted to prayer, fasting, and charity. Muslims believe that it was during this month that God first began to reveal the holy book of Islam, the Quran, to the prophet Muhammad. Most Muslims are required to refrain from food and drink during daylight hours for the entire month. The fast is broken in the evening by a meal called the *iftar,* which traditionally includes dates and water or sweet drinks, and is resumed again at sunrise. Fasting during Ramadan is one of the five Pillars of Faith, which are the most important religious duties in Islam. The practice is meant to remind Muslims of the poor, to cleanse the body, and to foster serenity and spiritual devotion. Ramadan ends with Eid al-Fitr, the "Festival of Breaking the Fast."

—Paula Kepos

4. Meat and dairy products cannot be eaten at the same meal or served on the same plate, and kosher and nonkosher foods cannot come into contact with the same plates.

Mormonism. The law of health—the Word of Wisdom—contains the laws for proper eating and the rules of abstinence for tobacco, alcohol, coffee, tea, chocolate, and illegal drugs. Mormons must choose foods that build up the body, improve endurance, and enhance intellect. Products from the land, such as grains, fruits, vegetables, and nuts, are to take the place of meats; meats, sugar, cheeses, and spices are to be avoided. Reason and self-control in eating is expected in order to stay healthy.

Rastafarianism. Members of this group are permitted to eat any food that is *I-tal* food, meaning that it is cooked only slightly. Therefore, meats are not consumed, canned goods are avoided, and drinks that are unnatural are not allowed. Fish under twelve inches long may be eaten, but other types of seafood are restricted.

Roman Catholicism. The dietary practices of devout Catholics center around the restriction of meat or fasting behaviors on specified holy days.

WORLD RELIGIONS, FOODS PRACTICES AND RESTRICTIONS, AND RATIONALE FOR BEHAVIOR

Type of religion	Practice or restriction	Rationale
Buddhism	• Refrain from meat, vegetarian diet is desirable • Moderation in all foods • Fasting required of monks	• Natural foods of the earth are considered most pure • Monks avoid all solid food after noon
Eastern Orthodox Christianity	• Restrictions on Meat and Fish • Fasting Selectively	• Observance of Holy Days includes fasting and restrictions to increase spiritual progress
Hinduism	• Beef prohibited • All other meat and fish restricted or avoided • Alcohol avoided • Numerous fasting days	• Cow is sacred and can't be eaten, but products of the "sacred" cow are pure and desirable • Fasting promotes spiritual growth
Islam	• Pork and certain birds prohibited • Alcohol prohibited • Coffee/tea/stimulants avoided • Fasting from all food and drink during specific periods	• Eating is for good health • Failure to eat correctly minimizes spiritual awareness • Fasting has a cleansing effect of evil elements
Judaism	• Pork and shellfish prohibited • Meat and dairy at same meal prohibited • Leavened food restricted • Fasting practiced	• Land animals that do not have cloven hooves and that do not chew their cud are forbidden as unclean (e.g., hare, pig, camel) • Kosher process is based upon the Torah
Mormonism	• Alcohol and beverages containing caffeine prohibited • Moderation in all foods • Fasting practiced	• Caffeine is addictive and leads to poor physical and emotional health • Fasting is the discipline of self-control and honoring to God
Protestants	• Few restrictions of food or fasting observations • Moderation in eating, drinking, and exercise is promoted	• God made all animal and natural products for humans' enjoyment • Gluttony and drunkenness are sins to be controlled
Rastafarianism	• Meat and fish restricted • Vegetarian diets only, with salts, preservatives, and condiments prohibited • Herbal drinks permitted; alcohol, coffee, and soft drinks prohibited • Marijuana used extensively for religious and medicinal purposes	• Pigs and shellfish are scavengers and are unclean • Foods grown with chemicals are unnatural and prohibited • Biblical texts support use of herbs (marijuana and other herbs)
Roman Catholicism	• Meat restricted on certain days • Fasting practiced	• Restrictions are consistent with specified days of the church year
Seventh-day Adventist	• Pork prohibited and meat and fish avoided • Vegetarian diet is encouraged • Alcohol, coffee, and tea prohibited	• Diet satisfies practice to "honor and glorify God"

On the designated days, Catholics may abstain from all food, or they may restrict meat and meat products. Water or nonstimulant liquids are usually allowed during the fast.

Seventh-day Adventists. The Seventh-day Adventist Church advocates a lacto-ovo vegetarian diet, including moderate amounts of low-fat dairy products and the avoidance of meat, fish, fowl, coffee, tea, alcohol, and tobacco products (though these are not strictly prohibited). The church's beliefs are grounded in the Bible, and in a "belief in the wholistic nature of people" (Seventh-day Adventist General Conference Nutrition Council).

While the dietary practices of different religions vary, and the rationale for each practice is based upon different texts, there is also much commonality. The practice of fasting is almost universal across religious groups, and most regard it as a mechanism to discipline the followers in a humbling way for spiritual growth. Many fasting practices are connected with specific holy days. The variation in consumption of meat and vegetables has a much wider variation. SEE ALSO EATING HABITS; FASTING.

Ruth A. Waibel

Bibliography

Brown, Linda Keller, and Mussell, Kay, eds. *Ethnic and Regional Foodways in the United States: The Performance of Group Identity.* Knoxville: University of Tennessee Press.

Desai, Anita (2000). *Fasting, Feasting.* New York: Houghton Mifflin.

Fishbane, Michael (1992). *The Garments of Torah: Essays in Biblical Hermaneutics.* Bloomington, MN: Indiana University Press.

Gordon, Lewis, ed. (1997). *Existence in Black: An Anthology of Black Existential Philosophy.* New York: Routledge.

Landman-Bouges, J. (1997). "Rastafarian Food Habits." *Cajanus* 9(4):228–234.

Siregar, Susan Rogers (1981). *Adat, Islam, and Christianity in a Batak Homeland.* Athens, OH: Center for International Studies at Ohio University.

Internet Resources

Church of Jesus Christ of the Latter-Day Saints. "The Word of Wisdom." Available from <http://www.mormon.org>

"Judaism 101." Available from <http://www.jewfaq.org>

Orthodox Christian Information Center. "Living an Orthodox Life." Available from <http://orthodoxinfo.com>

"The Rastafarian Religion." Available from <http://www.aspects.net/~nick/religions.html>

"Rastafarianism." Available from <http://hem1.passagen.se/perdavid/rastafar.htm>

Seventh-day Adventist General Conference Nutrition Council. "GCNC Position Statements." Available from <http://www.andrews.edu/NUFS/resources.html>

Rice-based Diets

Rice is the most important cereal crop for human consumption. It is the staple food for over 3 billion people (most of them poor) constituting over half of the world's population. All of the world's great civilizations developed only after the domestication of various cereal grains, which provided an adequate food supply for large populations. These have included corn in the Americas, wheat in the Near East and southern Europe (Greece and Rome), and rice in China and India. The use of rice spread rapidly from

The people of Sri Lanka get about 40 percent of their calories from rice. Though rice is the most important crop in Sri Lanka, the per-capita consumption of imported wheat is increasing. *[Photograph by Tim Page. Corbis. Reproduced by permission.]*

China, India, and Africa, and at the present time it is used as a principal food throughout the world. After the discovery of the Americas, the use of rice took hold in both continents. The national dish of Belize in Central America, for example, is composed of rice and beans. There are now hundreds of rice recipes, with each ethnic cuisine having developed individual recipes. Almost all cookbooks have rice recipes, including recipes for risottos and pilafs. Vegetarians, in particular, cherish rice because it is such an excellent food and can be prepared in so many different and appetizing ways. Rice, delicious in itself, readily takes on any flavor that is added. Long-grain rice, when cooked, becomes separate and fluffy, while medium-grain rice is somewhat chewier. Short-grain rice tends to clump together and remains sticky with its starchy sauce. Arborio is an example of a short-grained rice. Wehani rice has a nutty flavor. Basmati rice (aromatic) is very popular, as is jasmine rice.

Rice is the only subsistence crop grown in soil that is poorly drained. It also requires no **nitrogen** fertilizer because soil microbes in the rice roots fix nitrogen and promote rice growth. Rice adapts itself to both wetlands and dry soil conditions.

Nutritional Properties

Rice is a high-carbohydrate food with 85percent of the **energy** from carbohydrate, 7 percent from **fat**, and 8 percent from **protein**. However, rice also has a considerable amount of protein, with an excellent spectrum of **amino acids**. The protein quality of rice (66%) is higher than that of whole wheat (53%) or corn (49%). Of the small amount of fat in brown rice, much is **polyunsaturated**. White rice is extremely low in fat content.

A cup of cooked rice has approximately 5 grams of protein, which is sufficient for growth and maintenance, provided that a person receives adequate **calories** to maintain body weight or to increase it, if full growth has not yet occurred. Asiatic children for whom rice is the chief food source have not developed protein deficiency disorders such as **kwashiorkor**, as have infants

nitrogen: essential element for plant growth

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

fat: type of food molecule rich in carbon and hydrogen, with high energy content

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

amino acid: building block of proteins, necessary dietary nutrient

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

calorie: unit of food energy

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

THE NUTRITIONAL COMPOSITION OF ONE CUP OF COOKED RICE

	Brown Rice	White Rice
Calories	218	266
Protein (grams)	4.5	5.0
Carbohydrate (g)	45.8	58.6
Fiber (g)	3.5	0.5
Fat (g)	1.6	0.4
Polyunsaturated fatty acids (g)	0.6	0.1
Cholesterol (mg)	0	0
Thiamin (mg)*	0.20	0.34**
Vitamin A	0	0

*Daily requirement of thiamin is 1.2 mg for an adult man
**Enriched or parboiled rice

that are fed corn or cassava as a chief staple after weaning. Growth and development are normal on a rice **diet**. Due to its easy digestibility, rice is a good transition food after the cessation of breast or formula feeding.

diet: the total daily food intake, or the types of foods eaten

Rice and Thiamine Deficiency

In Asiatic populations, rice has been, and still is, a main source of **nutrition**. Thiamine, or vitamin B_1, is contained in the outer husk and coating of the rice kernel. When the technology for polishing rice became available, people took to eating white rice in preference to brown rice, but that process removed thiamine, causing beriberi, or thiamine deficiency, in many people, as well as heart and nerve diseases.

nutrition: the maintenance of health through proper eating, or the study of same

Dutch physicians in Java and Japanese physicians particularly noted the occurrence of beriberi with **edema**, heart failure, **neuropathy**, and many deaths. Thiamine, of course, was an unknown substance at that time. The history of rice is of interest in illustrating how the technology to make a food more appetizing (i.e., white rice versus brown rice) led to an epidemic of a new disease for those populations whose food intake was largely based upon rice. Studies by physicians in Japan and in Indonesia led to a cure for beriberi that included a more varied diet, plus the use of rice husks and the outer coatings of rice, which contained thiamine.

edema: accumulation of fluid in the tissues

neuropathy: malfunction of nerve cells

Today, much of the rice consumed is either enriched with thiamine or parboiled, which leads to retention of thiamine in the matrix of the white rice kernel. Beriberi, as a disease from the consumption of white rice, is now rare if the rice is parboiled or enriched. However, some varieties of polished (white) rice may not be enriched with thiamine. Thus, when thiamine intake from other food sources is limited, thiamine deficiency could still occur. In the United States, thiamine deficiency typically occurs in **chronic** alcoholics.

chronic: over a long period

Rice for Medical Therapy and Prevention

Rice has been the mainstay of treatment for a number of conditions, particularly for **hypertension** at a time when few effective drug therapies were available. In the 1940s, Walter Kempner developed a treatment for mild, and even **malignant**, hypertension at Duke University. His hypothesis was that a low-protein diet, free of salt, would be an effective treatment. He devised the "rice diet," which consisted of rice, fruits, and vegetables. This treatment had good results: the **blood pressure** of his patients fell, and even malignant hypertension was partially reversed. In addition, blood **cholesterol** levels also fell.

hypertension: high blood pressure

malignant: spreading to surrounding tissues; cancerous

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

Since this was a cholesterol-free and low-fat diet, it was one of the first to document a cholesterol-lowering effect from diet.

allergy: immune system reaction against substances that are otherwise harmless

The other therapeutic role of rice is in the treatment of **allergies**. Rice seems to be nonallergenic, and rice milk has been fed to infants allergic to cow's milk. Rice proteins have also been incorporated into standard infant formulas.

Genetic Engineering of Rice

"Golden rice" was genetically engineered to contain beta-carotene, not present in standard rice, to combat the widespread vitamin A deficiency and ensuing blindness in the children of the developing world. Beta-carotene is a vitamin A precursor that is converted to the vitamin by **enzymes** of the intestinal **mucosa**. Vitamin A, or retinol, is then absorbed and transported to the tissues, including the structures of the eye. Golden rice would thus seem to be an advance in the fight against vitamin A deficiency in rice-eating populations. However, there are some concerns about golden rice and other genetically engineered foods. Genetically engineered products have not necessarily been proven safe, and environmental or social risks may outweigh potential benefits that they may bring about.

enzyme: protein responsible for carrying out reactions in a cell

mucosa: moist exchange surface within the body

Clinical trials of golden rice are needed before it is accepted universally. Only when it is clearly determined that it can prevent vitamin A deficiency in experimental animals, and that it presents no hazards, will this genetically engineered food be considered safe for use in human nutrition. Further, society itself must also decide if genetically created foods are acceptable, a point currently in dispute.

Sequencing the Rice Genome

Since the 1960s, the "green revolution" has improved the yield of rice, and now the "green genome revolution" may bring about further improvements. The rice genome has now been sequenced, an achievement of great importance. The sequence of the rice genome will provide the template for the sequencing of other grasses (maize, barley, wheat, etc.). The genome sequences are now known for the *japonica* rice favored in Japan and other countries with a temperate climate, and for the *indica* subspecies of rice grown in China and most other parts of Asia. This knowledge will permit a future harnessing of **genes** for disease prevention, drought resistance, nutritional improvement, and many other possible modifiable features of rice. As a recent issue of *Science* suggested, a "green gene revolution" is needed to meet the challenge of "population growth, loss of arable land and climate changes."

gene: DNA sequence that codes for proteins, and thus controls inheritance

In summary, rice is an inexpensive, easily prepared, and delicious food. It is also a very nutritious food that benefits humans all over the world. SEE ALSO ASIAN AMERICANS, DIETS OF; ASIANS, DIET OF; BERIBERI; BETA-CAROTENE; CORN- OR MAIZE-BASED DIETS; DIETARY SUPPLEMENTS; FORTIFICATION; KWASHIORKOR; NUTRITIONAL DEFICIENCY.

William E. Connor
Sonja L. Connor

Bibliography

Beyer, P.; Al-Babili, S.; Ye, X.; et al. (2002). "Golden Rice: Introducing the B-Carotene Bisosynthesis Pathway into Rice Endosperm by Genetic Engineering to Defeat Vitamin A Deficiency." *Journal of Nutrition* 132:506S–509S.

Cantral, R. P., and Reeves, T. G. (2002). "The Cereal of the World's Poor Takes Center Stage." *Science* 296:53:

Chang, Te-Tzu (2000). "Rice" in *The Cambridge World History Food*, Vol. 1. Cambridge, England: Cambridge University Press.

Committee on Amino Acids Food and Nutrition Board National Research Council (1974). *Improvement of Protein Nutriture*. Washington, DC: National Academic of Sciences.

Davidson, A. (1999). *The Oxford Companion to Food*. New York: Oxford University Press.

Davidson, S.; Passmore, R.; Brock, J. F.; and Truswell, A. S. (1979). *Human Nutrition and Dietetics*, 7th edition. New York: Livingstone, Churchill.

Pennington, J. A. T. (1998). *Bowes and Church's Food Values of Portions Commonly Used*, 17th edition. Philadelphia: Lippincott.

Rickets

Rickets was once considered an extremely common disorder of childhood. The term itself is derived from the old English word for "twist," or "wrick," and throughout history children with rickets could be identified by their bowed legs and knock knees, which gave them a twisted appearance.

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

Rickets is caused by a deficiency in **vitamin D**. During growth, human bone is made and maintained by the interaction of **calcium**, **phosphorus**, and vitamin D. Calcium is deposited in immature bone (osteoid) in a process called calcification, which transforms immature bone into its mature and familiar form. However, in order to absorb and use the calcium available in food, the body needs vitamin D. In rickets, the lack of this important vitamin leads to low calcium, poor calcification, and deformed bones.

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

calcium: mineral essential for bones and teeth

phosphorus: element essential in forming the mineral portion of bone

Vitamin D is the only vitamin that can be both acquired through food and made by the body itself. Although vitamin D can be absorbed through foods rich in animal **fat**, such as milk, cheese, fish, and meat, this **absorption** constitutes only about 10 percent of what the body needs in a single day. The remaining 90 percent is created by the body. Ultraviolet radiation from the sun converts 7-dihydrocholesterol in the skin to vitamin D_3. This is then converted to the **hormone** calcitriol (the active form of vitamin D) in the kidney. Calcitriol allows absorption of calcium and phosphorus in the gut, primarily in the small intestine, and maintains the body's balance of calcium and phosphate through the kidney and bone. Without adequate vitamin D, the body can only absorb 10 to 15 percent of the calcium available in food. This balance of vitamin D, calcium, and phosphate is essential to the growth and maintenance of bones, especially in children. Deficiencies can also occur in elderly adults, a condition called **osteomalacia**.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

absorption: uptake by the digestive tract

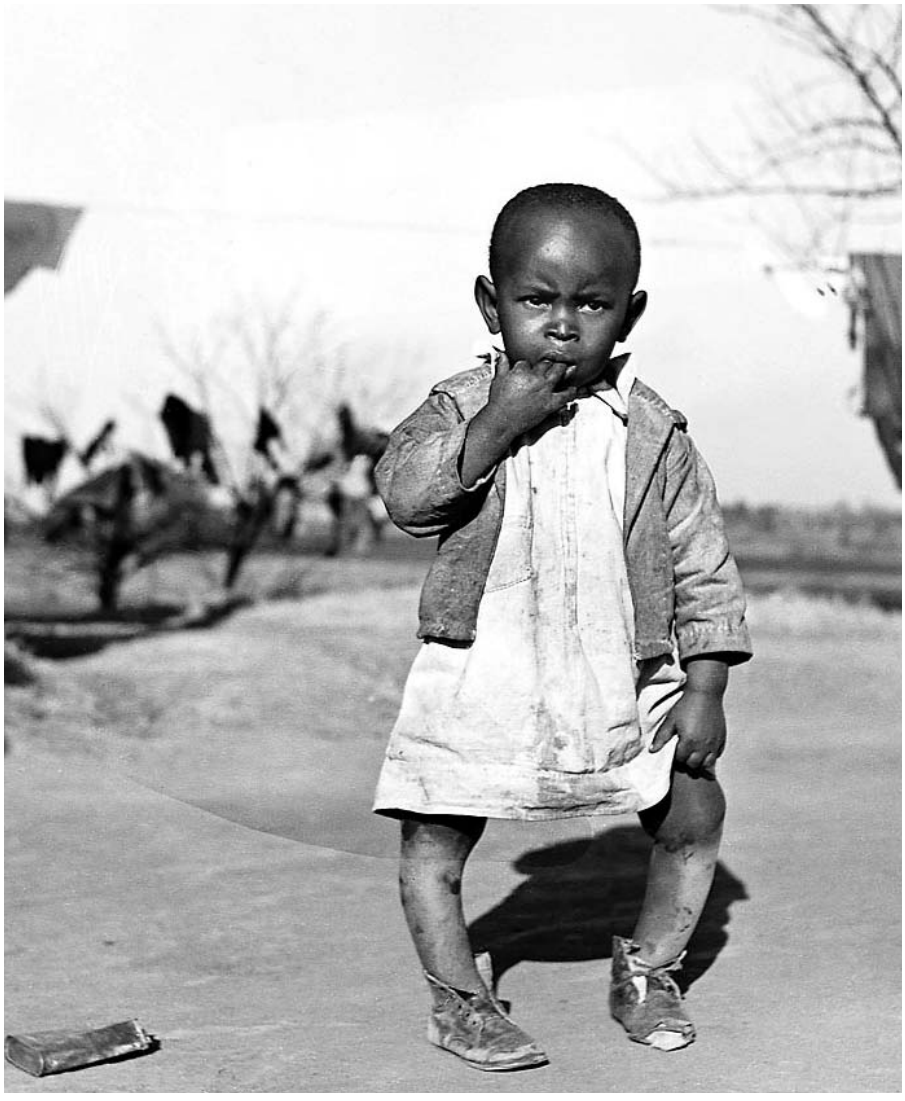
hormone: molecules produced by one set of cells that influence the function of another set of cells

osteomalacia: softening of the bones

Historically, rickets plagued the populations of European countries in the northern latitudes—at one time it was called "the English disease." During the Industrial Revolution and into the early 1900s, **smog** filled the developing cities of Europe, diminishing the amount of sunlight to which children were exposed and causing an epidemic of rickets. Some researchers estimate that prior to 1915, almost 85 percent of children in these industrialized areas of Europe and North America suffered from rickets. With research into the sources and function of vitamin D in the 1920s, however, the use of cod-liver oil, **fortified** cow's milk, and fortified formula virtually eliminated rickets in Europe and North America.

smog: air pollution

fortified: altered by addition of vitamins or minerals



This child's bowed legs are a symptom of rickets, a disease resulting from vitamin-D deficiency. Because their skin absorbs less sunlight, dark-skinned people need more sun exposure to synthesize the recommended daily amount of vitamin-D. *[photograph by Marion Post Wolcott. Corbis. Reproduced by permission.]*

diet: the total daily food intake, or the types of foods eaten

nutrition: the maintenance of health through proper eating, or the study of same

As vitamin D can either be consumed in small quantities through the **diet** or made in the skin, there are two main groups of risk factors for developing rickets. Dietary risk factors include diets low in vitamin D–rich foods, such as eggs, cow's milk, meat, and fish. Breast milk, a primary source of childhood **nutrition**, contains very little vitamin D, and infants who are exclusively breastfed are more likely to develop the disease. While human milk does contain sufficient amounts of calcium and phosphorus for an infant, its vitamin D content is only 4-60 IU/L (international units per liter), while the full-term infant requires approximately 400 IU daily. Infants and children who are not exposed to sunlight, like those in smog-filled cities or those who remain indoors or covered for cultural or religious reasons, are also at increased risk of developing rickets. In children with darkly pigmented skin, melanin acts in a similar way to block sunlight's ability to help the skin make vitamin D. Dark-skinned people require almost six times as much sunlight exposure to make the same amount of vitamin D as those with lighter skin.

Populations that remain at risk today include people with darkly pigmented skin, those who live in industrialized northern cities, and children in certain Arab countries where covering clothing and staying indoors during

early childhood are cultural norms. Even in tropical and sunny climates, rickets remains a problem in dense city centers like Calcutta and Johannesburg, and it is still diagnosed in mostly African-American children in the United States. Children who consume vegetarian or **vegan** diets, as well as infants of lactating mothers who have chronically low levels of vitamin D, may also be at increased risk for rickets. Although rare, diets directly deficient in calcium and/or phosphorus may also lead to rickets.

vegan: person who consumes no animal products, including milk and honey

One of the earliest signs of rickets in the infant is craniotabes (a softening of the skull) and delayed closing of the anterior fontanelle (the soft spot on the head). The infant's skull becomes large and thick (though soft), and muscle tone is poor. Poor calcification of osteoid at the ends of bones makes the bone spread in that area. At the ends of ribs, these splayed areas create a knobby-looking chain called the "rachitic rosary" on the front of the chest. In other areas, the pressure of a child's weight bends poorly mineralized bones, creating shortness, bow legs, and knock knees. Poor calcification also creates weakness, making bones prone to fracture. Children can also have delayed **dentition**, pelvic abnormalities, and enlarged joints, along with a curved spine and a forward projected breastbone. Rickets also lowers a child's immune defenses. For those with severe and untreated disease, bone bowing, short stature, and fractures can lead to long-term pain and immobility and require bracing and/or surgery.

dentition: formation of the teeth

Luckily, rickets is a very treatable and preventable disorder. Researchers have found that as little as twenty to thirty minutes of sun exposure per week in children in temperate climates is sufficient to maintain adequate levels of vitamin D in the blood. Other studies have found that oral supplements of 400 IU of vitamin D daily, often in the form of fish-liver oil, can prevent the disease in at-risk populations. Supplementation can also aid in the healing process. A single dose of 600,000 IU, or gradual treatment with 5,000–10,000 IU daily for two to three months, can be a sufficient treatment. And although some bony deformities may remain, many will repair themselves, and most growth parameters will return to near normal. Treatment can prevent grave complications, including developmental delays, waddling gait, and seizures.

Once a widespread scourge of childhood, rickets is now a preventable and treatable disease. It is necessary to understand the roles of vitamin D, calcium, and phosphorus in bone growth, as well as the mechanism of the disease in order to appropriately diagnose and treat it. When addressing the global impact of this disease, it is especially important to understand local environments, community diets, and cultural beliefs. SEE ALSO CALCIUM; MINERALS; OSTEOMALACIA; OSTEOPENIA; OSTEOPOROSIS.

Seema P. Kumar
Neelima Pania

Bibliography

Hartman, J. J. "Vitamin D Deficiency Rickets in Children: Prevalence and Need for Community Education." *Orthopedic Nursing* 19(1):63–66.

Joiner, T. A.; Foster, C.; and Shope, T. "The Many Faces of Vitamin D Deficiency Rickets." *Pediatrics in Review* 21(9):296–302.

McCafree, J. "Rickets on the Rise." *Journal of the American Dietetic Association* 101(1):16–17.

Specker, B. L., and Tsang, R. C. "Cyclical Serum 25-Hydroxyvitamin D Concentrations Paralleling Sunshine Exposure in Exclusively Breast-Fed Infants." *Journal of Pediatrics* 110:744–747.

Internet Resources

Finberg, Laurence (2002). "Metabolic Bone Disease." Available from <http://www.emedicine.com>

Finberg, Laurence (2002). "Rickets." Available from <http://www.emedicine.com>

Latham, Michale C. (1997). "Rickets and Osteomalacia." In *Food and Nutrition in the Developing World.* Rome, Italy: Food and Agricultural Organization of the United Nations (FAO). Available from <http://www.fao.org>

Roth, Karl S. "Hypophosphatemic Rickets." Available from <http://www.emedicine.com>

Rosenstein, Nils Rosén von

Nils Rosén von Rosenstein (1706–1773) was a Swedish physician, born in the city of Gothland. He is considered a founder of modern pediatrics, primarily because of a systematic treatise he wrote on the treatment of children and infants. This work, entitled *The Diseases of Children and Their Remedies*, was the first modern pediatric textbook, and it encouraged progress in the area of child health.

Rosenstein's writings were first disseminated as parts of calendars issued by the Swedish Royal Academy of Sciences, the oldest learned society in Sweden. In 1764, the academy compiled all the parts and put them in book form. According to Nigel Philips, a contemporary of Rosenstein, his book was considered "the most progressive which had yet to be written." The book contained chapters on such topics as **smallpox** and smallpox inoculation, teething, and measles. Also included were suggestions on the frequency of breastfeeding and information on how breastfeeding affects an infant's health. *The Diseases of Children and Their Remedies* was written so intelligibly and with such universal appeal that the average person of the time could read it.

smallpox: deadly viral disease


Underrättelser
Om
Barn-
Sjukdomar
Och deras
Bote-Medel.
Tilförene stycke-wis utgifne uti de små Almanachorna, nu samlade, tillökte och förbättrade
Af
Nils Rosén von Rosenstein,
Kongl. Archiater, Nidd. af Nordst.-Orden.
Exemplaret kostar 6 Daler Kopparmynt.
STOCKHOLM,
På Kongl. Wet. Acad. kostnad,
Tryckte hos Direct. LARS SALVIUS,
1764.

The title page to Nils Rosén von Rosenstein's *The Diseases of Children and Their Remedies.* The book includes advice for feeding infants, preventing disease in children, and curing some common illnesses. Its publication established Rosenstein as a pioneer in pediatrics. *[Eskind Library, Vanderbilt University.]*

Rosenstein was particularly interested in infant feeding. He was ahead of his time when he recommended feeding young children with diluted cow's milk by means of a bottle for sucking. He also advised that children's foods be covered to avoid contact with insects, along with other hygienic precautions. Rosenstein had an extensive medical practice that allowed him to make frequent practical observations. He laid the foundation of pediatrics as a specialty, and he gave direction to future pediatrics. Using his own notes he was also able to accurately describe and prescribe care for scarlet fever, whooping cough, diarrhea, and other illnesses. In his day, he was the most eminent physician in Sweden. He became a world famous professor of practical medicine at Uppsala University, and he was knighted by Queen Lovisa of Sweden. By the time the last Swedish edition of Rosenstein's book was published, in 1851, there existed at least twenty-five editions published in eight different languages.

Slande Celeste

Bibliography

Knipe, K. (2001). "Paediatrics: The Individuals and External Influences Involved in Forming this Special Branch of Medicine, from Hippocrates to the Present Day." Proceedings of the Royal College of Physicians Edinburgh 31:339–341.

Internet Resources

Rosenstein, Nils Rosén von (1776). *The Diseases of Children and Their Remedies.* Available from <http://www.collphyphil.org> and <www.mc.vanderbilt.edu/biolib/hc/nh6.html>

Satiety

Satiety is a feeling of fullness and satisfaction after eating. It is the opposite of hunger or appetite. The mechanisms and events that lead to a state of satiety are numerous, complex, and not well understood. It is believed that the release of certain **hormones** and the firing of certain nerves when food enters the intestine sends messages to the brain to signal that it is time to stop eating. **Genetic** predisposition and **learned behaviors** may affect at what point satiety occurs in an individual. Learning to stop eating when satiety is reached is an important component of weight control. SEE ALSO APPETITE; CRAVINGS; WEIGHT MANAGEMENT.

Beth Fontenot

hormone: molecules produced by one set of cells that influence the function of another set of cells

genetic: inherited or related to the genes

learned behaviors: actions that are acquired by training and observation, in contrast to innate behaviors

Scandinavians, Diet of

Scandinavia is a peninsula in northern Europe that is occupied by Norway and Sweden. Denmark is also generally considered to be part of Scandinavia because of its historical, political, and cultural ties to Norway and Sweden. These three countries are also part of the Nordic countries, which also include Finland and Iceland. With the exception of Denmark and Iceland, these countries are located north of the Baltic and North Seas and share common borders with each other and Russia. All of these countries are part of the Nordic Council. The Nordic countries have historical and cultural ties, and during the Viking era they had a common language and religion. They are also predominantly Protestant countries.

Nutrition and Health Status

There is a high **prevalence** of **cardiovascular** disease (**coronary heart disease**, **stroke**, **hypertension**) in this area, mainly due to the high intake of saturated fats, **cholesterol**, and sodium. Stomach **cancer** is also very common due to the high intake of salt and salt-cured foods, especially salted fish. Accidental injuries are the largest cause of death for individuals under forty-five years of age. Suicide and alcoholism are also prevalent, and **obesity** is on the rise.

Food-borne diseases such as **tularemia** are endemic in the Scandinavian region. These diseases are transmitted through the handling of undercooked, infected meat. "Mad cow disease" was also identified in cows in this region, and an outbreak of human *Salmonella* infections in the summer of 2000 was traced to hedgehogs.

prevalence: describing the number of cases in a population at any one time

cardiovascular: related to the heart and circulatory system

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

hypertension: high blood pressure

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

cancer: uncontrolled cell growth

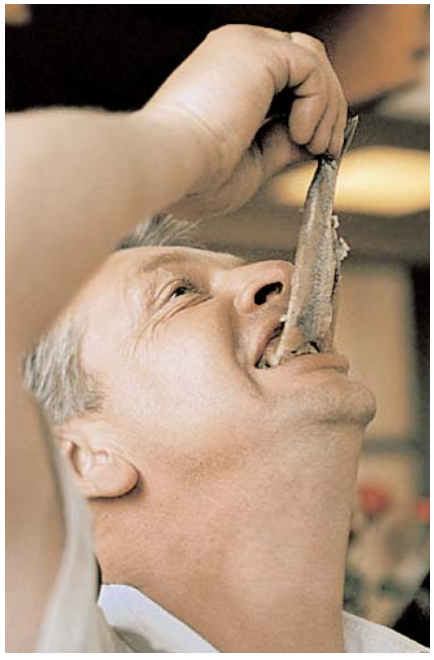
obesity: the condition of being overweight, according to established norms based on sex, age, and height

tularemia: bacterial infection by Francisella tularensis, causing fever, skin lesions, and other symptoms

Eating Habits and Dietary Patterns

The descendants of the Vikings continue to eat many of the foods of their ancestors, and they often prepare them in the same way. Preserved food are very common and include dried, smoked, salted, or pickled fish; dried fruits and jams; and fermented milk. Fresh fruits and vegetables are only available for a few months a year and are dried and stored for the fall and winter months. Strawberries, blueberries, and raspberries abound in the summer. Potatoes are an important staple of the **diet** and are served in a variety of

diet: the total daily food intake, or the types of foods eaten



A Dutch man eats raw herring, which is a delicacy in the Netherlands. Seafood is an important part of the Scandinavian diet, but it is not always eaten raw. Popular preparations include smoking, drying, pickling, and salting. *[AP/Wide World Photos. Reproduced by permission.]*

ways, including as pancakes. Other **staples** include fish, seafood, mutton, cheese, cabbage, apples, onions, berries, nuts, and bread. Bread is often made with rye, and both leaven and unleavened varieties are common.

staples: essential foods in the diet

Scandinavians eat simple, hearty meals. They generally eat three meals a day, plus a coffee break. Breakfast is light and usually includes bread or oatmeal porridge, fruit, eggs, cheese, herring, or potatoes. Fruit soup is a popular breakfast item in the winter and is topped with cream and served with bread and cheese.

Smorgasbords (bread and butter buffet tables) are popular at lunch in Scandinavia. In Denmark, open-faced sandwiches are made from the buffet table and eaten with a knife and fork. Buttered bread is topped with items such as sausage, herring, smoked salmon, boiled potatoes, cheese, and tomatoes. Such sandwiches are also served as a late-afternoon or bedtime snack. In Sweden, the buffet table offers a large variety of both hot and cold dishes. The Swedes eat herring first, followed by other fish dishes. Meats, salads, and hot dishes then follow (in that order), and dessert is eaten last. Dinner usually has several courses, including appetizer, soup, entrée, vegetables, and dessert. Pea soups served with pancakes are popular dinner items in the winter.

Desserts are rich but not overly sweet. Popular desserts include pancakes with preserves, fruit pies, and pastries. Danes are internationally known for their pastries, and Swedes are known for their butter cookies. Beverages served with meal include milk, coffee, tea, beer, schnapps, dry sherry, sweet Madeira, port, or *aquavit* (water of life). Aquavit (also called akavit, aquavite and akvavit) is an alcoholic beverage made from a grain or potato mash that is double-distilled. The second distillation features the addition of various flavorings such as caraway (most common), cumin, cardamom, lemon peel, aniseed, or fennel. Aquavit is generally not aged, and it is usually drunk straight and chilled, from a small chilled glass. It is a popular drink at smorgasbords.

Dairy products (from cows, goats, and reindeer) are heavily consumed. In addition to drinking milk, Scandanavians also have a high intake of sour cream, buttermilk, and cheese. Cheese is generally served at every meal. Cheese from this region of the world is popular internationally and includes Danish Blue and Havarti from Denmark, Herrgardsost and Svecia from Sweden, and Gammelost and Gjeitost (brown goats cheese) from Norway.

Fish is a major staple in the diet, and Scandinavia is the largest supplier of fish in Europe. The region is one of the largest exporters of dried salt cod in the world. Sweden is famous for its crayfish, Denmark for its oysters, and Norway for its lobsters and prawns. Smoked and cured fish (e.g., herring, mackerel, cod, salmon, and eel) are produced commercially for both the domestic market and for exporting. Cured cod is traditionally prepared for Christmas in Norway and Sweden and served with pork **fat** and bacon.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

Historically, meat was in limited supply, so it was often combined with other ingredients. The famous Swedish meatballs and the Danish *fricadeller* (patties made of ground beef, lamb, and pork) came out of this tradition. Today, the Scandinavians are hearty meat eaters. Pork is the favorite meat in Denmark, a country that has as many pigs as people. Scandinavians also hunt wild birds, elk, deer, and bear, just as their Viking ancestors did. Even a few

Long winters and short summers limit the fruits and vegetables available to Scandinavians. Their diet tends to be high in fat and salt, and includes such exotic fare as reindeer milk, whale steak, and lutefisk. *[Photograph by Ted Spiegel. Corbis. Reproduced by permission.]*

of the more esoteric tastes of the Vikings live on. Norwegians love whale steak and claim that it tastes as good as beef. Smoked horseflesh is also popular with the Swedes—they call it "hamburger" and buy it thinly sliced.

Special Meals

Christmas is a welcome holiday during the long Scandinavian winter. Traditional foods eaten on Christmas Eve are rice porridge, fresh cod, and lutefisk. Rice porridge is served with cinnamon and sugar and has one hidden blanched almond. The person who finds the almond is believed to be blessed with good luck for the following year. Lutefisk is boiled cod (treated in a

lye solution); it is served with a white sauce, melted butter, green peas, boiled potatoes, and mustard. Christmas Day dinner features ham or pork served with red cabbage or sauerkraut. The Danes usually serve goose on Christmas Day.

In Norway, Christmas festivities begin weeks before the holiday. Most families brew a Christmas beer called *juleol.* They also cook traditional pork dishes, bake biscuits, cookies, cakes, and *julekake*, a sweet bread filled with raisins, candied peel, and cardamom. Swedes have a month-long Christmas celebration that begins on December 13, the feast of St. Lucia. Christmas is celebrated on December 24 with rice pudding and ginger cookies. In Denmark, the Christmas feast is held at midnight on Christmas Eve.

Midsummer's Day (June 24) is another popular holiday in Scandinavia. It features maypole dancing, feasting, and bonfires. Fish, such as herring and cured salmon (*gravlax*), along with boiled new potatoes are common. In Norway, a cream pudding (*rommegrot*) is served with cinnamon and sugar. In Sweden, wild strawberries are eaten.

Delores C. S. James
Ranjita Misra

Bibliography

Haas, Elson M. (1992). *Staying Healthy with Nutrition: The Complete Guide to Diet and Nutritional Medicine.* Berkeley, CA: Celestial Press.

Kittler, Pamela G., and Sucher, Kathryn P. (2001). *Food and Culture*, 3rd edition. Stamford, CT: Wadsworth/Thomson Learning.

Ojakangas, Beatrice (2001). *Scandinavian Feasts: Celebrating Traditions throughout the Year.* Minneapolis, MN: University of Minnesota Press.

Internet Resources

"Explore Denmark." Available from <http://www.geocities.com/denmark1.geo/explor10.htm>

World Health Organization (2000). "Disease Outbreaks." Available from <http://www.who.int/disease-outbreak-news>

School-Aged Children, Diet of

The category of school-aged children includes children three to four years old who are preschoolers; elementary school children (kindergarten to fourth grade), who may be between four and ten years of age; middle school children between eleven and thirteen (grades five to eight); and high school children fourteen to eighteen (grades nine to twelve). Often, the **nutrients** their bodies need for optimal functioning and growth are different for each of these age groups.

nutrient: dietary substance necessary for health

Nutritional Needs

The **Recommended Dietary Allowances** (RDAs) represent levels of intake of essential nutrients that, on the basis of scientific knowledge, are judged by the Food and Nutrition Board of the National Academy of Sciences to be adequate to meet the nutrient needs of practically all healthy persons. In the United States, the National School Lunch Program (NSLP) and the School Breakfast Program (SBP), which provide free and reduced-priced meals for children in schools, are required to provide one-third of the RDAs

Recommended Dietary Allowances: nutrient intake recommended to promote health

at lunch and one-fourth of the RDAs at breakfast, thus ensuring that children eating at school consume adequate amounts of essential nutrients.

The *Dietary Guidelines for Americans* (DGA), published by the U.S. Department of Agriculture (USDA), is also used to help determine the nutritional needs of American children. Through the DGA, the USDA recommends using the Food Guide Pyramid (FGP) as a tool for healthful food choices. Some key guidelines include not exceeding 30 percent of total **energy** intake from **fat** and getting less than 10 percent from saturated fats. The FGP for young children (two to six years old) identifies recommended portions of foods from grains (six servings), vegetables (three servings), fruit (two servings), milk (two servings), and meat (two servings), as well as recommending limiting the intake of fats and sweets. The nutrient needs of teens can be determined using the FGP for adults. The DGA also provide guidance in determining the number of servings of foods from each group, depending on total energy need.

Dietary Patterns

While school-food service personnel attempt to provide healthful meals and food choices, children do not always eat the food they receive. The dietary patterns of children are determined by social, **psychological**, and economic factors.

Toddlers and preschoolers spend more time eating at home than they do in school. Their food choices and food preferences are thus largely dependent on what their parents and caregivers provide. When children are young, their parents and families have greater control over what they eat. As they get older, however, what their friends eat in the school **environment**, and what is available to them in school and elsewhere, will have an impact on what they eat. According to Kweethai Neill, Tom Dinero, and Diane Allensworth, what children eat at school is dependent on many factors, including the cafeteria environment, peer pressure, administrative support, teacher participation, cafeteria staff, and the quality of food choices offered.

At the beginning of the twenty-first century, more families are headed by single parents than ever before, and a greater number of two-parent families have both parents in the workforce. As a result, toddlers and preschoolers often have to depend on their schools to feed them. If they are eligible for the SBP and NSLP at school, they can have free or reduced-priced breakfasts and lunches. Even so, there is no guarantee they will eat what they are given.

Children need nutritious foods to grow and to function. Many American adolescents skip breakfast by choice either because they do not have the time to eat or in order to lose weight. In addition, many school-aged children depend on **junk foods** for their nourishment. Studies on American adolescents show that, in general, they have inadequate intake of fruit, vegetables, and whole grains. More than one-third of their daily intake comes from eating snacks between meals. These snacks include high-fat **fast-food** items such as cheeseburgers and potato chips. American teens consume more than a third of their **calories** from saturated fats. Krebs-Smith and colleagues found that one-fourth of the vegetables that children consume are french-fried potatoes. The Centers for Disease Control and Prevention has reported that 70.7 percent of high school students do not eat five or more servings of fruits and vegetables during the day, that 72.6 percent do not attend

Junk Food in Schools

In recent years, public health officials and school administrators have come to realize that schools are frequently working against the cause of sound nutrition in children and adolescents. Many school districts have negotiated exclusive contracts with fast food and beverage companies to provide their products to students, with a portion of the revenues going to the schools. As a result, cafeteria and vending machine lunches commonly include pizza, burgers, chips, soda, candy, and ice cream. Exacerbating the situation, approximately twelve thousand schools (with eight million students) show Channel One, which features commercials promoting junk food. The United States Department of Agriculture and five major medical associations have called for school administrators to reverse this trend and foster better nutrition in schools. The movement has begun to take hold, as school systems including Los Angeles, New York, and Texas have taken steps to ban junk food from vending machines and cafeterias.

—Paula Kepos

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

fat: type of food molecule rich in carbon and hydrogen, with high energy content

psychological: related to thoughts, feelings, and personal experiences

environment: surroundings

junk food: food with high fat and sugar content, without correspondingly high amounts of protein, vitamins, or minerals

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

calorie: unit of food energy

physical education class daily. It is not surprising, given such findings, that childhood **obesity** is increasing.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

Vending machines in schools also contribute to the obesity problem of school children. Many schools have signed contracts with beverage companies to place vending machines in schools. Schools receive huge amounts of "kickback" money for these contracts. In return, vending machines offer high-calorie non-nutritious sodas to students. Many vending machines in schools also provide snacks that are high in calories, fats, and sugars.

Snacking

Snacking is fast becoming the main eating style among children in America. According to Jans and colleagues, there was a significant increase in snacking among children between the years 1977 to 1996. They found that the number of snacking occasions increased, thus increasing the total energy consumption for these children. They also reported that the proportion of energy consumption from fat increased.

globalization: development of worldwide economic system

Worldwide, adolescents consume more fat than they need to. **Globalization** and free trade have brought fast-food eating establishments to most countries, especially to developing nations. McDonalds, Pizza Hut, Burger King, and places like these are commonly found in Europe, Asia, Australia, the Caribbean, and Latin America. Vegetable oils and fats are cheap and easily available, and more food products high in fats are accessible even to those of low-income persons in developing countries. Consequently, even poorer nations are no longer immune to the ills of Westernization, including obesity.

convenience food: food that requires very little preparation for eating

The shrinking world brought about by satellite television and the Internet has created a popular culture among teens around the world—a culture inundated by junk snacks, sodas, pizzas, and **convenience foods**. Eating a meal at the table is no longer a tradition, as nuclear families are more rare. Teens are used to "grab and run" eating styles, as are many adults. Food manufacturers and franchisers take advantage of this profit-making opportunity to produce more convenience foods, snacks, and beverages that are high in fats and calories. Teens prefer popular, tasty, and easy-to-find junk foods. The average American consumes more than forty-two gallons of soda a year. Many teens are included in this group.

Obesity

While adolescents around the world are eating more calories, they are not necessarily eating healthier food. High fats and more calories, combined with a decrease in physical activity, have created an obesity problem among adolescents around the world. The increase in popularity of television viewing and video games, better public and private transportation, and the urbanization of cities account for adolescents adopting more **sedentary** lifestyles. In addition, children have fewer safe neighborhoods to walk, run, play and ride their bicycles in.

sedentary: not active

overweight: weight above the accepted norm based on height, sex, and age

Between 1980 and 1994, the percentage of children who are **overweight** increased from 11 percent to 24 percent. The trend is also evident in Brazil, Chile, Britain, Ireland, Spain, Sweden, China (among children of high-income parents), Taiwan, Thailand, and Australia. American adolescents,

although they are eating more in calories, have diets that are low in many important nutrients. Because of this, many are at risk for **hyperlipidemia**, **cardiovascular** problems, **diabetes**, and obesity. Sixty-one percent of children between five and fifteen who are overweight have one or more risk factors for cardiovascular disease, and 27 percent of these children have two or more risk factors. Increasing numbers of children are being diagnosed with type 2 diabetes, which was once considered an adult-onset disease related to obesity.

hyperlipidemia: high levels of lipids (fats or cholesterol) in the blood

cardiovascular: related to the heart and circulatory system

diabetes: inability to regulate level of sugar in the blood

Overweight children have a 70 percent chance of becoming overweight adults. Obesity in childhood, leading to obesity in adulthood, multiplies the health risks for these individuals. Obesity in childhood also brings with it emotional pain from being teased, isolated, and discriminated against. Overweight children also suffer from low self-esteem, which may affect their ability to succeed at school.

While more adolescents become overweight, the media and peer pressure demand that girls look thinner and boys get bulkier. These societal pressures lead many teens to engage in disordered eating behaviors, such as extreme dieting. Consequently, many suffer from some form of **eating disorder**. Teens face a dilemma in a society that values youthfulness and thinness but encourages a **lifestyle** of sedentary convenience. Such a lifestyle includes a decrease in physical activity, and therefore energy expenditure, as well as fast foods full of fat and high in calories, making it difficult for adolescents to escape a sentence of obesity and ill health.

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

It is therefore important to encourage children, teenagers, and adults to adopt a physically active lifestyle and healthful eating habits, and to try to motivate young people to become healthier individuals. In addition, public policy to limit junk foods in schools and to encourage families to make healthful food choices for their children can also play a role. SEE ALSO ADOLESCENT NUTRITION; DIETARY GUIDELINES; FAST FOODS; FOOD GUIDE PYRAMID; PRESCHOOLERS AND TODDLERS, DIET OF; SCHOOL FOOD SERVICE.

Kweethai C. Neill

Bibliography

Drenowski, A., and Popkin, B. M. (1997). "The Nutrition Transition: New Trends in the Global Diet." *Nutrition Reviews* 55:31–34.

Freedman, D. S.; Dietz, W. H.; Srinavasan, S. R.; and Berenson, G. S. (1999). "The Relation of Overweight to Cardiovascular Risk Factors among Children and Adolescents: The Bogalusa Heart Study." *Pediatrics* 103:1175–1182.

Jahns, L.; Siega-Riz, A. M.; and Popkin, B. M. (2001). "The Increasing Prevalence of Snacking among U.S. Children from 1977 to 1996." *Journal of Pediatrics* 138(4):493–498.

Krebs-Smith, S. M.; Cooke, A.; Subar, A. F.; Cleveland, L.; Friday, J.; and Kahle, L. (1996). "Fruit and Vegetable Intakes of Children and Adolescents in the United States." *Archives of Pediatric and Adolescent Medicine* 150:81–86.

Neill, K. C.; Dinero, T. E.; and Allensworth, D. (1997). "School Cafeteria: A Culture for Promoting Child Nutrition Education." *The Health Education Monograph Series* 15(3):40–48.

Popkin, B. M. (1994). "The Nutrition Transition in Low-Income Countries: An Emerging Crisis." *Nutrition Reviews* 52:285–298.

Popkin, B. M. (1998). "The Nutrition Transition and Its Health Implications in Lower–Income Countries." *Public Health Nutrition* 1(1):5–22.

Scneider, D. (2000). "International Trends in Adolescent Nutrition." *Social Science and Medicine* 51(6):955–967.

U.S. Department of Agriculture (2000). *Nutrition and Your Health: Dietary Guidelines for Americans*, 5th edition. Washington, DC: U.S. Government Printing Office.

National Research Council (1989). *Recommended Dietary Allowances*, 10th edition.

National Center for Health Statistics. (2000). *The Adolescent Chart Book*. Washington, DC: U.S. Government Printing Office.

School Food Service

There are 48 million school children who are served by school food services in the United States everyday. Many of these children participate in the National School Lunch Program (NSLP), which was established by Congress in 1946 to provide low-cost or free nutritionally sound lunches to public school children. By 1946, about 7.1 million children were being served. This grew to 22 million by 1970, and by 2000 more than 27.4 million children were fed through the NSLP. Since 1946 more than 180 billion lunches have been served. School food service and the NSLP play a very important role in children's learning.

The NSLP is administered by the Food and Nutrition Service of the U.S. Department of Agriculture (USDA) at the federal level and by state educational agencies at the local level. Most school districts have a food service or child nutrition service director who oversees the work of cafeteria managers and staff in individual school cafeterias. In many school districts, meals are prepared from scratch by kitchen staff, while many districts contract commercial caterers to provide the food. **Fast-food** companies are also competing to get into school cafeterias.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

School districts that participate in the NSLP receive cash subsidies and food commodities from the USDA. They serve lunches to eligible students (who may receive the meals free or at a reduced price) and are then reimbursed for the meals. In addition to the NSLP, the School Breakfast Program (SBP) was begun in 1966. By 2001, 7.7 million students were served free or reduced-price breakfasts through the SBP.

Children from families with incomes at or below 130 percent of the poverty level (as described by the U.S. Department of Health and Human Service) are eligible for free meals. Those from families with incomes between 130 and 185 percent of the poverty level are eligible for reduced-priced meals. Usually these children pay no more than forty cents for lunch and thirty cents for breakfast. School food-service programs must operate their business as nonprofit programs.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

calorie: unit of food energy

nutrient: dietary substance necessary for health

To qualify for federal reimbursements, school lunches must meet the Dietary Guidelines for Americans (DGAs) which recommend that no more than 30 percent of an individual's total caloric intake come from **fat**, and no more than 10 percent from **saturated fat**. Federal regulations also mandate that school lunches provide one-third of the Recommended Dietary Allowance (RDA) for **protein**, vitamin A, vitamin C, **iron**, **calcium**, and **calories**. The SBP provides breakfasts that meet the Dietary Guidelines for Americans, and provide one-fourth of the RDA for the above **nutrients**. RDAs vary for children of different ages. Elementary schools, middle schools, and high schools should therefore serve meals that meet the age-appropriate RDAs. Table 1 shows the school lunches that meet the RDA requirements of children at different grade levels.

With the help of the American School Food Service Association, school cafeterias around the nation provide balanced meals, which are crucial to growing children's bodies and minds. *[Photograph by Martha Tabor. Working Images Photographs.]*

Plate Waste

Children do not always eat everything on their lunch or breakfast trays. While the USDA attempts to mandate compliance in nutrition integrity of meals provided by school food service, there is no guarantee that children will actually consume everything. G. Richard Jansen and Judson M. Harper, in their 1978 study of the consumption and plate waste of food in the NSLP of fifty-eight elementary schools and high schools, reported that of the 23,000 lunches measured, students tended not to eat all items in the meals. High school students tended to waste less food than elementary students. In 2001, Shanklin found that while students chose meals that were healthful, many did not finish their meals. Vegetables were the least popular item in the meals. While 64 percent of the students selected green peas, most of the students discarded half of what they chose.

The issue of plate waste is an important one. Parents and teachers may help by educating students about nutrition and the importance of eating healthful meals, while school-food service personnel can strive to offer nutritious choices in ways that students will find more appealing.

Competitive Foods

According to the USDA, competitive foods are foods "sold to children in food service areas during meal periods in competition with the federal meal programs." The USDA divides competitive foods into two categories. The first is *foods of minimal nutritional value* (FMNV). USDA regulations prohibit the sale of FMNV in school-food service areas during mealtimes. FMVN include carbonated drinks (such as sweetened soft drinks), chewing gum, and candy. These items may be sold in other areas at anytime during the school day. States and local school districts may have their own restrictions on the sale of FMNV.

The second category includes other foods offered for individual sale in food service or other areas on a school campus. These foods may include

MINIMUM NUTRIENT AND CALORIE LEVELS FOR SCHOOL LUNCHES (SCHOOL WEEK AVERAGES)

	Preschool	Grades K–6	Grades 7–12
Calories	517	664	825
Total fat (percentage of total food energy)	*1	*1, 2	*2
Saturated fat (percentage of actual total food energy)	*1	* 1, 3	*3
RDA for protein (g)	7	10	16
RDA for calcium (mg)	267	286	400
RDA for iron (mg)	3.3	3.5	4.5
RDA for vitamin A (RE)	150	224	300
RDA for vitamin C (mg)	14	15	18

*1. The Dietary Guidelines for Americans recommends that after 2 years of age, children should gradually adopt a diet, that by about 5 years of age, contains no more than 30 percent of calories from fat.
2. Not to exceed 30 percent over a school week
3. Less than 10 percent over a school week.
"RE" refers to "retinol equivalent," a measure of the vitamin A activity in foods.

second servings of foods from the NSLP, a la carte items, and other foods and beverages from vending machines, school stores, or snack bars that students buy in addition to or in place of the NSLP.

FMNV items include snacks that are high in fat and sugar, as well as sodas, which are dense with empty calories. Most of these items are offered in vending machines, snack bars, school stores, and sometimes as fund raisers that occur during mealtimes at school. These foods have certain characteristics. First, they have minimal nutritional value and have no regulated nutrition standards. Second, these foods usually contain high amounts of fat, calories, and sugar. In many schools, the lunch period does not offer sufficient time for students to stand in line, get their food and to eat it. In cases where lines are long at the school cafeteria, many students choose to buy snacks from vending machines. Often students spend all their lunch money in the vending machines before they get to the cafeteria.

School food service (SFS) personnel face many problems when it comes to providing quality service to children. For one thing, they are not allowed to make a profit. Yet, they have to compete with commercial food caterers for staff and customers. They also have to provide meals that are appealing, low cost, and that follow the DGA and federal regulations for RDAs in order to qualify for reimbursements for free and reduced-price lunches. While most parents do not mind giving their children as much as five dollars to spend at fast-food restaurants, they complain about spending $2.75 for a well- prepared nutritious school meal for their children.

SFS personnel have to please the school administrators, parents, teachers, children, and the public in order to be successful. The public is often not aware that cafeteria workers work very hard, often get no benefits because most of them are part-time workers, get paid less than their counterparts in commercial operations, and do not get much appreciation for their work. Strangely, many cafeteria workers remain in their jobs for long periods. Many of America's school cafeterias are staffed by dedicated individuals who love children.

The American School Food Service Association maintains that their mission goes beyond traditional school meal programs to better their schools and communities. They are committed to the health and well-being of the

children served by their programs. SEE ALSO ADOLESCENT NUTRITION; SCHOOL-AGED CHILDREN, DIET OF.

Kweethai C. Neill

Bibliography

Jansen, G. R. and Harper, J. M. (1978). "Consumption and Plate Waste of Menu Items Served in the National School Lunch Program." *Journal of the American Dietetic Association* 73 (4), 395–400.

Shanklin, C. "Kids Choose Healthy Lunches, But Don't Eat Them." *Journal of the American Dietetic Association* 101, 1060–1063.

Internet Resources

U.S. Department of Agriculture. "National School Lunch Program." Available from <http://www.fns.usda.gov>

U.S. Department of Agriculture. "School Breakfast Program." Available from <http://www.fns.usda.gov>

Scurvy

This X-ray of an infant afflicted by scurvy shows some of the skeletal effects of the disease, including bowed legs, stunted bone growth, and swollen joints. Infants who are fed only cow's milk are at risk of developing scurvy, since cow's milk is not an adequate source of vitamin C. *[Photograph by Lester V. Bergman. Corbis Images. Reproduced by permission.]*

Scurvy is a condition characterized by hemorrhages around the hair follicles of the arms and legs, generalized weakness, **anemia**, and gum disease (gingivitis) resulting from a lack of ascorbic acid (vitamin C) in the **diet**. Early epidemics of scurvy occurred during the Renaissance (1600–1800s) among explorers and seafaring men. In 1746, James Lind, a British naval surgeon, established that eating lemons and oranges cured the disease.

Vitamin C is destroyed by heat, and thus not present in pasteurized and commercially **processed foods**. Children and teenagers who consume too many processed foods and few fresh fruits and vegetables may be getting inadequate amounts of vitamin C. (In 1914, an increased **incidence** of scurvy among infants was attributed to consumption of heated (pasteurized) milk and vitamin C–deficient commercially processed foods.) Though rare, scurvy is now frequently observed among elderly persons, alcoholics, and **malnourished** adults. In addition, smokers have higher requirements for vitamin C, and are therefore more at risk.

Kiran B. Misra

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

anemia: low level of red blood cells in the blood

diet: the total daily food intake, or the types of foods eaten

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

incidence: number of new cases reported each year

malnourished: lack of adequate nutrients in the diet

Small for Gestational Age

Small for gestational age, also known as intrauterine growth retardation, is defined as an infant or fetus smaller in size than expected, meaning a weight in the bottom tenth percentile for a particular age. Small for gestational age is believed to be related to placental insufficiency, infectious disease, **congenital** malformations, drug and alcohol abuse, and cigarette smoking. Other risk factors include maternal **hypertension**, first pregnancies, and exposure to environmental **toxins**. It is considered to be one cause of low birth weight (less than twenty-five hundred grams, or five pounds eight ounces). It is not synonymous with prematurity, which is defined as birth before thirty-seven-weeks gestation. SEE ALSO INFANT MORTALITY RATE; LOW BIRTH WEIGHT INFANT; PREGNANCY.

Mary Cowley Parke

congenital: present from birth

hypertension: high blood pressure

toxins: poison

Bibliography

Strauss, R. S. (2000). "Adult Functional Outcome of Those Born Small for Gestational Age: Twenty-Six Year Follow-Up of the 1970 British Birth Cohort." *Journal of the American Medical Association* 283:625–632.

Internet Resources

Centers for Disease Control and Prevention (1994). "Low Birth Weight and Intrauterine Growth Retardation." In *From Data to Action: Public Health Surveillance for Women, Infants, and Children*. Available from <http://www.cdc.gov/nccdphp>

"Small-for-Gestational-Age Infant." *Merck Manual*. Available from <http://www.merck.com>

Smoking

Smoking is an important and preventable cause of death and illness. However, as more money has been spent on smoking cessation programs, the **incidence** of cigarette smoking has risen. In 2002, 48 percent of men and 12 percent of women in the world were smokers (World Health Organization). Tobacco consumption increased from 1,100 million individuals during the early 1990s to 1,300 million by the year 2000 (United Nations Economic and Social Council). At this rate, the number of tobacco-related deaths is projected to reach more than 9 million by the year 2020. The number of tobacco-related deaths increased from 4.2 million to 4.9 million between 2000 and 2002, meaning that more than nine people die due to smoking-related illnesses every minute.

incidence: number of new cases reported each year

Research indicates that tobacco causes more than twenty categories of fatal and disabling diseases, including lung **cancer**, **cardiovascular** disease, and respiratory diseases. However, tobacco is very addictive, and the majority of smokers have difficulty quitting even when they have a medical condition. For example, a 2000 study of 15,660 adults by the Agency for Healthcare Research and Quality found that 38 percent of people with emphysema, 25 percent of people with **asthma**, 20 percent of people with **hypertension** and cardiovascular problems, and 19 percent of people with **diabetes** continue to smoke. Although smoking was responsible for their health conditions, they perceived that, since their health conditions already exist, quitting would not have an affect on their future health and well-being.

cancer: uncontrolled cell growth

cardiovascular: related to the heart and circulatory system

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

hypertension: high blood pressure

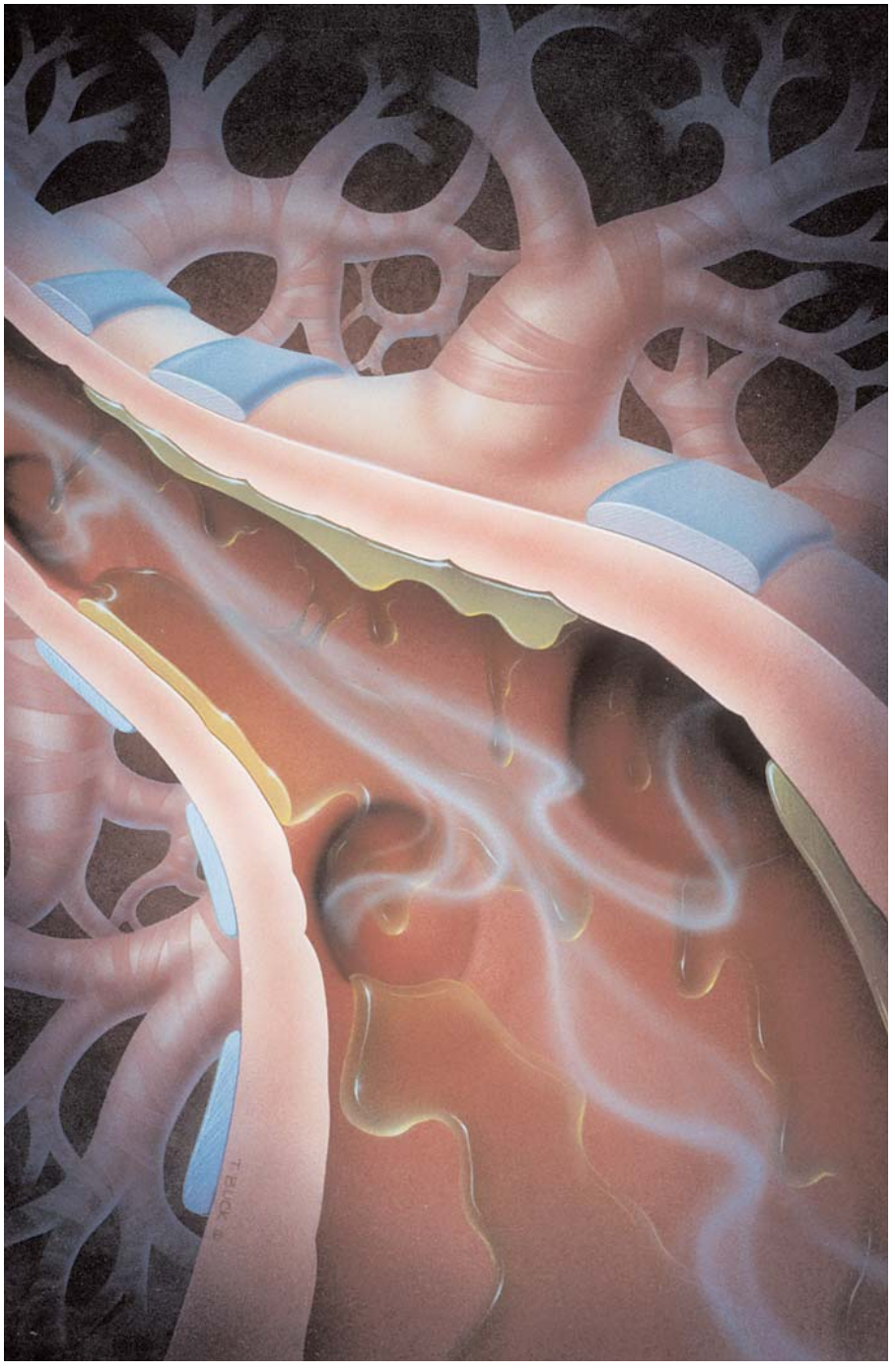
diabetes: inability to regulate level of sugar in the blood

A recent area of concern related to tobacco use has been nonsmokers' exposure to second-hand smoke. Parental smoking has been proven to contribute to increased rates of sudden infant death syndrome (SIDS) in addition to **chronic** illnesses in children such as asthma, bronchitis, colds, and **pneumonia**. Pregnant women who chew tobacco, smoke, or are exposed to second-hand smoke have a higher risk of miscarriage and of giving birth to low birth weight babies, who are prone to infection. Women who smoke are more likely to be victims of primary and secondary infertility, to have delays in conceiving, and to have an increased risk of early **menopause** and low bone density ("Current Issues and Forthcoming Events"). Most women are unaware of these dangers. Not only can the expectant mother place her unborn fetus in danger, but she can also place herself at risk for future smoking-related diseases and early mortality.

chronic: over a long period

pneumonia: lung infection

menopause: phase in a woman's life during which ovulation and menstruation end



An illustration of cigarette smoke entering the lungs. Cigarette smoke contains over 4,000 chemicals, many of which are toxic or carcinogenic. Repeated inhalation of the smoke causes permanent damage to internal organs and reduces the body's ability to fight infection. *[Todd Buck/Custom Medical Stock Photo, Inc. Reproduced by permission.]*

Quitting smoking at any age improves life expectancy. The 2002 Cancer Prevention Study examined the benefits of smoking cessation in 877,243 men and women in the United States. Life expectancy of smokers who quit before age thirty-five was extended by 8.5 years in men and by 7.7 years in women. The study found that smokers who quit at any age are subjected to meaningful life extensions (Taylor, et al.). In addition to a life free from smoking-related diseases, an individual who quits smoking can experience increased longevity. SEE ALSO CANCER; HEART DISEASE; LOW BIRTH WEIGHT INFANT; NUTRITIONAL DEFICIENCY; PREGNANCY.

Daphne C. Watkins

Bibliography

"Current Issues and Forthcoming Events" (2001). *Journal of Advanced Nursing*, 36(5).

Taylor, Donald H., Jr., et al. "Benefits of Smoking Cessation for Longevity." *American Journal of Public Health* 92(6).

World Health Organization (2002). *World Health Report 2002—Reducing Risks, Promoting Healthy Life*. Geneva: Author.

Internet Resources

United Nations Economic and Social Council (2002). "Secretary General's Report to the Economic and Social Council (ECOSOC) on the activities of the United Nations Ad-Hoc Interagency Task Force on Tobacco Control." Available from <http://www.un.org/esa/coordination/ecosoc/SG_UNTF_ECOSOC.pdf>

Society for Nutrition Education

The Society for Nutrition Education (SNE) is an organization of nutrition professionals whose aim is to be involved in nutrition education and health promotion. The organization represents professional interests in nutrition education within the United States and worldwide. SNE is dedicated to promoting healthy, sustainable food choices and has a vision of healthy people in healthy communities.

The organization was founded in July 1968, and, according to its mission statement, is "the premier association linking the fields of food, nutrition, and education. The society enhances members' ability to help the public make informed food choices."

The society also publishes the *Journal of Nutrition Education and Behavior* (formerly know as the *Journal of Nutrition Education*).

Susan Himburg

Bibliography

Ullrich, Helen D. (1992). *The SNE Story: 25 Years of Advancing Nutrition Education*. Berkeley, CA: Nutrition Communications Associates.

Internet Resources

Society for Nutrition Education. "SNE Membership." Available from <http://www.sne.org/>

South Americans, Diet of

South America is the fourth largest continent on the planet, making up 12 percent of the earth's surface. It contains twelve independent nations: Argentina, Brazil, Bolivia, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, and Venezuela. In addition, it contains three territories: The Falkland Islands (Great Britain), French Guiana (France), and the Galapagos Islands (Ecuador). The continent has a very diverse population. There are small pockets of native Indian groups and significant numbers of descendents of Spanish, Portuguese, Italian, German, West African, and East Indians settlers. There also are considerable numbers of Chinese and Japanese. Approximately 90 to 95 percent of South Americans are Roman Catholic.

Nutritional Status

A high percentage of South Americans live in extreme poverty. **Parasitic** infection, **protein-calorie malnutrition**, iron-deficiency **anemia**, iodine deficiency, and vitamin-A deficiency are common nutritional problems in the rural and urban areas in many South American countries. **Heart disease**, **hypertension**, and **obesity** are also on the rise.

Eating Habits and Meal Pattern

South Americans typically eat three meals and one or two snacks daily. Milk is usually not consumed as a beverage but used in fruit-based drinks and coffee, and milk-based desserts are popular. Fruits, vegetables, and nuts are eaten in abundance. Cassava flour and meal are common in many areas.

Coffee is a major beverage throughout the continent, and South American countries now produce most of the coffee consumed worldwide; Brazil alone produces about a third of the world's coffee. Coffee usually is served concentrated, then diluted with evaporated milk or water. Coffee is consumed heavily in Argentina, Colombia, Ecuador, and Brazil, while tea is popular in Chile and Uruguay. **Herbal** teas are used as remedies throughout the continent.

Yerba maté (pronounced "yerba mahtay") is a caffeinated, tea-like beverage that is consumed for its "medicinal" properties. Its many health claims include energizing the body, stimulating mental alertness, strengthening the **immune system**, and aiding weight loss. Maté is consumed mainly in Argentina, Uruguay, Paraguay, and southern Brazil. It is brewed from the dried leaves and stemlets of the perennial tree *Ilex paraguarensis.* The *bombilla* is a special metal straw used to drink this brew.

Breakfast is normally a light meal with coffee or tea; bread with butter and jam; and sometimes fruit or fruit juice. Meat and cheese are usually eaten in Brazil and Chile. Lunch is traditionally a heavy meal, and it is followed by a *siesta* (nap), which helps one recover from both the food and the heat. The *siesta* is still common among many locals, but the tradition is disappearing from the business day. Appetizers such as fritters and turnovers may start the lunch meal, followed by grilled meat, rice, beans, cassava, and greens. Dinner is another heavy meal, and it often lasts several hours. Dinner usually begins late in the evening, sometimes as late as 9:00 P.M. Desserts are usually simple. Typical desserts are fresh or canned fruits with cheese, a custard called *flan*, and a milk cake called *tres leches.* Snacks are readily available from street vendors and bakeries. Popular snacks include turnovers filled with spicy meats, seafood, and vegetables; hot dogs; and steak or meat sandwiches.

Traditional Cooking Methods and Food Habits

The cuisine of South America varies from country to country and region to region. The cuisine tends to be a blend of cultural backgrounds, available foods, cooking styles, and the foods of colonial Europeans. Some regions have a largely maize-based **diet** (often spiced with chili peppers), while other regions have a rice-based diet. Grilled meats are popular. Traditionally, sides of beef, hogs, lamb, and goats are grilled slowly for hours. Another cooking method is to steam foods in a pit oven. For example, in Peru, a *pachamanca*

Coffee Comes to Brazil

Coffee was first brought to the Americas by French colonists in the early eighteenth century. According to legend, the emperor of Brazil dispatched Lieutenant Colonel Francisco de Mello Palheta to obtain seeds of the precious crop from the governor of French Guiana, sending him to the country under the pretext of mediating a border dispute. When the governor refused de Mello's request for seeds, the colonel turned his attentions to the governor's wife, who seems to have launched the entire Brazilian coffee industry by slipping him a few seedlings in a bouquet. Three hundred years later, Brazil produces one-third of the world's coffee.

—Paula Kepos

parasitic: feeding off another organism

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calorie: unit of food energy

malnutrition: chronic lack of sufficient nutrients to maintain health

anemia: low level of red blood cells in the blood

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

obesity: the condition of being overweight, according to established norms based on sex, age, and height

herbal: related to plants

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

diet: the total daily food intake, or the types of foods eaten

Some of the delicacies found on South American menus are toasted fire ants from Columbia, called *hormiga,* and these barbecued guinea pigs, or *cuy,* from Ecuador. *[Photograph by Owen Franken. Corbis. Reproduced by permission.]*

typically includes a young pig or goat (as well as chicken, guinea pig, tamales, potatoes, and corn) cooked under layers of hot stones, leaves, and herbs. Clambakes are popular in Chile.

Quinoa, the seed of the *Chenopodium*, or goosefoot plant, has been a staple food of millions of native inhabitants, but production declined for centuries after the Spanish conquest in the 1500s. It is used as a grain and substituted for grains because of its cooking characteristics. It became a minor crop due to its decline, and at times it has been grown only by peasants in remote areas for local consumption. In Peru, Chile and Bolivia, quinoa is widely cultivated for its nutritious seeds, which are used in creating various soups and bread, and it is also fermented with millet to make a beer-like beverage. A sweetened concoction of quinoa is used medicinally.

Regional Food Habits

Brazil. Brazilian foods have a heavy Portuguese, African, and native influence. The Portuguese contributed dried salt cod, *linguiça* (Portuguese sausage), spicy meat stews, and desserts such as corn and rice pudding. Africans brought to the area as slaves contributed okra, *dendê* oil (palm oil), and peppercorns. The national dish of Brazil is *feijoda completa*, which consists of black beans cooked with smoked meats and sausages served with rice, sliced oranges, boiled greens, and hot sauce. It is topped with toasted cassava meal. Coffee, rum, and beer are common beverages.

Colombia and Venezuela. Venezuelan and Colombian foods have Spanish influences. Many foods are cooked or served with olive oil, cheese, parsley, cilantro, garlic, and onions. Hot chile peppers are served on the side of most dishes. Local fruits and vegetables are abundant, and tropical fruits are often dried to make fruit leather. In Columbia, chicken stew and *sancocho* (a meat stew with starchy vegetables) are popular. One of the most unusual specialties of Columbia is *hormiga*, a dish made from fire ants. Toasted ants are also a favorite treat during the insect season in June. In Venezuela,

cornmeal bread, or *arepa*, is a staple food. *Arepa* is cooked on a griddle and is sometimes stuffed with meat or cheese before it is fried. *Pabellón caraqueño* is also popular. This dish consists of flank steak served on rice with black beans, topped with fried eggs and garnished with plantain chips. Coffee, rum, and beer are common beverages.

Argentina, Chile, Bolivia, Uruguay, and Paraguay. These southern countries are major beef producers. Argentineans eat more beef per capita than any other country in the world. Argentina is famous for *asados*, restaurants specializing in barbecued and grilled meat dishes—mainly beef, but also pork, lamb, and chicken. The national dish of Argentina is *matambre*, which is herb-seasoned flank steak rolled around a filling of spinach, whole hard-boiled eggs, and whole or sliced carrots. It is then tied with a string and either poached in broth or baked.

Citizens of these southern states enjoy hearty soups and stews daily. Fish soups and stews are popular in coastal Chile. Stews in Argentina often combine meats, vegetables, and fruits. The soups of Paraguay have heavy European influences and include *bori-bori*, which is a beef soup with cornmeal and cheese dumplings. Pizza, pasta, and meat dishes are popular in these countries. Wines from the midlands of Chile are considered to be some of the best produced on the continent.

Guyana, French Guiana, and Suriname. Guyanese cuisine is a culinary hybrid with African, East Indian, Portuguese, and Chinese influences. Guyanese usually cook three full meals every day. Rice and *roti* (flat bread) are **staples** at lunch and dinner. Fresh cow's milk may be part of the morning or evening meal. A favorite dish is *pepper pot*, a stew made with bitter cassava juice, meat, hot pepper, and seasoning. Other popular foods are *roti* and curry, garlic pork, cassava bread, chow mein, and "cook up," a one-pot meal that can include any favorite meats or vegetables. Popular homemade drinks are *mauby*, made from the bark of a tree, *sorrel*, made from a leafy vegetable used in salads, and ginger beer. People in French Guiana enjoy an international cuisine, as well as Chinese, Vietnamese, and Indonesian dishes. Imported soft drinks and alcoholic drinks are popular but expensive. Suriname's cuisine has heavy Javanese, Dutch, Creole, Chinese, and Hindustani influences. Beer and rum are popular alcoholic drinks.

staples: essential foods in the diet

Peru and Ecuador. The cuisine of Peru and Ecuador is typically divided into the highland foods of the Andes and the lowland dishes of the tropical coastal regions. The cuisine in the mountain areas is the most unique in South America, preserving many dishes of the Inca Indians. Potatoes are eaten at nearly every meal, including snacks. More than 200 varieties of potato can be found in the Lake Titicaca region. They range in color from purple to blue, and from yellow to brown. Size and texture vary as well—some are as small as nuts, while others can be as large as oranges. The foods of Peru and Ecuador feature an abundant use of chile peppers. *Salsa de ají*, a mixture of chopped chile, onion, and salt is served at most meals. The coastal region is famous for its *cerviches*, a method for preparing seafood in which the main ingredient is marinated in lime or sour orange.

The natural beauty of South America makes it a popular ecotourism destination. Food-borne and water-borne diseases are the number one cause of illness in travelers. Visitors are therefore advised to wash their hands

often and to drink only bottled or boiled water or carbonated drinks in cans or bottles. They also should avoid tap water, fountain drinks, and ice cubes. SEE ALSO CARIBBEAN ISLANDERS, DIET OF; CENTRAL AMERICANS AND MEXICANS, DIETS OF.

Delores C. S. James

Bibliography

Kittler, P. G., and Sucher, K. P. (2001). *Food and Culture*, 3rd edition. Stamford, CT: Wadsworth.

Internet Resources

U.S. Centers for Disease Control and Prevention. "Health Information for Travelers to Temperate South America." Available from <http://www.cdc.gov/travel/temsam.htm>

Hamre, Bonnie. "South America for Visitors." Available from <http://gosouthamerica.about.com/cs/cuisin1/>

Southern Europeans, Diet of

Italy, Spain, Portugal, Greece, and southern France make up the region known as southern Europe. Southern France is included because it is culturally similar to the rest of southern Europe. Greece is often grouped with eastern Europe; however, it is included here because Greek food has greatly influenced the cuisine of southern Europe.

Italy is a boot-shaped country that protrudes into the Mediterranean Sea. The Alps separate it from the rest of Europe. The island of Sicily is part of Italy and is famous for its cuisine. Spain lies to the west of France and occupies most of the Iberian peninsula. It is separated from France by the Pyrenees Mountains. The remainder of the peninsula is taken up by Portugal, which lies to the west of Spain. Portugal also includes the Azore and Madeira Islands, which are located in the Atlantic Ocean.

Influences on Traditional Foods

diet: the total daily food intake, or the types of foods eaten

The **diet** of southern Europeans differs from that of northern and eastern Europeans mainly due to the regions that influenced it. The ancient Greeks brought the olive tree to southern Europe, and Spain is now the world's largest producer of olives. Chickpeas and fish stew were also introduced by the Greeks. Different adaptations of this fish stew are now popular dishes in France (*boullabaisse*) and in Italy (*zuppa di pesce alla marinara*).

Muslim culture also played a role in the food traditions of southern Europe. Spices (in particular, saffron), oranges, lemons, rice, sugar cane, and several types of sweetmeats were brought to the area by Muslims. Spanish cuisine reflects Muslim tradition in its use of saffron-colored rice and the addition of nuts to sauces and desserts. The Italians often use a sweetened almond paste called *marzipan*, which came from the Muslims, in their desserts. Italians add saffron to their rice to create dishes such as *risotto alla Milanese*, popular in northern Italy.

Asia has also added to southern Europe's food traditions, mainly affecting the cuisine of Portugal. Spices (such as pepper and nutmeg) as well as fruits (such as mangoes and bananas) came from Asia. Lastly, the discovery

A Spanish celebration featuring *paella,* a rice and seafood dish served here in a giant *paellera.* Saffron, a spice from the Muslim countries to the south and east, gives the dish its yellow color. *[Photograph by Owen Franken. Corbis. Reproduced by permission.]*

of the Americas brought new fare to southern Europe, including vanilla, chocolate, pineapple, tomatoes, white potatoes, corn, turkey, and squash.

Similar foods are used across southern Europe. It is mainly the method of preparation and presentation that differs from country to country. Italian cuisine can generally be divided into that of northern and southern Italy. In the north, pasta is made with eggs and shaped in ribbons, while in the south, which is generally poorer, it is made without eggs and in hollow tubes, like macaroni. Northern dishes are served with cream sauces and stuffed with meats and cheeses, while southern dishes are served unstuffed with tomato sauce. People in the north use more meats, dairy, and rice than those in the south, which is known for its use of olive oil, vegetables, and little meat.

The Spanish include a lot of seafood in their diet. Meats are served alongside plenty of vegetables. Soups and stews are **staples** and are flavored with garlic and tomatoes. Red wine and crusty bread accompany each meal. Portuguese dishes are very similar to those of Spain, but generally include more spices.

staples: essential foods in the diet

Dietary Benefits, Deficits, and Changes

The International Conference on Nutrition (ICN) was convened in Rome in 1992 and established the food-based dietary guidelines (FBDG) for Europe. The purpose of the FBDG is to provide dietary guidance to the public. They are based on scientific knowledge, but are presented in a way that assists people in reaching nutritional goals. The southern European diet is fairly representative of these guidelines (see accompanying figure).

Southern Europeans experience less **heart disease**, stomach and lung cancers, **strokes**, **high blood pressure**, **diabetes**, and **obesity** than other Western nations. This lower rate of **chronic** disease has been attributed to diet. The diet of people in this area is similar to that recommended in the American Food Guide Pyramid. It differs mainly in the amount of meat and dairy consumed.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

Meals are based on grain products, such as rice, pasta, and bread. In addition, southern Europeans consume large amounts of fruits and vegetables, which provide plenty of **vitamins**, **minerals**, and **fiber**. Red meats, chicken, and eggs are used sparingly. Fish is popular and provides omega-3 **fatty acids**. A moderate intake of red wine also provides health benefits. Additionally, southern Europeans tend to lead a more relaxed, stress-free life. They often have a post-lunch siesta, which aids proper digestion. They also tend to be physically active.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

fiber: indigestible plant material which aids digestion by providing bulk

fatty acids: molecules rich in carbon and hydrogen; a component of fats

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

overweight: weight above the accepted norm based on height, sex, and age

Although the dietary habits described above are traditionally true, recent trends show that the southern European diet now also includes elements of the Western **fast-food** craze. A study by Eurostat, the European Commission's statistical branch, found that southern Europeans are getting fatter. Thirty-five percent of Greek males are **overweight**, as are 32 percent of Spanish males. Thirty-one percent of Greek and Portuguese women are overweight. Rates of high blood pressure, heart disease, and diabetes are increasing.

sedentary: not active

Southern Europeans have not abandoned their traditional foods; rather, they have added hamburgers and fries to them. In addition, **sedentary** jobs are on the rise, as fewer people are earning their money through manual labor. Governments of southern Europe don't have the finances to fight this trend. Michele Carruba of the Research Center on Obesity at the University of Milan says that "the advertising budget of Coke alone is more than Italy spends on food research."

Influences on the American Diet

The influence of the southern European diet can be seen in many dishes in the United States. Italian pasta dishes have become a mainstay. *Fettuccine Alfredo*, *lasagne Bolognese*, and *tortellini* can be found in many American restaurants. Soups like *pasta e fagiole* and cheeses like *gorgonzola*, *parmesan*, and *mozzarella* are popular. Many meals are accompanied by Italian wines, such as *chianti*, and crusty bread.

Dishes of Spain's southern region can be found in American cooking. Plenty of seafood and vegetables characterize these dishes (such as *paella*). Fruits and desserts such as rice pudding and *flan* are also popular in the United States. The influence of Portuguese foods is more subtle, but often characterized by exotic fruits. SEE ALSO CENTRAL EUROPEANS AND RUSSIANS, DIETS OF; FOOD GUIDE PYRAMID; NORTHERN EUROPEANS, DIET OF; SCANDINAVIANS, DIET OF.

Kirsten Herbes

Bibliography

Goyan Kittler, Pamela, and Sucher, Kathryn P. (2001). *Food and Culture.* Belmont, CA: Wadsworth.

Wardlaw, Gordon M. (1999). *Perspectives in Nutrition*, 4th edition. New York, NY: WCB/McGraw-Hill.

Internet Resources

British Heart Foundation (2000). "Diet: Mortality and Morbidity Attributable to Poor Diets." Available from <http://www.dphpc.ox.ac.uk/bhfhprg/>

"The Fat of the Land." *Time Europe.* 157(1). Available from <http://www.time.com/time/europe>

Food and Agricultural Organization of the United States. "Food-Based Dietary Guidelines." Available from <http://www.fao.org>

Oldways Preservation and Exchange Trust. "The Mediterranean Diet Pyramid." Available from <http://www.oldwayspt.org>

Peanut Institute. "Mediterranean Diet Found to be More Effective than Strict Low-fat Option." Available from <http://www.peanut-institue.org>

Soy

A member of the legume family, the soybean is rich in omega-3 **fatty acids**, **fiber**, folic acid, **calcium**, magnesium, potassium, and the **B vitamins** and is also **cholesterol** free and low in **saturated fat**. The **protein** in soybeans is complete, containing all the essential **amino acids** found in animal sources (4 ounces of **tofu** [soybean curd] contain the same amount and quality of protein as a similar-size hamburger). For individuals who want to include more plant-based protein in their **diet** and particularly for those on a vegetarian diet, soy products provide a way to add nonmeat protein to the diet.

Soy and Your Heart

Among the many benefits of soy are the potential for lowering one's risk of **heart disease**, **menopausal** bone loss, breast and **prostate cancer,** and **osteoporosis**. The results of a 1995 meta-analysis (combining results from separate but related studies) published in the *New England Journal of Medicine* found that consuming an average of 47 grams of soy protein a day, rather than animal protein, significantly decreased LDL cholesterol in people with moderately elevated or elevated cholesterol levels (low-density **lipoproteins** (LPLs) are the "bad" type of cholesterol and have been associated with clogged **arteries** and heart attacks). The study also found that high-density lipoprotein **HDL** cholesterol (the beneficial, or "good," cholesterol) was not affected by the consumption of soy protein.

Scientists suggest that soy protein and **isoflavones** are the active substances helping to keep blood vessels flexible and preventing deadly blood clots. Isoflavones are **phytochemicals** (naturally occurring compounds) found in plants, and they have potentially strong **biological** activity, meaning they exert a **physiological** effect, in the body. Phytochemicals give plants their color, flavor, and odor, and they have benefits to the body beyond basic **nutrition**. The U.S. Food and Drug Administration (FDA) has approved a health claim stating that consuming 25 grams of soy protein per day, along with a diet low in saturated fat and cholesterol, may reduce the risk for heart disease. The FDA also suggests that four servings of soy foods per day can lower LDL cholesterol by 10 percent. To use this claim, a food product must contain 6.25 grams of soy protein per serving. The claim does not include a recommendation for isoflavone level, which remains an issue of debate. The 25 gram recommendation applies to all ages.

Soy sources	Amount of soy protein
1 cup (8 ounces) soymilk	10 grams
4 ounces tofu	13 grams
1 soy burger	10–12 grams
1 soy protein bar	14–gram average
1 soy sausage link	6 grams
¼ cup roasted soy nuts	18–20 grams

fatty acids: molecules rich in carbon and hydrogen; a component of fats

fiber: indigestible plant material which aids digestion by providing bulk

calcium: mineral essential for bones and teeth

B vitamins: a group of vitamins important in cell energy processes

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

amino acid: building block of proteins, necessary dietary nutrient

tofu: soybean curd, similar in consistency to cottage cheese

diet: the total daily food intake, or the types of foods eaten

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

menopausal: related to menopause, the period during which women cease to ovulate and menstruate

prostate: male gland surrounding the urethra that contributes fluid to the semen

cancer: uncontrolled cell growth

osteoporosis: weakening of the bone structure

lipoprotein: blood protein that carries fats

artery: blood vessel that carries blood away from the heart toward the body tissues

HDL: high density lipoprotein, a blood protein that carries cholesterol

isoflavones: estrogen-like compounds in plants

phytochemical: chemical produced by plants

biological: related to living organisms

physiological: related to the biochemical processes of the body

nutrition: the maintenance of health through proper eating, or the study of same

Many of today's common diseases are not diseases of aging, but of **lifestyle**, and they can take twenty to thirty years to develop. Typically, when soy protein replaces animal protein, the consumption of saturated fat and cholesterol goes down. About 40 percent of the soybean's **calories** come from **fat**, with the majority (54 %) being unsaturated. The **polyunsaturated** fat in the soybean includes omega-3 fatty acids, which are not frequently found in plants.

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

calorie: unit of food energy

fat: type of food molecule rich in carbon and hydrogen, with high energy content

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

Soy and Cancer

Soybeans and soy foods in the diet may provide strong anticancer activity because they are natural sources of isoflavones. A specific isoflavone called genistein, which is found is soy, appears to help block tumor-cell growth. Current studies indicate that consuming soy may reduce the risk of developing prostate cancer, while isoflavone supplements may help physicians stabilize prostate cancer by decreasing the prostate-specific antigen (PSA) level used to measure how well the cancer is being controlled.

There has been much debate and disagreement about soy consumption and its role in breast cancer. Similar in chemical structure to **estrogen**, isoflavones are in fact, weak estrogens, and they may act as such in the body. **Hormone** replacement therapy (HRT) has been shown to increase breast density, a factor in breast-cancer risk (as breast density increases, so does the risk for breast cancer), while recent soy studies have found that soy use in both premenopausal and postmenopausal women did not affect breast density.

estrogen: hormone that helps control female development and menstruation

hormone: molecules produced by one set of cells that influence the function of another set of cells

Soy and Menopause

The popularity of soy-based foods is also due to their potential for reducing the symptoms of menopause. In a study published in *Obstetrics and Gynecology*, researchers found that women who consumed 60 grams of isolated soy protein daily reported a reduction in moderate to severe hot flashes. Other studies have contradicted this finding, however, Japanese women, who typically have a soy-rich diet, do experience a lower **incidence** of most postmenopausal symptoms than women in Western countries, including hot flashes, hormone-related cancers, and osteoporosis.

incidence: number of new cases reported each year

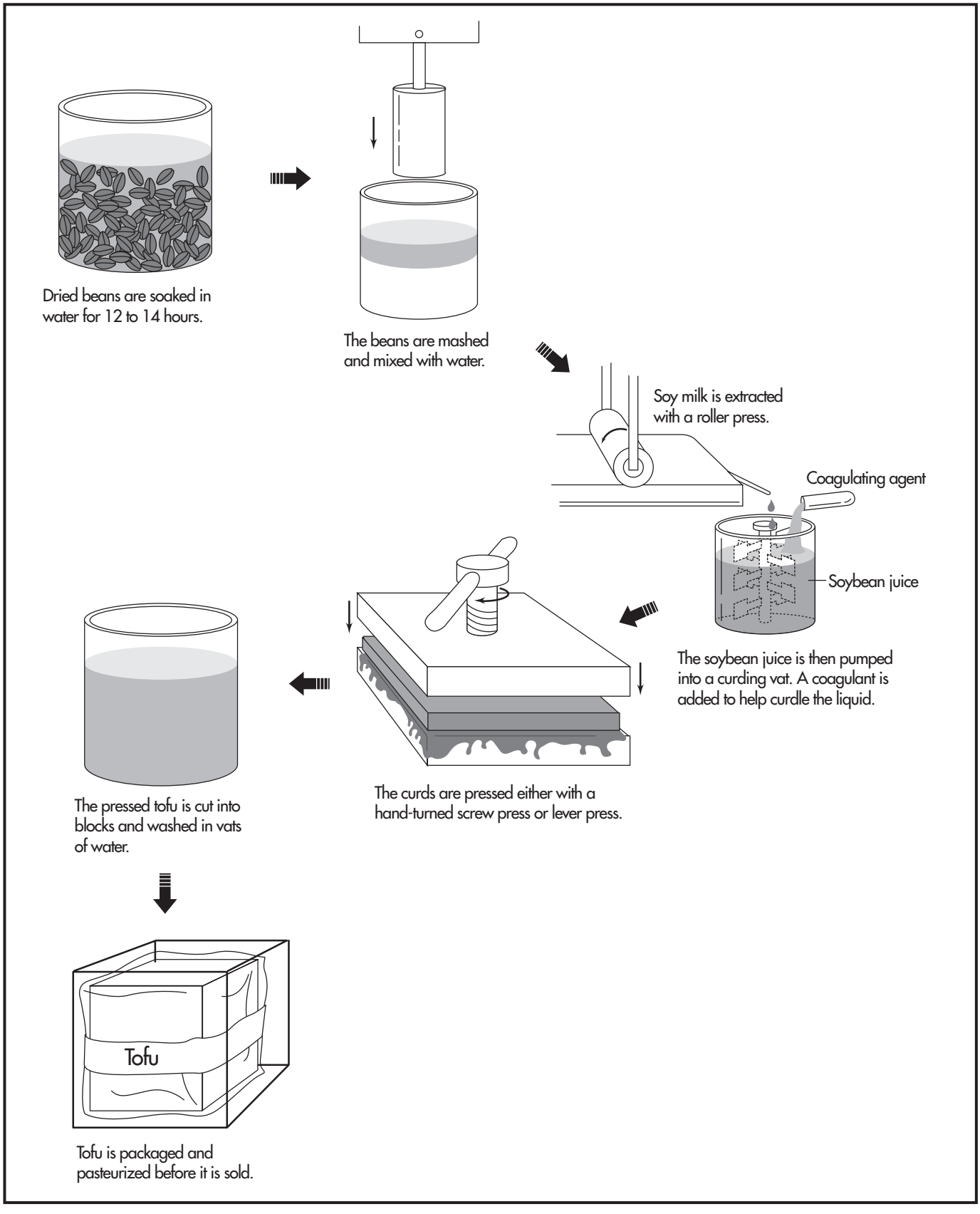
Soy and Osteoporosis

Another area with conflicting studies is the link between soy and osteoporosis. One method for determining your bone health and changes in bone density over time is calcium **metabolism** (a process where a substance, necessary for life, is synthesized or broken down). For bone density to increase, more calcium must be kept in the bones. This retention is measured by tests that look at calcium **absorption** versus calcium loss as measured in the urine. In studies that have compared a soy diet to a calcium/whey diet, calcium loss through the urine was much lower on the soy diet. Some researchers suggest that the amino-acid content of soy protein, as compared to that of animal protein, is the reason for less calcium loss in the urine.

metabolism: the sum total of reactions in a cell or an organism

absorption: uptake by the digestive tract

The versatile soybean remains a popular food choice, and adding soy to the diet is one component of a healthful eating program. Even the soybean



Soybeans are soaked, mashed, mixed with water, and then pressed to extract soy milk, which is curdled to make tofu. Combining 25 grams of soy protein per day with a low-fat diet can have significant health benefits. *[Hans & Cassidy. The Gale Group. Reproduced by permission.]*

pod itself, called edamame, is sometimes eaten as a snack food. SEE ALSO FUNCTIONAL FOODS; LEGUMES; MEAT ANALOGS; PLANT-BASED DIETS; VEGETARIANISM.

Susan Mitchell

Bibliography

Anderson, James W., et al. (1995). "Meta-Analysis of the Effects of Soy Protein Intake on Serum Lipids." *New England Journal of Medicine* 333:276–82.

Albertazzi P., et al. (1998). "The Effect of Dietary Soy Supplementation on Hot Flashes." *Obstetrics and Gynecology* 91:6–11.

Internet Resources

Messina, Mark (2002). "Symposium Highlights Significant Research On Soy and Human Health." *The Soy Connection*, Winter. Chesterfield, MO: United Soybean Board. Also available from <http://www.talksoy.com>

Stevens and Associates (2002). "The U.S. Soyfoods Directory." Available from <http://www.soyfoods.com>

United States Department of Agriculture, Agricultural Research Service (2002). "USDA-Iowa State University Database on the Isoflavone Content of Foods." Available from <http://www.nal.usda.gov/fnic/foodcomp/Data/isoflav/isoflav.html>

Space Travel and Nutrition

nutrition: the maintenance of health through proper eating, or the study of same

Nutrition has played a critical role throughout the history of exploration, and space exploration is no exception. While a one- to two-week flight aboard the Space Shuttle might be analogous to a camping trip, adequate nutrition is absolutely critical when spending several months aboard the International Space Station or several years on a mission to another planet. To ensure adequate nutrition, space-nutrition specialists must know how much of various individual **nutrients** astronauts need, and these nutrients must be available in the spaceflight food system. To complicate matters, spaceflight **nutritional requirements** are influenced by many of the **physiological** changes that occur during spaceflight.

nutrient: dietary substance necessary for health

nutritional requirements: the set of substances needed in the diet to maintain health

physiological: related to the biochemical processes of the body

environment: surroundings

Space Physiology

Spacecraft, the space **environment**, and weightlessness itself all impact human physiology. Clean air, drinkable water, and effective waste collection systems are required for maintaining a habitable environment. Without the Earth's atmosphere to protect them, astronauts are exposed to a much higher level of radiation than individuals on the Earth. Weightlessness impacts almost every system in the body, including those of the bones, muscles, heart and blood vessels, and nerves.

calcium: mineral essential for bones and teeth

kidney stones: deposits of solid material in kidney

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

intestines: the two long tubes that carry out much of the processes of digestion

absorption: uptake by the digestive tract

Bone.

Bone loss, especially in the legs, is significant during spaceflight. This is most important on flights longer than thirty days, because the amount of bone lost increases as the length of time in space increases. Weightlessness also increases excretion of **calcium** in the urine and the risk of forming **kidney stones**. Both of these conditions are related to bone loss.

Many nutrients are important for healthy bone, particularly calcium and **vitamin D**. When a food containing calcium is eaten, the calcium is absorbed by the **intestines** and goes into the bloodstream. **Absorption** of calcium from the intestines decreases during spaceflight. Even when astronauts take extra calcium as a supplement, they still lose bone.

On Earth, the body can produce vitamin D after the skin is exposed to the sun's ultraviolet light. In space, astronauts could receive too much ultraviolet light, so spacecraft are shielded to prevent this exposure. Because of this, all of the astronauts' vitamin D has to be provided by their **diet**. However, it is very common for vitamin D levels to decrease during spaceflight.

diet: the total daily food intake, or the types of foods eaten

Sodium intake is also a concern during spaceflight, because space diets tend to have relatively high amounts of sodium. Increased dietary sodium is associated with increased amounts of calcium in the urine and may relate to the increased risk of kidney stones. The potential effect of these and other nutrients on the maintenance of bone health during spaceflight highlights the importance of optimal dietary intake.

Bone is a living tissue, and is constantly being remodeled. This remodeling is achieved through breakdown of existing bone tissue (a process called resorption) and formation of new bone tissue. Chemicals in the blood and urine can be measured to determine the relative amounts of bone resorption and formation. During spaceflight, bone resorption increases significantly, and formation either remains unchanged or decreases slightly. The net effect of this imbalance is a loss of bone mass.

It is not clear whether bone mass lost in space is fully replaced after returning to Earth. It is also unclear whether the quality (or strength) of the replaced bone is the same as the bone that was there before a spaceflight. Preliminary data seem to show that some crew members do indeed regain their preflight bone mass, but this process takes about two or three times as long as their flight. The ability to understand and counteract weightlessness-induced bone loss remains a critical issue for astronaut health and safety.

The changes in bone during spaceflight are very similar to those seen in certain situations on the ground. There are similarities to **osteoporosis**, and even **paralysis**. While osteoporosis has many causes, the end result seems to be similar to spaceflight bone loss. Paralyzed individuals have **biochemical** changes very similar to those of astronauts. This is because in both cases the bones are not being used for support. In fact, one of the ways spaceflight bone loss is studied is to have people lie in bed for several weeks. Using this approach, scientists attempt to understand the mechanisms of bone loss and to test ways to counteract it. If they can find ways to successfully counteract spaceflight bone loss, doctors may be able to use similar methods to treat people with osteoporosis or paralysis.

osteoporosis: weakening of the bone structure

paralysis: inability to move

biochemical: related to chemical processes within cells

Muscle. Loss of body weight (mass) is a consistent finding throughout the history of spaceflight. Typically, these losses are small (1 percent to 5 percent of body mass), but they can reach 10 percent to 15 percent of preflight body mass. Although a 1 percent body-weight loss can be explained by loss of body water, most of the observed loss of body weight is accounted for by loss of muscle and adipose (**fat**) tissue. Weightlessness leads to loss of muscle mass and muscle volume, weakening muscle performance, especially in the legs. The loss is believed to be related to a **metabolic** stress associated with spaceflight. These findings are similar to those found in patients with serious diseases or trauma, such as burn patients.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

metabolic: related to processing of nutrients and building of necessary molecules within the cell

Exercise routines have not succeeded in maintaining muscle mass or strength of astronauts during spaceflight. Most of the exercises performed have been **aerobic** (e.g., treadmill, stationary bicycle). Use of resistance

aerobic: designed to maintain adequate oxygen in the bloodstream

exercise, in which a weight (or another person) provides resistance to exercise against, has been proposed to aid in the maintenance of both muscle and bone during flight. Ground-based studies (not done in space) of resistance exercise show that it may be helpful, not only for muscle but also for bone. Studies being conducted on the International Space Station are testing the effectiveness of this type of exercise for astronauts.

Blood. A decrease in the mass of red blood cells (i.e., the total amount of blood in the body) is also a consistent finding after short- and long-term spaceflight. The actual composition of the blood changes little, because the amount of fluid (blood **plasma**) decreases as well. The net result is that the total volume of blood in the circulatory system decreases. While this loss is significant (about 10 percent to 15 percent below preflight levels), it seems to be simply an adaptation to spaceflight, with no reported effect on body function during flight.

plasma: the fluid portion of the blood, distinct from the cellular portion

The initial loss of red blood cells seems to happen because newly synthesized cells (which are not needed in a smaller blood volume) are destroyed until a new steady state is reached. One consequence of the increased destruction of red blood cells is that the **iron** released when they are destroyed is processed for storage in the body. Too much iron may be harmful, and is thus a concern for long space missions.

iron: nutrient needed for red blood cell formation

Space Food Systems

Historically, space food systems have evolved as U.S. space programs have developed. The early Mercury program (1961–1963) included food packaged in bite-sized cubes, freeze-dried powders, and semiliquid foods (such as ham salad) stuffed into aluminum tubes.

The Gemini program (1965–1966) continued using bite-sized cubes, which were coated with plain gelatin to reduce crumbs that might clog the air-handling system. Freeze-dried foods were put into a special plastic container to make rehydrating easier.

The Apollo program (1968–1972) was the first to have hot water. This made rehydrating foods easier, and also improved taste and quality. Apollo astronauts were the first crew members to use the *spoonbowl*, a utensil that eliminated having to consume food into the mouth directly from the package.

The quality, taste, and variety of foods improved even more during the Skylab program (1973–1974), the only program to have refrigerators and freezers for storage of fresh foods. The menu contained seventy-two different food items.

The Shuttle program, which began in 1981, includes food prepared on Earth from grocery store shelves. With the help of a dietitian, crew members plan individual three-meal-per-day menus that contain a balanced supply of the nutrients needed for living and working in space. Crew members are allowed to add a few of their own personal favorite foods (which may require special packaging to withstand the rigors of spaceflight). Freeze-dried foods are rehydrated using water that is generated by the Shuttle's fuel cells. Foods are eaten right from the package (on individual food trays), or they may be heated in a convection oven in the Shuttle galley.

Astronauts on the International Space Station prepare to share a meal. The quality of their menu contrasts sharply with those of the early space explorers, whose meals were either semi-liquids—squeezed from a tube—or bite-sized cubes. *[NASA. Reproduced by permission.]*

During the Shuttle-Mir program (1995–1998), a joint menu was used that contained half Russian and half U.S. Shuttle foods. These had to meet the nutritional needs established by technical committees representing both space programs. The Russian four-meal-per-day menu was used, with each space program providing two of the meals. Three larger meals were designed to be eaten as scheduled meals; the fourth meal was composed of foods that could be eaten at any time throughout the day.

A Space Shuttle meal tray includes scissors to cut open food packages and Velcro to hold them in place. The tray itself is secured to the wall or to an astronaut's lap to keep it from drifting away. *[NASA. Reproduced by permission.]*

The current food system for the International Space Station, which started in 2000, is similar to the system used in the Shuttle-Mir program. The four-meal-per-day menu plan is used, with equal provision of foods by the U.S. and Russian space programs. The menu is composed mainly of packaged foods that are freeze-dried and thermostabilized (canned), with very few fresh foods. The crew members plan their own menus with the assistance of a dietitian, and an effort is made to include all of the nutrients needed for working in the space environment. After the habitation module galley is equipped with refrigerators, freezers, and a microwave-convection oven, a more extensive menu, including a variety of fresh foods, will be available.

Dietary Intake during Spaceflight

Dietary intake has been monitored on select Apollo, Skylab, Shuttle, and Shuttle-Mir flights as a part of scientific studies. Preflight and postflight intakes are determined using conventional methods for **dietary assessment**. Crew members are provided a diet-record logbook and digital scale, or the foods are weighed by the research dietitian and provided during each of the five- to eighteen-day data collection sessions. A variety of nutrient-analysis software programs are used. Crew members record their intake during spaceflight by writing it in a log or, more frequently, they use a barcode reader that scans the food package label and then record the amount consumed. The amounts of certain nutrients in each meal are calculated from the record of how much of each type of food was eaten, plus knowledge of the amount of each nutrient in each type of food. Nutrient calculations using chemical analysis data for each spaceflight food item are performed after the flight. On the International Space Station, crew members complete a food-frequency questionnaire each week, and the data is down-linked for analysis. Dietary intake can thus be assessed in real time. Changes in diet may then be suggested to the crew members to prevent nutrient deficiencies.

dietary assessment: analysis of nutrients in the diet

A primary concern is that astronauts consume enough **energy** (**calories**) for optimal work performance and good health. Of the flight crews that have been monitored, only the Skylab crew members consumed enough energy—99 percent of their predicted intake. Most of the crew members in other flight programs consumed about 70 percent of what was planned. On the Skylab flights, much time and attention was given to eating and food preparation, and the crew members' extensive exercise program may have stimulated their appetite. On all other flights, the crew members have had a very busy schedule, with little time and attention devoted to eating.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

calorie: unit of food energy

Crew members' dietary intakes on Skylab, Shuttle, and Shuttle-Mir flights have tended to be higher in **carbohydrate** and lower in fat than their preflight intakes. This change may have been related to an abundance of foods high in carbohydrates, especially sugar-sweetened beverages, or perhaps these items are more easily prepared during a busy work schedule. Ample fat sources are available in the Shuttle food inventory—more than half of the main dish items contain greater than 30 percent of their calories as fat.

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

Intake of fluid should be about 2,000 milliliters (2 liters) per day, which is sufficient to prevent **dehydration** and kidney stone formation. Fluid intakes have varied from 1,000 to 4,000 milliliters per day, indicating that some crew members are getting less than the recommended amount.

dehydration: loss of water

Inflight sodium intakes of all crew members have exceeded the recommendation of less than 3,500 milligrams per day. Sodium intake is high because many of the "off-the-shelf" food items used have a high sodium content.

Calcium intakes have been below the recommended range of 1,000 to 1,200 milligrams per day. This level is estimated to minimize the bone mineral loss that occurs during spaceflight.

Iron intakes have been 50 to 60 percent greater than the recommendation of ten milligrams per day. As with sodium, iron intakes are high because the food items have already been iron-fortified. Too much iron in the body may cause tissue damage.

Nutrition is critical for health, both on Earth and during spaceflight. Specific nutrition concerns for spaceflight include adequate consumption of calories for energy, adequate fluid intake to prevent dehydration and renal stones, adequate calcium to minimize bone loss.

There seems to be an excess of both sodium and iron in the inflight diet, compared to predicted requirements. A food delivery system needs to be designed to include foods that will provide nutrients at the recommended levels, while providing variety and palatability to make eating more pleasant.

The International Space Station represents the beginning of an era of humans living and working in space, with the potential for a permanent human presence in space. Nutrition will play a vital role in ensuring the health and safety of spacefaring individuals, whether they are in low Earth orbit or on journeys to the moon, Mars, or beyond. A more complete understanding of the effects of spaceflight will not only help humans to explore the universe, but will provide information needed to maintain human health and treat diseases here on Earth. SEE ALSO NUTRITIONAL DEFICIENCY; OSTEOPOROSIS.

Scott M. Smith
Barbara L. Rice

Bibliography

Bourland, Charles T. (1998). "Advances in Food Systems for Space Flight." *Life Support and Biosphere Science* 5:71–77.

Lane, Helen W., and Smith, Scott M. (1998). "Nutrition in Space." In *Modern Nutrition in Health and Disease*, 9th edition, eds. M. E. Shils, J. A. Olson, M. Shike, and A. C. Ross. Baltimore: Williams & Wilkins.

Smith, Scott M.; Davis-Street, Janis E.; Rice, Barbara L.; Nillen, Jeannie L; Gillman, Patricia L.; and Block, Gladys (2001). "Nutritional Status Assessment in Semi-Closed Environments: Ground-Based and Space Flight Studies in Humans." *Journal of Nutrition* 131:2053–2061.

Smith, Scott M., and Lane, Helen W. (1999). "Gravity and Space Flight: Effects on Nutritional Status." *Current Opinion in Clinical Nutrition and Metabolic Care* 2:335–338.

Smith, Scott M., and Lane, Helen W. "Nutritional Support." In *Principles of Clinical Medicine for Space Flight*, ed. Michael R. Barratt and Sam L. Pool. New York: Springer-Verlag (2002).

Sports Nutrition

Aside from training, **nutrition** is the most important influence on sports performance. To reach one's highest potential, all of the body's systems

nutrition: the maintenance of health through proper eating, or the study of same

must be working optimally. The best way to achieve this is to eat a variety of nutritious foods. **Calories**, **carbohydrate**, **protein**, **fat**, **vitamins**, **minerals**, and fluids all play a unique and crucial role.

calorie: unit of food energy

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

fat: type of food molecule rich in carbon and hydrogen, with high energy content

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

Calories

To have enough **energy** for exercise (and for life), an adequate number of calories must be consumed. The amount of calories needed depends on many different factors, such as age, sex, height, weight, muscle mass, and fat mass. Too few calories can negatively affect workouts and energy levels, as well as cause the breakdown of muscle and bone, increasing the risk of injury.

It is important to nourish the body after several hours with no food (such as during sleep), so breakfast is an important part of adequate calorie intake. Choosing high-nutrient foods—such as **fortified** cereals with milk, peanut butter with whole grain bread, yogurt, cheese, or fruit—gives the body the right fuel to start the day. Nutritious meals and snacks can also help the body stays fueled throughout the day.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

fortified: altered by addition of vitamins or minerals

Carbohydrates

Carbohydrates are the body's main energy source for all types of exercise. Carbohydrate is stored as **glycogen** in the body, and the amount of glycogen stored in the body affects stamina and endurance. When muscle cells run out of glycogen, **fatigue** sets in and performance will suffer, though the effects will vary among different sports. Training and eating properly, with particular attention to carbohydrates, can increase and maintain glycogen stores, which is particularly important for endurance athletes.

glycogen: storage form of sugar

fatigue: tiredness

A large part of an athlete's **diet** should be carbohydrate. Foods high in carbohydrate include pasta, rice, cereals, starchy vegetables (e.g., potatoes, carrots, corn, sweet potatoes), fruit, and bread. Not all carbohydrates are equal in providing needed nutrients, however. Focusing on carbohydrate from whole grains, fruits, and vegetables will make sure vitamins, minerals, **fiber**, and other important nutrients are part of one's diet, while filling up on too many sweets and **processed foods** can negatively impact sports performance.

diet: the total daily food intake, or the types of foods eaten

fiber: indigestible plant material which aids digestion by providing bulk

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

Protein

Protein is essential to build and repair muscle tissue. Protein allows muscles to contract, gain in size, and increase in strength. Loading up on protein does not guarantee larger muscles. Protein in excess of the body's needs is stored as fat, not protein. Muscle growth comes from hard work, proper training, and balanced nutrition. Food sources of protein include lean meat and poultry (fish and chicken), fish, **legumes** (dried beans and peas), nuts, seeds, and dairy products. Protein needs for active athletes, especially endurance sports, are higher than for non-athletes. The maximum recommended amounts of protein is 1.2 to 1.4 g/kg of body weight. This requirement can be met through diet alone.

legumes: beans, peas and related plants

Fat provides energy, protects the body's organs and helps with the **absorption** of some vitamins. When fats are eaten as part of healthful foods, they provide an important energy source for athletes in training. Good choices include the fats from nuts, seeds, vegetable oils (canola, olive, peanut), and avocados.

absorption: uptake by the digestive tract

When the body is dehydrated, blood circulation decreases and the muscles do not receive enough oxygen for maximum performance. Thirst is an indication that dehydration has already occurred, so it is important to drink frequently during exercise, before thirst sets in. Here, Sean "P. Diddy" Combs drinks from a water bottle during the 2003 New York City Marathon. *[Photograph by Richard Cohen. Corbis. Reproduced by permission.]*

Vitamins and Minerals

All vitamins and minerals are important. Two that deserve special attention from athletes are **iron** and **calcium**. Iron is important to carry **oxygen** in blood, and it plays a key role in sports performance. The best sources of iron are lean red meats, shrimp, iron-fortified cereals, and bread products.

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

oxygen: O_2, atmospheric gas required by all animals

Calcium keeps bones strong. Foods from the dairy group, including milk, yogurt, and cheese are excellent sources of calcium. Non-dairy sources of calcium include dark leafy green vegetables, but the calcium may not be absorbed as well. There are also many calcium-fortified juices and foods that can help boost calcium intake. In addition, weight-bearing exercises increase bone density. Calcium needs for female teenage athletes is 1300 mg daily.

Fluids

Water is critical to all body functions and makes up about 60 percent of a person's body weight. Water helps move nutrients throughout the body and helps remove waste from the body. Replacing the fluids lost during exercise is essential to sustaining performance, preventing **dehydration**, and avoiding injury. Even mild dehydration can cause muscle and body fatigue, which will reduce athletic performance. Since thirst is not always a reliable indicator of fluid loss, athletes should drink fluids before they get really thirsty.

dehydration: loss of water

Eight to ten cups a water a day is the recommended daily intake for most people. However, extra fluids are needed by athletes to replenish what is lost during exercise. Drinks with caffeine or alcohol should be avoided, as they are dehydrating. Exercising in extreme heat increases fluid needs even more, since more is lost through sweat. Taking in too much water can be just as dangerous as not taking in enough. Athletes should experiment with different fluid intakes to determine the best amounts for optimal performance.

Sports drinks can be helpful, especially for events lasting sixty minutes or longer. In addition to fluid, they provide the advantage of quick replacement of carbohydrate and minerals and also replace **electrolytes** lost

electrolyte: salt dissolved in fluid

FLUID INTAKE GUIDELINES

Time in reference to event	Ounces of fluid (oz.)
24 hours before	Drink freely
2 hours before	8–16 oz.
15 minutes before	8–16 oz.
During	4 to 8 oz. every 15–20 minutes
After	Drink freely

in sweat. Another advantage is taste. Athletes may be more likely to drink more fluid if the beverage has a desirable flavor. The ideal carbohydrate solution is 4 to 8 percent carbohydrate, which is typically found in sports drinks.

Sports Supplements

Sports supplements are advertised widely and promise increased power and strength, improved athletic performance, and better overall health. However, in addition to being potentially dangerous, they can be extremely expensive.

The majority of supplements have not been researched thoroughly, especially on teenage athletes. In addition, long-term studies on safety are not extensively available. Stimulating herbs such as guarana and yohimbine can cause **anxiety** and dizziness. One dangerous example is ephedra, which can have adverse effects such as nervousness, irregular heartbeat, and can be deadly in some cases. Creatine supplements may negatively affect kidney function and promote dehydration. **Amino acid** and protein supplements, while not dangerous, are an unnecessary expense when diet alone can meet protein needs. No supplement is the world can take the place of hard training and proper nutrition, and food should be the first priority in an athlete's nutrition program.

anxiety: nervousness

amino acid: building block of proteins, necessary dietary nutrient

The Timing of Meals

The importance of what foods are eaten is matched only by when they're eaten. Proper nutrition is important not just on the day of competition, but on a daily basis. Eating a meal or snack an hour or so before athletic activity will provide energy without having a full stomach. It is also important to replenish the body's stores after athletic activity. A meal or snack within one hour of activity will assure this. Carbohydrates should be the main focus, along with protein in smaller amounts.

Female Athlete Triad

In females, three associated medical conditions form the female athlete triad: disordered eating, **amenorrhea** (suppression of the menstrual cycle), and **osteoporosis** (weakening of the bones). A female athlete can have one, two, or all of these conditions.

Disordered eating is a medical term that includes a broad spectrum of eating disorders. Girls may feel pressured to "lose a few pounds" to increase performance. The intentions may be good at the start, but it can escalate to serious health problems. Heavy exercise and low calorie intake can cause a drop in **estrogen** (a **hormone**), which has a protective effect on bone. Low-

amenorrhea: lack of menstruation

osteoporosis: weakening of the bone structure

estrogen: hormone that helps control female development and menstruation

hormone: molecules produced by one set of cells that influence the function of another set of cells

ered estrogen can also lead to irregular menstrual periods, or to the complete cessation of periods. Amenorrhea is not a normal response to high levels of physical activity, but a sign of serious potential problems.

With lowered estrogen levels, the female athlete can experience bone loss similar to that seen in **menopause**. Unfortunately, the lost bone is never replaced. This has both short- and long-term consequences on bone health. The increased risk of bone damage, for example, can lead to **stress** fractures and osteoporosis.

menopause: phase in a woman's life during which ovulation and menstruation end

stress: heightened state of nervousness or unease

Athletes spend many hours training so their body can perform at its best. It is important that proper nutrition also be a focus so the hours aren't spent in vain. An adequately nourished body provides the proper fuel to maximize athletic effort. SEE ALSO DEHYDRATION; ERGOGENIC AIDS; FEMALE ATHLETE TRIAD.

Kim Schenck

Bibliography

American Dietetic Association (2000). "Nutrition and Athletic Performance: Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine." *Journal of American Dietetic Association* 100:1543–1566.

Clark, Nancy (2003). *Nancy Clark's Sports Nutrition Guidebook*. Champaign, IL: Human Kinetics.

Coleman, Ellen (2003). *Eating for Endurance.* Boulder, CO: Bull Publishing.

Sizer, Frances, and Whitney, Eleanor (2003). *Nutrition Concepts and Controversies*. Belmont, CA: Wadsworth/Thomson Learning.

Internet Resources

University of Illinois Extension. "Sports and Nutrition: The Winning Connection." Available from <http://www.urbanext.uiuc.edu/hsnut>

Stark, William

British physician
1747–1770

William Stark (1741–1770) was born in Birmingham, England, of Scottish parentage. He obtained his medical degree at Leiden, Netherlands, in 1769. Upon returning to London in June 1769, Stark began a series of dietary studies in which he was his own subject. At the start of his twenty-four experiments, he described himself as being a healthy, six-foot tall young man.

These experiments were performed in an effort to prove that a "pleasant and varied **diet**" was as healthful as simpler strict diets. Stark kept accurate measures of temperature and weather conditions, the weights of all food and water he consumed, and the weight of all daily excretions. Stark also recorded how he felt on a daily basis.

diet: the total daily food intake, or the types of foods eaten

In his first experiment, Stark ate bread and water with a little sugar for thirty-one days. This experiment left Stark dull and listless. He consumed a more varied diet for a few weeks. When he felt better, however, the experiments resumed. Gradually, he added other foods to this regimen, one at a time. He added olive oil, milk, roast goose, boiled beef, **fat**, figs, and veal. After the first two months, his gums were red and swollen, and they bled when pressure was put on them. This was a symptom of **scurvy**, a disease

fat: type of food molecule rich in carbon and hydrogen, with high energy content

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

William Stark's self-sacrificing dietary research ended in his death from scurvy, a disease caused by vitamin C deficiency. Had he heeded the recent discoveries of James Lind, pictured here giving lemons to sailors, Stark would have known to include citrus fruits in his experimental diet. *[© Bettman/Corbis. Reproduced by permission.]*

caused by a lack of vitamin C that was fairly common at the time. By November, he was living on nothing but pudding, except for a pint of black currants in celebration of Boxing Day (the day after Christmas). Stark did consider testing the effects that fresh fruits and vegetables would have on his health, but decided instead on honey puddings and Cheshire cheese.

After eight months of experimenting, Stark died on February 23, 1770, at the age of twenty-nine. He did not discover anything new about scurvy, but, through his experiments and record-keeping skills, he showed to what extent human scurvy is caused by a lack of vitamin C in the diet. Stark showed that simple diets that do not include fruits and vegetables are not conducive to health. He thus showed the value of a pleasant and varied diet by clearly demonstrating the consequences of a dietary regime lacking variety. James Carmichael Smyth published Stark's experiments eighteen years after his death. SEE ALSO SCURVY.

Slande Celeste

Bibliography

Saunders, Alan. "Martyrs of Nutrition." Australian Broadcasting Corporation. Available from <http://www.abc.net.au/science/sweek/bites/comfy.htm>

Vanderbilt University Medical Center. "Scurvy and Vitamin C." Available from <http://www.mc.vanderbilt.edu>

Sustainable Food Systems

A *food system* is a process that aims to create a more direct link between the producers (farmers) of food and **fiber** and the consumers of the food. This system consists of several components, including production, processing, distribution, consumption, and waste disposal.

fiber: indigestible plant material which aids digestion by providing bulk

A food system can be characterized as being local, regional, national, or global. The word *sustainable* is often associated with the sustainable agriculture movement, which had its beginnings in North America in the 1980s. This period was characterized by a wave of bank foreclosures of farm oper-

ations, particularly small and family-owned farms. Many were unable to compete with the large national and international farming corporations and were forced to sell their farms and go out of business. **Globalization**, through international trade agreements, were also viewed by some in the agriculture community as another reason for the demise of many small and family-owned farms.

globalization: development of world-wide economic system

Misuse and overuse of chemical fertilizers and pesticides contributed heavily to the degradation of many farms and waterways throughout the United States, Canada, and other developing countries. Out of this "farm crisis" came national and international institutions and organizations of concerned citizens, producers, community organizations, and environmental groups. They agitated for the creation of policies and laws that supported new environmentally safe approaches to producing food and fiber and that would ensure the livelihood of farmers and vibrant rural communities. Thus, a sustainable food system is a system that sustains people as well as the land.

Why Are Sustainable Food Systems Important?

A sustainable food system, whether it is local or regional, brings farmers closer to consumers by producing fruits and vegetables or raising livestock or fish closer to the places they are sold. Advocates of this system believe that when it comes to food security, the closer producers are to homes and neighborhoods, the greater the access to more nutritious and affordable food.

Globally, crop production is a highly intensive operation in both inputs and **energy** consumption. Of the 10 to 20 percent of the fossil-fuel energy that is used by agricultural operations, 40 percent is indirect energy used in the development of chemical pesticides and fertilizers. There is thus a need to work with natural processes to conserve all resources, minimize waste, and lessen the impact on the **environment**. In theory, this usually means limited use of synthetic fertilizers, pesticides, growth regulators, and livestock feed additives. Instead, it means more reliance on methods such as crop rotations, animal manures, **legumes**, mechanical cultivation, mineral-bearing rocks to maintain soil fertility and productivity; and on natural, cultural, and **biological** controls to manage insects, weeds, and other pests. The emphasis is on prevention of problems and the use of curative interventions, such as pesticides, as last resorts.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

environment: surroundings

legumes: beans, peas and related plants

biological: related to living organisms

Urban growth and infrastructure development has reduced the amount of prime agricultural land. The United States, for example, loses two acres of farmland every minute to urban growth between 1992 and 1997. According to the United Nations projections, 4.9 billion people or 60 percent of the world population will be living in urban areas by 2030. It is not clear how this population can be adequately fed and nourished. Increasing population also means increased quantities of food to be distributed, which increases the amount of trucks used to transport the food, thereby contributing to traffic congestion and air pollution.

Promoting Sustainable Local Food Systems

Consumers around the world can make a difference by choosing to vote with their dollars to support local and regional food systems. There are a

Sustainable agriculture is a method of farming that minimizes environmental damage and depletion of resources. To be successful, sustainable agriculture requires a commitment from food producers as well as food consumers. *[JLM Visuals. Reproduced by permission.]*

number of ways that individuals can support and help to sustain food systems in their area.

Farmers markets. Buying fresh food from local farmers markets supports family farms and circulates money within the community. Organic foods should be purchased, if possible, since they are grown with little or no artificial pesticides or fertilizers.

Community and school gardens. These gardens provide fresh produce, particularly for underserved populations in low-income and poverty-stricken neighborhoods. This increases the dietary quality and ensures a measure of food security.

Community-supported agriculture (CSA). In this type of arrangement, individuals buy shares the harvest of a farm before the crops are planted. In return, individuals receive fresh fruits and vegetables and sometimes local meats, cheeses, flowers, and eggs, on a weekly or prearranged basis.

Pick-your-own farms (U-Pick-It) and roadside stands. At some rural farms, consumers are allowed to pick their own fresh fruits and vegetables. This can serve as a social outing for urban families who drive to rural roadside stands.

These practices help consumers choose foods grown using agricultural practices that keep water sources clean, support healthy soil, and encourage wildlife conservation. A healthy and successful food system emphasizes support for local sources of food production and processing, encourages and supports environmental responsibility, and provides economic stability all within the context of a local or regional area. Sustainable food systems also encompass and emphasize such larger issues as stable farm families, food security and access, community self-reliance, and even entrepreneurship. Sustainable food systems provide hope for a sustainable future. SEE ALSO FAMINE; FOOD INSECURITY; ORGANIC FOODS; PESTICIDES.

Carlos Robles

Internet Resources

American Farmland Trust. "Farming on the Edge: Sprawling Development Threatens Americas Best Farmland." Available from <http://www.farmland.org/farmingontheedge>

Deumling, D.; Wackernagel, M.; and Monfreda C. "Eating Up the Earth: How Sustainable Food Systems Shrink Our Ecological Footprint." *Agriculture Footprint Brief*, July 2003. Available from <http://www.RedefiningProgress.org>

Food and Agricultural Organization (FAO) of the United Nations. *Studying Food Supply and Distribution Systems to Cities in Developing Countries and Countries in Transition: Methodological and Operational Guide*, revised edition. Available from <http://www.fao.org>

Wilkins, J. "Community Food Systems: Linking Food, Nutrition, and Agriculture." Cornell Cooperative Extension, Food and Nutrition Available from <http://www.cce.cornell.edu/food>

Toxemia

Toxemia is the presence of abnormal substances in the blood, but the term is also used in reference to a condition in pregnancy also known as *preeclampsia*. This refers to pregnancy-induced hypertension (**high blood pressure**) and any possible accompanying symptoms, such as quick or sudden weight gain, water retention, and excessive swelling of the feet, hands, and face. The condition is most common among first pregnancies, with multiple births (e.g., twins), in younger or older women, and in women who had preeclampsia in previous pregnancies. It generally occurs near the due date, but it can also occur earlier in pregnancy. When monitoring a female with toxemia, the **blood pressure** and urine **protein** are checked often and bed rest may be prescribed. Toxemia can be mild or severe. When severe, it is dangerous for both the pregnant female and her child, especially if the mother's blood pressure gets too high. SEE ALSO PREGNANCY.

Judith C. Rodriguez

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Bibliography

Sizer, Frances, and Whitney, Eleanor (2003). *Nutrition Concepts and Controversies*, 9th edition. Belmont, CA: Thomson.

Internet Resources

Hill, D. Ashley. "Issues and Procedures in Women's Health: Pre-eclampsia." Available from http://www.obgyn.net

Tulp, Nicolaas

Dutch physician
1593–1674

The Dutch physician Nicolaas Tulp was born on October 11, 1593, in Amsterdam, Holland, the fourth child of a prominent merchant family. He was originally named Claes (Nicolas) Pieterz, but he later adopted the name Tulp, meaning "tulip." Tulp attended Leiden University in Holland, receiving his medical degree in 1614. He then returned to Amsterdam, opening a practice in surgery and general medicine. In 1628, Tulp was appointed as a lecturer of the Suregon's Guild, a position he held until 1652. His duties were to lecture in anatomy and surgery, to apprentice surgeons, and to

Rembrandt's "The Anatomy Lecture of Dr. Nicolaes Tulp." Dr. Tulp was a lecturer for the Amsterdam Surgeon's Guild, and among his duties was the presentation of public dissections. *[© Francis G. Mayer/Corbis. Reproduced by permission.]*

deliver public dissections. The most famous of these, held on January 31, 1632, was depicted by the artist Rembrandt in his famous painting "The Anatomy Lesson of Dr. Tulp," now in Holland's Mauritshuis museum.

Tulp's best-known medical work, published in Latin in 1641, is titled *Observationes Medicae*. Tulp believed that all medical publications should be published in Latin, which the public could not read, to prevent people from treating their own illnesses. In his book, Tulp summarized his own cases and observations, including his description of beriberi, a disease caused by vitamin B1 (thiamine) deficiency. This is one of the first known descriptions of beriberi. Tulp had treated a Dutchman who was brought back to Holland from the East Indies, suffering from what the natives of the Indies called beriberi or "the lameness." Although Tulp described beriberi in detail, he was unaware that it was caused by a dietary deficiency. It was more than two hundred years later that Dutch physicians discovered the cause of beriberi. Tulp also described the ileocecal valve at the junction of the large and small **intestines**, still known as Tulp's valve.

intestines: the two long tubes that carry out the bulk of the processes of digestion

During the plague epidemic of 1635, Tulp supported quarantine as a means to control the spread of the disease. At the same time, Tulp suggested that local pharmacists be placed under municipal control, because he viewed them as inefficient. This resulted in the formation of the first local medical authority in Holland. Another result of Tulp's concern was the publication of the first Dutch pharmacopoeia, a book describing **drugs**, chemicals, and medicinal preparations.

drugs: substances whose administration causes a significant change in the body's function

In addition to his scientific endeavors, Tulp was an active public servant. He served four times as mayor of Amsterdam, was treasurer of the city for twenty-seven years, and was elected several times as a city councilor. Tulp also served as a judge, trustee of the city orphanage, and curator of two local schools. Tulp was married to Aagfe Van der Vogh in 1617; unfortunately,

she died in 1628. Tulp died in the The Hague in 1674, at the age of eighty-one. SEE ALSO BERIBERI.

Karen Bryla

Bibliography

Gillispie, Charles Coulston, ed. (1976). *Dictionary of Scientific Biography.* Vol. XIII. New York: Scribners.

Spencer, Frank, ed. (1997). *History of Physical Anthropology: An Encyclopedia*, Vol. 2. New York: Garland.

Todhunter, E. Neige (1967). "Biographical Notes from the History of Nutrition." *Journal of the American Dietetic Association* 50:200.

Underweight

U

A person is considered underweight if his or her **body mass index** (BMI) falls below a certain threshold (body mass index is a measure determined by a person's age, height, and weight). For infants and children, a BMI below the 10th percentile for a specific age indicates an individual who is underweight. For adults, a BMI below 19.1 for females and 20.7 for males is considered underweight. A BMI of 17.5 indicates an individual is very underweight.

Individuals who are underweight are at high risk for **malnutrition**. Being underweight can affect growth and **development**, and it can cause infertility or delayed menstruation. It can also result in **fatigue**, irritability, and a lack of concentration, as well as impairing the body's ability to **thermoregulate** itself. Due to a decreased immune response, underweight individuals are less resistant to infections and disease.

It is recommended that underweight individuals gain one pound per week until an appropriate weight is reached. This can be accomplished by consistently (daily) increasing one's intake of calorically denser foods (i.e., nuts instead of pretzels), eating more frequently, and drinking fluids between meals rather than with meals. SEE ALSO BODY MASS INDEX; MALNUTRITION; NUTRITIONAL DEFICIENCY; WEIGHT MANAGEMENT.

body mass index: weight in kilograms divided by square of the height in meters; a measure of body fat

malnutrition: chronic lack of sufficient nutrients to maintain health

development: the process of change by which an organism becomes more complex

fatigue: tiredness

thermogregulate: regulate temperature

Leslie Bonci

Bibliography

Duyff, Roberta L. (1996). *The American Dietetic Association's Complete Food and Nutrition Guide.* Minneapolis, MN: Chronimed.

Internet Resources

American Dietetic Association. Available from <http://www.eatright.org>

United Nations Children's Fund (UNICEF)

The United Nations International Children's Emergency Fund (UNICEF) was created in 1946. It was renamed the United Nations Children's Fund in 1953, when the fund's focus changed from emergency aid to on going support of children's needs. The acronym UNICEF was retained, however. With eight regional offices and 125 country offices, UNICEF strives to create a world where all children share in the joy and promise of childhood with dignity, security, and self-fulfillment.

UNICEF in Bam, Iran

In December 2003, the city of Bam in southeastern Iran was hit by an earthquake that measured 6.3 on the Richter scale. It was estimated that 30,000 people were killed and 40,000 others injured. More than 100,000 people were affected, with more than 90 percent of homes heavily damaged or destroyed. Within 48 hours, UNICEF had sent two major shipments of emergency supplies and gone to work to provide safe water and sanitation. The organization created a tracing system utilizing a digital camera to help document missing children and reunite them with their families. Within one month, the first children returned to temporary schools established by UNICEF.

—Paula Kepos

Administration of UNICEF

The United Nations, headquartered in New York, hosts the world center for UNICEF operations. Thirty-six members of an executive board report to the Economic and Social Council of the United Nations. The Board oversees implementation of policies; monitoring of worldwide activities; and the consistency and acceptability of UNICEF strategies and programs, as well as the organization's financial budget, administrative plans, and reports.

Resources for UNICEF Operations

National governments and other United Nations organizations support UNICEF efforts in 161 sites around the world. The United States provides the greatest annual contribution ($248 million in 2000), while combined funds from the United Kingdom, Japan, Sweden, Norway, the Netherlands, Denmark, Australia, Canada, and Italy ($335 million) add significant governmental support. One-third of UNICEF's resources are received through Private Sector Division partnerships with social organizations, celebrities, and businesses.

Mission

The goal of UNICEF is to give every child a brighter future. The organization's pledge, "we will continue the same unwavering support for children that we have maintained," remains, as partners allocate resources for basic childhood needs of food, security, and shelter. The partnerships further support education for all children and enforcement of child labor practices. UNICEF's staff and volunteers must combat the enormous challenges facing children in war-torn countries, where poverty is rampant, as they try to control infection and disease, provide safe food and water, and fight discrimination.

UNICEF Accomplishments Since 1990

nutrition: the maintenance of health through proper eating, or the study of same

During the 1990s, there were many successful efforts by UNICEF to improve health, **nutrition**, and survival for women and children around the world. In 1990, UNICEF members, who held voting rights, supported the formation of the Convention on the Rights of the Child. During 1991, UNICEF and the World Health Organization (WHO) initiated efforts to improve the health and nutritional status of pregnant women, mothers with babies, and infants, through the Ten Steps to Successful Breastfeeding program. In response, health centers around the world adopted the "ten steps," and became "baby-friendly" hospitals and birthing centers. By 2002, more than 15,000 sites in 136 counties were educating women and promoting healthful behaviors to improve the nutritional status of babies.

The first International Children's Day of Broadcasting began in1992 to promote excellence in radio and television programming for children. Since then, more than two thousand media groups have provided wholesome and child-sensitive programs around the world. In 1993, twenty-five years of success with oral rehydration therapy (ORT) was celebrated. ORT provides a simple solution of sugar, salt, and water, and has saved millions of children in developing countries where safe water and sanitary conditions are unavailable. The highlight of 1994 was the Global Girls' Education Pro-

gramme in which education for young girls was a priority. UNICEF research efforts on the status of young girls began in 1994 with household surveys administered in sixty countries. This provided a baseline for a vast database about the status of health, nutrition, security, and other programs.

During 1995, UNICEF strengthened the initiatives to make issues of gender for women and the impact of war on children less of a problem. UNICEF sought support from nations through a 20/20 initiative—asking them to allocate 20 percent of their budgets for 20 percent of UNICEF's social services programs. By 1996, UNICEF had expanded its programs in AIDS awareness, prevention, and assistance to families and children in need of support for AIDS-related resources, and the Voices of Youth, a website where children can share information and insights on AIDS and other topics of interest, had begun. In 1997, a UNICEF document signed by 123 nations sought to protect children from weapons of destruction, and the International Conference on Child Labour met to support the elimination of employment for children where exploitation or hazardous conditions exist.

UNICEF, with the WHO and others, increased their efforts to address **malaria** prevention efforts in 1998, and by 1999 had formed a partnership with Global Alliance for **Vaccines** and Immunizations (GAVI) to supply vaccines against measles, mumps, **hepatitis** B, **diphtheria** and other preventable communicable conditions. During 2000 and 2001, the Say Yes for Children program received pledges of financial support from government and private sources in the ongoing effort to fund the improvement of health, education, nutrition, and safety of children.

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

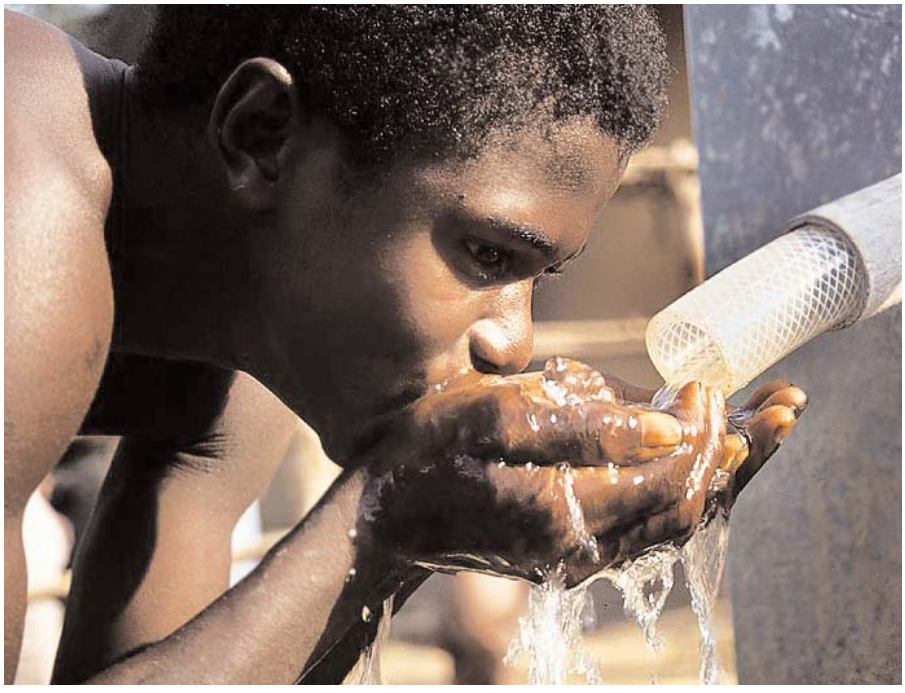
hepatitis: liver inflammation

diphtheria: infectious disease caused by Cornybacterium diphtheriae, causing damage to the heart and other organs

Programs and Operations of UNICEF

UNICEF and partners worldwide provide programs and oversee operations that have been directed either toward specific causes or generally to improve health, nutrition, security, or other needs. These programs include:

- The Oneworld Alliance for UNICEF, which is a partnership with airline companies who show in-flight UNICEF videos, collect donations from passengers, and ship emergency supplies.
- Rotary International supports and funds the Global Polio Eradication Initiative and National Immunization Days, a program of the United States Centers for Diseases Control and Prevention.
- The Kiwanis Worldwide Service Project focuses on iodine deficiency disorders. As a result, 70 percent of all households worldwide have iodized salt, a significant step toward improvement of the nutritional and health status of children.
- Check Out for Children is a program in place in hotels outside of North America where guests are invited to donate $1 to UNICEF. In celebration of the success of this program and the five million dollars contributed since inception, a Give Me Five (for $5 donations) program has been launched in Europe, Africa, India, and the Middle East.
- The Federation Internationale de Football Association (FIFA) has partnered with UNICEF to support implementation of the Convention



Six thousand people, many of them children, die every day from infections caused by contaminated water. UNICEF responds to this situation by educating people about water safety and helping people secure their water supplies. *[Photograph by Liba Taylor. Corbis. Reproduced by permission.]*

on the Rights of the Child. FIFA projects include the sale of notebooks, t-shirts, backpacks, and other items with FIFA and UNICEF logos that focus on children's rights to education, health care, and play.

- UNICEF greeting card and product sales have accounted for over $1 billion in revenues to support UNICEF programs.
- Global Movement for Children is a program to assist children in war-torn areas and to protect at-risk children from sexual exploitation and violence.
- Trick or Treat for UNICEF, on National UNICEF Day (October 31), raises awareness of UNICEF programs and the importance of ongoing support through volunteerism and contributions.

In summary, UNICEF funds programs and provide unique partnerships to eradicate disease, improve the health and nutritional status of children, and to make the world a better place for children to grow and develop. Other efforts to educate girls, improve children's working conditions, and establish housing and security in impoverished and war-torn environments have been addressed and supported. More work is needed, however, as the future of the global community depends, in part, on the health and well-being its children. SEE ALSO ORAL REHYDRATION THERAPY; WORLD HEALTH ORGANIZATION (WHO).

Ruth A. Waibel

Internet Resources

UNICEF. "Annual Report, 2000." Available from <http://www.unicef.org/ar00>

UNICEF. "The Progress of Nations, 2000." Available from <http:www.unicef.org/pon00>

UNICEF. "The State of the World's Children, 2001." Available from <http://www.unicef.org/sowc01>

Vegan

A **vegan** (pronounced VEE-gun) is a vegetarian who does not eat any animal products, including eggs and dairy products. A well-planned vegan **diet** can be nutritionally adequate, even for children and pregnant and lactating women. However, it is important that wise food selections are made. These selections include soymilk **fortified** with vitamin B_{12}, **vitamin D**, and **calcium**. Also important are whole grains, nuts, and seeds, which are rich sources of **zinc** and other **nutrients**. Foods high in vitamin C will help to increase **iron absorption**. SEE ALSO PLANT-BASED DIETS; VEGETARIANISM.

Cheryl Flynt

vegan: person who consumes no animal products, including milk and honey

diet: the total daily food intake, or the types of foods eaten

fortified: altered by addition of vitamins or minerals

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

calcium: mineral essential for bones and teeth

zinc: mineral necessary for many enzyme processes

nutrient: dietary substance necessary for health

iron: nutrient needed for red blood cell formation

absorption: uptake by the digestive tract

Bibliography

Seventh-day Adventist Dietetic Association (1997). *The Vegetarian/Vegan Resource: An Annex to Diet Manuals.* Roseville, CA: Author.

Internet Resources

Vegetarian Nutrition Resource Group. Available from <http://www.vegetariannutrition.net>

Vegetarian Resource Group. Available from <http://www.vrg.org>

Vegetarianism

A vegetarian eating plan, also known as plant-based eating, is based on a diet of grains, fruits, vegetables, nuts, and seeds, with occasional use of dairy and egg products. This style of eating has existed since the beginning of recorded history. As early as 600 B.C.E., a vegetarian movement was founded in ancient Rome. Vegetarian eating became popular in England and the United States in the mid-nineteenth century. For many individuals, their whole **lifestyle** is defined by their vegetarian eating. In 1998, 7 percent of American adults considered themselves to be vegetarians.

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

Types of Vegetarians

There are several vegetarian eating styles. Most vegetarians consider themselves lacto-ovo vegetarians, meaning they generally eat dairy and egg products, but do not include meat, poultry, or fish in their diet. Lacto vegetarians eliminate all animal foods except dairy products. Total vegetarians, or vegans (pronounced VEE-guns), eliminate all animal products. Individuals who occasionally eat meat, poultry, or fish consider themselves semi-vegetarian.

Most individuals who choose a vegetarian eating style want to be healthier and lower their risk for disease. Others are concerned about the **environment** and the cost of raising animals for food. Some do not agree with the inhumane treatment and killing of animals for food. There are also a number of individuals who choose vegetarian eating for religious purposes.

environment: surroundings

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

diabetes: inability to regulate level of sugar in the blood

obesity: the condition of being overweight, according to established norms based on sex, age, and height

osteoporosis: weakening of the bone structure

Benefits of Vegetarianism

Research has shown a number of health benefits related to vegetarian eating. **Heart disease**, **high blood pressure**, adult-onset **diabetes**, **obesity**, **osteoporosis**, and certain cancers occur less often in people who are vegetarian. Science has demonstrated that these health benefits are related to healthful

food choices. Eating whole grains, fruits, vegetables, nuts, and seeds provides the body with the ammunition needed to fight disease and illness. A diet high in meat, **saturated fat**, milk, cheese, and butter does not provide the same health benefits.

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

Nutritional Adequacy

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Almost every food contains **protein**. Even though animal foods are high in protein, they are not the only foods able to supply protein, which is necessary for the growth and maintenance of the body. Sources of protein in the vegetarian diet include cooked dried beans, nuts, seeds, and soy products.

fortified: altered by addition of vitamins or minerals

calcium: mineral essential for bones and teeth

tofu: soybean curd, similar in consistency to cottage cheese

Dairy and egg products provide vitamin B_{12}. For the vegetarian, foods such as **fortified** cereals and soymilk can provide the vitamin B_{12} needed by the body. Dairy products are also an excellent source of **calcium**, along with calcium-fortified soymilk, **tofu** processed with calcium, broccoli, nuts, collard greens, and calcium-fortified orange juice. High-calcium foods are important for strong bones and should be consumed early in life to build the body's calcium stores.

iron: nutrient needed for red blood cell formation

absorption: uptake by the digestive tract

Although red meat is a major source of **iron** in Western diets, vegetarians actually have higher iron intakes than nonvegetarians. Plant sources of iron include beans, fortified cereals, whole grain products, tofu, dark green leafy vegetables, seeds, prune juice, and blackstrap molasses. Including a vitamin C–rich food with meals will help to increase the body's **absorption** of iron.

The American Dietetic Association has stated that "appropriately planned vegetarian diets are healthful, are nutritionally adequate, and provide health benefits in the prevention and treatment of certain diseases" (*Journal of the American Dietetic Association*, 1317).

Vegetarianism at Different Ages

When choosing vegetarian eating, it is important to be aware that there are special nutritional needs at different stages of life. Pregnancy and breastfeeding require additional **calories** and **nutrients**. A well-planned vegetarian diet can provide these in the amounts needed for a healthy mother and baby.

calorie: unit of food energy

nutrient: dietary substance necessary for health

During infancy, childhood, and the teenage years, adequate calories to sustain proper growth are necessary. This usually is not a problem for infants because they are either breastfed or on formula. During childhood and the teenage years, meals should consist of high-calorie, high-nutrient (good sources of protein, **vitamins**, and **minerals**) foods. Because many plant foods are low in calories and high in **fiber**, it is easy for the child or teenager to feel full before eating an adequate amount of calories. Moderate amounts of high-fat foods can help to increase calorie intake. In-between-meal snacks are useful, as they also provide needed calories. Healthy snacks include items like peanut-butter sandwiches and milk (or soy milk), a melted cheese and bagel sandwich, fruit smoothies, and, after three years of age, dried fruits, nuts, and seeds.

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

fiber: indigestible plant material which aids digestion by providing bulk

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

Older adults may have difficulty obtaining vitamins D and B_{12}, as well as calories. Many people do not get enough sunlight for their bodies to produce the recommended amount of **vitamin D**, which is essential for

Fresh tofu is packed in water for shipping, which helps it retain its flavor and form. Tofu is made from soybean curds. It provides all the excellent nutritive properties of soy, including high-quality protein. *[© Michael S. Yamashita/Corbis. Reproduced by Corbis Corporation.]*

absorbing calcium and preventing osteoporosis. Using breakfast cereals and soy products fortified with vitamin D is important, though it may also be necessary to take a supplement because the absorption of vitamin B_{12} decreases as people get older.

It is important to eat foods that are fortified with B_{12}, such as soymilk, or to take a B_{12} supplement. Older adults are also at risk for not getting enough calories, because the appetite tends to decrease with age. Eating foods that are low in calories and high in fiber makes it difficult to get the needed **energy** intake to stay healthy. Eating high-calorie, nutrient-dense foods and in-between-meal snacks is important.

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

Careful planning ensures that vegetarian eating will provide the **nutrition** needed to stay healthy. One helpful tool is the Vegetarian Food Guide Pyramid, which provides guidelines for selecting foods and the appropriate portion sizes.

nutrition: the maintenance of health through proper eating, or the study of same

Using a variety of foods is essential to good health when following the Food Guide Pyramid. One single food cannot provide the body with all the nutrition it needs. Five portions of fruits and vegetables should be consumed daily, including a citrus fruit and a dark green leafy vegetable. Whole grains should be eaten whenever possible; these have more nutrients and fiber than processed grains such as white bread and white rice. Proteins should be chosen wisely. While dairy products and eggs are good protein sources, they are also high in saturated fats and **cholesterol**. Nuts, seeds, beans, and soy products should be part of the diet.

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

A carefully planned vegetarian diet can provide the nutrients needed for health at any time during the life cycle. Most individuals who choose this eating style do so because of the many health benefits associated with vegetarian eating, including reduced risk for heart disease, diabetes, and some cancers. SEE ALSO MEAT ANALOGS; PLANT-BASED DIETS; SOY; VEGAN; WHOLE FOODS DIET.

Cheryl Flynt

Bibliography

American Dietetic Association. "Position of the American Dietetic Association: Vegetarian Diets." *Journal of the American Dietetic Association* 97(11):1317–1321.

Duyff, Roberta Larson (1996). *The American Dietetic Association's Complete Food and Nutrition Guide.* Minneapolis, MN: Chronimed.

Seventh-day Adventist Dietetic Association (1997). *The Vegetarian/Vegan Resource: An Annex to Diet Manuals.* Roseville, CA: Author.

Vitamins, Fat-Soluble

fat: type of food molecule rich in carbon and hydrogen, with high energy content

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

intestines: the two long tubes that carry out much of the processes of digestion

malabsorption: decreased ability to take up nutrients

absorption: uptake by the digestive tract

adipose tissue: tissue containing fat deposits

water-soluble: able to be dissolved in water

carotenoid: plant-derived molecules used as pigments

Because they dissolve in **fat**, **vitamins** A, D, E, and K are called *fat-soluble* vitamins. They are absorbed from the small **intestines**, along with dietary fat, which is why fat **malabsorption** resulting from various diseases (e.g., cystic fibrosis, ulcerative colitis, Crohn's disease) is associated with poor **absorption** of these vitamins. Fat-soluble vitamins are primarily stored in the liver and **adipose tissues**. With the exception of vitamin K, fat-soluble vitamins are generally excreted more slowly than **water-soluble** vitamins, and vitamins A and D can accumulate and cause toxic effects in the body.

Vitamin A

Vitamin A was the first fat-soluble vitamin identified (in 1913). Vitamin A comprises the preformed retinoids, plus the precursor forms, the provitamin A **carotenoids**. *Preformed retinoids* is a collective term for retinol, retinal, and retinoic acid, all of which are biologically active. The *provitamin A carotenoids* include beta-carotene and others, which are converted to retinoids with varying degrees of efficiency. Retinoids are sensitive to heat, light, and oxidation by air. Beta-carotene is relatively more stable. Vitamin E helps protect vitamin A from oxidation. There is some loss of vitamin A with cooking, but only after boiling for a comparatively long period.

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

development: the process of change by which an organism becomes more complex

Retinoids are converted to retinol in the intestines and transported with dietary fat to the liver, where it is stored. A special transport **protein**, retinol-binding protein (RBP), transports vitamin A from the liver to other tissues. Carotenoids are absorbed intact at a much lower absorption rate than retinol. Of all the carotenoids, beta-carotene has the highest potential vitamin-A activity. The active forms of vitamin A have three basic functions: vision, growth and **development** of tissues, and immunity.

- *Vision.* Vitamin A combines with a protein called *opsin* to form *rhodopsin* in the rod cells of the retina. When vitamin A is inadequate, the lack of rhodopsin makes it difficult to see in dim light.
- *Growth and development of tissues.* Vitamin A is involved in normal cell differentiation—a process through which embryonic cells transform into mature tissue cells with highly specific functions. Vitamin A supports male and female reproductive processes and bone growth.
- *Immunity.* Vitamin A is essential for immune function and vitamin-A deficiency is associated with decreased resistance to infections. The severity of some infections, such as measles and diarrhea, is reduced by vitamin-A supplementation among those who suffer from vitamin-A deficiency.

FAT SOLUBLE VITAMINS

Vitamin	Functions	Deficiency symptoms	People at risk	Sources	Daily recommended intakes	Toxicity
Vitamin A Preformed retinoids and provitamin A carotinoids	Vision in dim light and color vision, cell differentiation and growth, immunity	Poor growth, night blindness, blindness, dry skin, Xerophthalmia	Rare in United States but common in preschool children living in poverty in developing countries, alcoholics	Preformed vitamin A: liver, fortified milk, fish liver oils Provitamin A: red, orange, dark green, and yellow vegetables, orange fruits	Infants: 400–500 mg RAE Children: 300–400 mg RAE Adolescents: 600–900 mg RAE Adult men & women: 700–900 mg RAE Pregnant women: 750–770 mg RAE Lactating women: 1200–1300 mg RAE	Headache, vomiting, double vision, hair loss, dry mucous membranes, bone and joint pain, fractures, liver damage, hemorrhage, coma, teratogenic effects: spontaneous abortions, birth defects. Upper level is 3000 mg of preformed vitamin A based on risk of birth defects and liver toxicity.
Vitamin D Cholecalciferol Ergocalciferol	Maintainence of intracellular and extracellular calcium concentrations	Rickets in children, osteomalacia in older adults	Dark skinned individuals, older adults, breastfed infants from vitamin D deficient mother	Vitamin D fortified milk, fish oils	0–50 years: 5 mg 51–70 years: 10 mg, >70 years: 15 mg	Calcification of soft tissues, growth restriction, excess calcium excretion via the kidney. Upper level is 50 mg based on the risk elevated blood calcium.
Vitamin E Tocopherols Tocotrienols	Antioxidant, prevention of propagation of free radicals	Hemolysis of red blood cells, degeneration of sensory neurons	Patients with fat malabsorption syndromes, smokers [overt deficiency is rare]	Plant oils, seeds, nuts, products made from oils	Infants: 4–5 mg Children: 6–7 mg Adolescents:11–15 mg Adult men & women: 15 mg Pregnant women: 15 mg Lactating women: 19 mg	Inhibition of vitamin K metabolism. Upper level is 1000 mg based on the risk of hemorrhage.
Vitamin K Phylloquinone Menaquinone	Synthesis of blood clotting factors and bone proteins	Hemorrhage, fractures	Those taking antibiotics for a long period of time; older adults with scant green vegetable intake	Green vegetables, liver synthesis by intestinal microorganisms	Infants: 2–2.5 mg Children: 30–55 mg Adolescents: 60–75 mg Adult men: 90 mg Adult women: 120 mg Pregnant/ lactating women: 75–90 mg	No upper level has been set

SOURCE Wardlaw, Gordon M.; Hampl, Jeffrey S.; and Disilvestro, Robert A. (2004). *Perspectives in Nutrition*, 6th edition. New York: McGraw-Hill.

It has been suggested that beta-carotene and other carotenoids (also called **phytochemicals**) may function as **antioxidants** by neutralizing **free radicals**. Free radicals are unstable, highly reactive **molecules** that damage **DNA**, cause cell injury, and increase the risk of **chronic** disease. Beta-carotene has also been associated with reducing the risk of lung **cancer**. Lutein and zeaxanthin, yellow carotenoid pigments in corn and dark green leafy vegetables, may reduce the risk of **macular degeneration** and age-related **cataracts**. Lycopene, a red carotenoid pigment in tomatoes, may help reduce the risk of prostrate cancer, **cardiovascular** disease, and skin damage from sunlight.

phytochemical: chemical produced by plants

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

free radical: highly reactive molecular fragment, which can damage cells

molecule: combination of atoms that form stable particles

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

chronic: over a long period

cancer: uncontrolled cell growth

macular degeneration: death of cells of the macula, part of the eye's retina

cataract: clouding of the lens of the eye

cardiovascular: related to the heart and circulatory system

Deficiency.

Dietary deficiency of vitamin A is rare in North America and western Europe, but it is the leading cause of blindness in children worldwide. Newborn and premature infants, the urban poor, older adults, people with alcoholism or liver disease, and those with fat malabsorption syndrome are all at increased risk.

One of the earliest symptoms of vitamin-A deficiency is night blindness. It is a temporary condition, but if left untreated it can cause permanent blindness. This degeneration is called xerophthalmia, and it usually occurs in children after they are weaned. Symptoms include dryness of the cornea and eye membranes due to lack of mucus production, which leaves the eye vulnerable to surface dirt and bacterial infections. Vitamin-A deficiency can cause follicular hyperkeratosis, a condition in which hair follicles become plugged with keratin, giving a bumpy appearance and a rough, dry texture to skin.

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

In developing countries, the severity of **infectious diseases** such as measles is often correlated to the degree of vitamin-A deficiency. Providing large doses of vitamin A reduces the risk of dying from these infections. The age range of the target population for vitamin-A intervention programs is usually from birth to seven years. Administration of high-potency doses in the range of 15,000 to 60,000 micrograms (µg) are distributed to young children in targeted areas of the world to build up liver stores for up to six months. However, consumption of adequate food sources is the most important long-term solution to vitamin-A deficiency.

Toxicity.

Vitamin-A toxicity, called *hypervitaminosis A*, can result from long-term supplementation of two to four times the RDA for preformed vitamin A. Excess intake of preformed vitamin A is a teratogen, meaning it can cause birth defects. Birth defects associated with vitamin-A toxicity include cleft palate, heart abnormalities, and brain malfunction. Acute excess intake during pregnancy can also cause spontaneous abortions. Pregnant women should avoid prenatal supplements containing retinal, as well as medications made from retinoids, such as Accutane and Retin-A. Prolonged and excessive consumption of carotene-rich foods can lead to hypercarotenemia, a **clinical** condition characterized by deep orange discoloration of the skin and increased carotene levels in the blood. This condition is usually harmless.

clinical: related to hospitals, clinics, and patient care

Vitamin D (Calciferol)

In the seventeenth century, vitamin-D deficiency was so common in British children that it came to be known as "children's disease of the English." In

the mid-1800s, cod liver oil became well known for treating this disease. In 1925, Elmer McCollum and coworkers determined that the "antirachitic" (antirickets) substance in cod liver oil was vitamin D. Because vitamin D is relatively stable in foods, many countries fortify milk with vitamin D to help prevent rickets. However, significant losses may result from **fortified** milk exposed to light.

Vitamin D from foods is absorbed from the upper part of the small intestine, along with dietary fat, and transported to the liver. In the skin, ultraviolet (UV) radiation from the sun converts a **cholesterol** derivative to cholecalciferol, which enters the blood stream and is transported to the liver. In the liver, vitamin D is converted to calcidiol, an inactive form that circulates in blood. Kidneys take up calcidiol and convert it to an active **hormone** form of vitamin D called calcitriol. People with chronic kidney failure have very low levels of calcitriol and must be routinely treated with this form of the vitamin.

The best-known function of active vitamin D is to help regulate blood levels of **calcium** and phosphorous. Vitamin D increases absorption of these **minerals** from the **gastrointestinal** (GI) tract. In combination with parathyroid hormone, it enhances their reabsorption from the kidneys and their mobilization from bones into the blood. Vitamin D helps maintain calcium levels even if dietary intakes are not optimal. Calcitriol affects growth of normal cells and some cancer cells. Adequate vitamin-D status has been linked to a reduced risk of developing breast, colon, and prostrate cancers.

Deficiency. Long-term deficiency of vitamin D affects the skeletal system. In children, vitamin-D deficiency leads to rickets, a condition in which bones weaken and bow under pressure. Although vitamin-D **fortification** has reduced **incidence** of rickets in North America, it is sometimes seen in children with malabsorption syndrome and is still common in many parts of the world. In adults, vitamin-D deficiency causes **osteomalacia**, or "soft bones," increasing the risk for fractures in hip, spine, and other bones. Vitamin-D deficiency also contributes to **osteoporosis**. In elderly persons, vitamin-D supplementation reduces the risk of osteoporotic fractures.

Infants are born with stores of vitamin D that last about six months. Breast milk contains very little vitamin D, however, and infants beyond six months of age who are exclusively breastfed must obtain vitamin D via exposure to sunlight or a supplement given under the guidance of a physician.

Older adults are especially at risk for vitamin-D deficiency for several reasons. The skin, liver, and kidneys lose their capacity to synthesize and activate vitamin D with advancing age, and older adults typically drink little or no milk, a major dietary source of vitamin D. Older adults also rarely venture outdoors, and when they do, they apply sunscreen to exposed areas of the body, further contributing to the decline in vitamin-D synthesis in the skin.

Sunscreens with a sun protection factor (SPF) of 8 and above prevent vitamin-D synthesis. Sunscreen should be applied only after enough time has elapsed to provide sufficient vitamin-D synthesis. Exposure to the sun does not cause vitamin-D toxicity, and for most people, exposing the hands, face, and arms on a clear summer day for fifteen minutes a few times a week should provide sufficient Vitamin D. Dark-skinned people require longer sunlight exposure because melanin, a skin pigment, is a natural sunscreen.

Sunlight stimulates the synthesis of vitamin D, which regulates the body's absorption of calcium and therefore is essential to skeletal health. Just fifteen minutes in the sun several times weekly is sufficient. After that, sunscreen should be applied to avoid ultraviolet damage to the skin. *[Photograph by Michael Keller. Corbis. Reproduced by permission.]*

fortified: altered by addition of vitamins or minerals

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

hormone: molecules produced by one set of cells that influence the function of another set of cells

calcium: mineral essential for bones and teeth

mineral: an inorganic (non-carbon-containing) element, ion or compound

gastrointestinal: related to the stomach and intestines

fortification: addition of vitamins and minerals to improve the nutritional content of a food

incidence: number of new cases reported each year

osteomalacia: softening of the bones

osteoporosis: weakening of the bone structure

Dietary recommendations assume that no vitamin D is available from exposure to sunlight. Thus, people who do not venture outdoors or who live in northern or predominantly cloudy climates need to pay attention to dietary sources. Plants are poor sources of vitamin D, so strict vegetarians must meet their vitamin-D needs through exposure to sunlight, fortification, or supplementation.

Toxicity. Vitamin D is most likely to have toxic effects when consumed in excessive amounts through supplementation. Excess vitamin D raises blood calcium levels, resulting in calcium precipitation in soft tissues and stone formation in the kidneys, where calcium becomes concentrated in an effort to excrete it.

Vitamin K

In 1929, the Danish researcher Henrik Dam first noted that vitamin K played a critical role in **blood clotting**, and he named it vitamin "K" for "Koagulation." Vitamin K comprises a family of compounds known as *quinones*. These include *phylloquinone* from plants and the *menaquinones* from animal sources. Phylloquinone is the most biologically active form. Menaquinones are also synthesized by **bacteria** in the colon and absorbed, contributing about 10 percent of total vitamin-K needs. Vitamin-K absorption depends on normal consumption and digestion of dietary fat. It is primarily stored in the liver.

blood clotting: the process by which blood forms a slid mass to prevent uncontrolled bleeding

bacteria: single-celled organisms without nuclei, some of which are infectious

Vitamin K helps in the activation of seven blood-clotting-factor proteins that participate in a series of reactions to form a clot that eventually stops the flow of blood. Vitamin K also participates in the activation of bone proteins, which greatly enhances their calcium-binding properties. Low levels of circulating vitamin K have been associated with low bone-mineral density. Thus, an adequate intake of vitamin K may help protect against hip fractures.

Deficiency. A primary deficiency of vitamin K is rare, but a secondary deficiency may result from fat malabsorption syndrome. Prolonged use of **antibiotics** can destroy the intestinal bacteria that produce vitamin K, precipitating deficiency in individuals at risk. Newborn infants are born with a sterile intestinal tract and those who are breastfed, may run the risk of vitamin-K deficiency, since breast-milk production takes a few days to establish and breast milk is naturally low in this vitamin. To prevent hemorrhaging, all infants in North America receive injections of vitamin K within six hours of birth.

antibiotic: substance that kills or prevents the growth of microorganisms

Toxicity. High doses of vitamin K can reduce the effectiveness of anticoagulant **drugs** such as warfarin (Coumadin), which is used to prevent blood clotting. People taking these drugs should maintain a consistent daily intake of vitamin K. Megadose supplements of vitamin A and E can pose a risk to vitamin-K status. Vitamin A interferes with absorption of vitamin K, and large doses of vitamin E decrease vitamin K–dependent clotting factors, thus promoting bleeding. Toxicity from food is rare, because the body excretes vitamin K much more rapidly than other fat-soluble vitamins.

drugs: substances whose administration causes a significant change in the body's function

Vitamin E

The link between vitamin-E deficiency and reproductive failure in rats was first discovered in 1922 by Herbert Evans and Katherine Scott Bishop. The

chemical name of vitamin E, tocopherol, is derived from *toco*, meaning "related to childbirth."

Vitamin E comprises a family of eight naturally occurring compounds: four tocopherols and four tocotrienols, of which alpha-tocopherol is the only one to have vitamin-E activity in the human body. It is also the most common form of vitamin E in food. Vitamin E is highly susceptible to destruction by **oxygen**, metals, light, and deep-fat frying. As a result, prolonged food storage lowers the vitamin-E content of food.

oxygen: O_2, atmospheric gas required by all animals

As with other fat-soluble vitamins, absorption of vitamin E requires adequate absorption of dietary fat. In addition, the percentage of absorption declines as the amount consumed is increased. Vitamin E is stored mainly in adipose tissue, while some is stored in the muscle. The remaining vitamin E is found in cell membranes in tissue.

Vitamin E is an antioxidant and one of the body's primary defenders against **oxidative** damage caused by free radicals. Its activity is enhanced by other antioxidants such as vitamin C and the mineral selenium. Vitamin E interrupts free-radical chain reactions by getting oxidized, thus protecting cell membranes from free-radical attack. Scientists have implicated oxidative stress in the development of cancer, **arthritis**, cataracts, **heart disease**, and in the process of aging itself. However, it is not yet known whether supplementation with megadoses of vitamin E offers protection against heart disease and cancer beyond that provided by positive dietary and **lifestyle** changes.

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

arthritis: inflammation of the joints

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

Deficiency. Due to the widespread use of vegetable oils, primary vitamin-E deficiency is rare. Most deficiencies occur in people with fat malabsorption syndrome. Smokers and adults on very low-fat diets are at increased risk of developing vitamin-E deficiency. Preterm infants are particularly susceptible to hemolytic **anemia** (anemia caused by the destruction of red blood cells) due to vitamin-E deficiency. These infants are born with limited stores of vitamin E, which are exhausted by rapid growth, and they are inefficient in absorbing vitamin E from the intestinal tract. Without vitamin E to protect against oxidation, the destruction of cell membranes causes red blood cells to burst. To prevent hemolytic anemia, special formulas and supplements containing vitamin E are prescribed for preterm infants.

anemia: low level of red blood cells in the blood

Toxicity. Large doses of vitamin E can counter the actions of vitamin K and decrease the production of vitamin K–dependent clotting factors, thus promoting serious hemorrhaging effects in adults. Individuals who are vitamin-K deficient or who are taking anticoagulant medications such as warfarin or aspirin are especially at risk from megadoses of vitamin E. SEE ALSO VITAMINS, WATER-SOLUBLE.

Kiran B. Misra

Bibliography

Insel, Paul; Turner, Elaine R.; and Ross, Don (2002). *Nutrition.* Sudbury, MA: Jones and Bartlett.

Wardlaw, Gordon M.; Hampl, Jeffrey S.; and Disilvestro, Robert A. (2004). *Perspectives in Nutrition*, 6th edition. New York: McGraw-Hill.

Whitney, Eleanor Noss, and Rolfes, Sharon Rady (2002). *Understanding Nutrition*, 9th edition. Belmont, CA: Wadsworth/Thomson Learning.

Vitamins, Water-Soluble

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

diet: the total daily food intake, or the types of foods eaten

water-soluble: able to be dissolved in water

B vitamins: a group of vitamins important in cell energy processes

niacin: one of the B vitamins, required for energy production in the cell

nervous system: the brain, spinal cord, and nerves that extend throughout the body

Vitamins are essential organic substances that are needed in small amounts in the **diet** for the normal function, growth, and maintenance of body tissues. **Water-soluble** vitamins consist of the **B vitamins** and vitamin C. With exception of vitamin B_6 and B_{12}, they are readily excreted in urine without appreciable storage, so frequent consumption becomes necessary. They are generally nontoxic when present in excess of needs, although symptoms may be reported in people taking megadoses of **niacin**, vitamin C, or pyridoxine (vitamin B_6). All the B vitamins function as coenzymes or cofactors, assisting in the activity of important enzymes and allowing energy-producing reactions to proceed normally. As a result, any lack of water-soluble vitamins mostly affects growing or rapidly metabolizing tissues such as skin, blood, the digestive tract, and the **nervous system**. Water-soluble vitamins are easily lost with overcooking.

Thiamin (Vitamin B_1)

metabolism: the sum total of reactions in a cell or an organism

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

edema: accumulation of fluid in the tissues

muscle wasting: loss of muscle bulk

absorption: uptake by the digestive tract

Thiamin functions as the coenzyme thiamin pyrophosphate (TPP) in the **metabolism** of **carbohydrate** and in conduction of nerve impulses. Thiamin deficiency causes beri-beri, which is frequently seen in parts of the world where polished (white) rice or unenriched white flour are predominantly eaten. There are three basic expressions of beriberi: childhood, wet, and dry. Childhood beriberi stunts growth in infants and children. Wet beriberi is the classic form, with swelling due to fluid retention (**edema**) in the lower limbs that spreads to the upper body, affecting the heart and leading to heart failure. Dry beriberi affects peripheral nerves, initially causing tingling or burning sensations in the lower limbs and progressing to nerve degeneration, **muscle wasting**, and weight loss. Thiamine-deficiency disease in North America commonly occurs in people with heavy alcohol consumption and is called Wernicke-Korsakoff syndrome. It is caused by poor food intake and by decreased **absorption** and increased excretion caused by alcohol consumption.

Riboflavin (Vitamin B_2)

Riboflavin is stable when heated in ordinary cooking, unless the food is exposed to ultraviolet radiation (sunlight). To prevent riboflavin breakdown, riboflavin-rich foods such as milk, milk products, and cereals are packaged in opaque containers. Riboflavin is a component of two coenzymes—flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD)—that act as hydrogen carriers when carbohydrates and fats are used to produce energy. It is helpful in maintaining good vision and healthy hair, skin and nails, and it is necessary for normal cell growth.

cataract: clouding of the lens of the eye

nutrient: dietary substance necessary for health

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

Riboflavin deficiency causes a condition known as ariboflavinosis, which is marked by cheilosis (cracks at the corners of the mouth), oily scaling of the skin, and a red, sore tongue. In addition, **cataracts** may occur more frequently with riboflavin deficiency. A deficiency of this **nutrient** is usually a part of multinutrient deficiency and does not occur in isolation. In North America, it is mostly observed in alcoholics, elderly persons with low income or **depression**, and people with poor eating habits, particularly those who consume highly refined and fast foods and those who do not consume milk and milk products.

Unlike fat-soluble vitamins, water-soluble vitamins are easily lost during cooking and processing. The body does not store excess quantities of most water-soluble vitamins, so foods bearing them must be consumed frequently. *[Photograph by LWA-Stephen Welstead. Corbis. Reproduced by permission.]*

Niacin (Vitamin B_3)

Niacin exists in two forms, nicotinic acid and nicotinamide. Both forms are readily absorbed from the stomach and the small intestine. Niacin is stored in small amounts in the liver and transported to tissues, where it is converted to coenzyme forms. Any excess is excreted in urine. Niacin is one of the most stable of the B vitamins. It is resistant to heat and light, and to both acid and alkali environments. The human body is capable of converting the **amino acid** tryptophan to niacin when needed. However, when both tryptophan and niacin are deficient, tryptophan is used for **protein** synthesis.

amino acid: building block of proteins, necessary dietary nutrient

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

WATER SOLUBLE VITAMINS

Vitamin	Deficiency	Recommended daily intake	Food sources	Toxicity
Thiamine (Vitamin B_1)	Beri Beri: anorexia, weight loss, weakness, peripheral neuropathy Wernicke-Korsakoff syndrome: staggered gait, cross eyes, dementia, disorientation, memory loss	Infants: 0.2 – 0.3 mg Children: 0.5 – 0.6 mg Adolescents: 0.9 – 1.2 mg Men: 1.2 mg Women: 1.1 mg Pregnant/Lactating Women: 1.4 mg	Pork/pork products, beef, liver, yeast/baked products, enriched and whole grain cereals, nuts, and seeds	None reported
Riboflavin	Ariboflavinosis: inflammation of tongue (glossitis), cracks at corners of mouth (cheilosis), dermatitis, growth retardation, conjunctivitis, nerve damage	Infants: 0.3 – 0.4 mg Children: 0.5 – 0.6 mg Adolescents: 0.9 – 1.3 mg Men: 1.3 mg Women: 1.1 mg Pregnant Women: 1.4 mg Lactating Women: 1.6 mg	Milk, eggs, mushrooms, whole grains, enriched grains, green leafy vegetables, yeast, liver, and oily fish	None reported
Niacin	Pellagra: diarrhea, dematitis, dementia, and death	Infants: 2 – 4 mg NE Children: 6 – 8 mg NE Adolescents: 12 – 16 mg NE Men: 16 mg NE Women: 14 mg NE Pregnant Women: 18 mg NE Lactating Women: 17 mg NE	Meat, poultry, fish, yeast, enriched and whole grain breads and cereals, peanuts, mushrooms, milk, and eggs (tryptophan)	Flushing of skin, itching, nausea & vomiting, and liver damage occurs at intake over 35 mg/day from supplements
Pantothenic acid (Vitamin B_5)	Rare	Infants: 1.7 – 1.8 mg Children: 2 – 3 mg Adolescents: 4 – 5 mg Men & Women: 5 mg Pregnant Women: 6 mg Lactating Women: 7 mg	Widely distributed in foods	None reported
Biotin (Vitamin B_8)	Infants: Dermatitis, convulsions, hair loss (alopecia), neurological disorders, impaired growth	Infants: 5 – 6 µg Children: 8 – 12 µg Adolescents: 20 – 25 µg Men & Women: 30 µg Pregnant Women: 30 µg Lactating Women: 35 µg	Whole grains, eggs, nuts and seeds, widely distributed in small amounts	Not known
Vitamin B_6	Dermatitis, anemia, convulsion, depression, confusion, decline in immune function	Infants: 0.1 – 0.3 mg Children: 0.5 – 0.6 mg Adolescents: 1.0 –1.3 mg Men & Women (19 – 50 years): 1.3 mg Men over 50 years: 1.4 mg Women over 50 years: 1.3 mg Pregnant Women: 1.9 mg Lactating Women: 1.2 mg	Meat, fish, poultry, spinach, potatoes, bananas, avocados, sunflower seeds	None from foods, excess intake above 100 mg/day from supplements causes neuropathy (nerve destruction) and skin lesions
Folate	Megaoblastic (macrocytic) anemia, abdominal pain, diarrhea, birth defects	Infants: 65 – 80 µg Children: 150 – 200µg Adolescents: 300 – 400 µg Men & Women: 400 µg/day Pregnant Women: 600 µg Lactating Women: 500 µg	Ready-to-eat breakfast cereals, enriched grain products, green vegetables, liver, legumes, oranges. The use of fortified foods are encouraged for all women of child bearing age (15–45 years).	None (up to 5 mg/day); intake from fortified food and supplements over 1000 µg/day, not including food; folate masks vitamin B_{12} deficiency allowing progression of neurological damage. Supplements containing > 400 µg available by prescription only.

There are two coenzyme forms of niacin: nicotinamide adenine dinucleotide (NAD^+) and nicotinamide adenine dinucleotide phosphate ($NADP^+$). They both help break down and utilize proteins, fats, and carbohydrates for energy. Niacin is essential for growth and is involved in **hormone** synthesis.

hormone: molecules produced by one set of cells that influence the function of another set of cells

Pellagra results from a combined deficiency of niacin and tryptophan. Long-term deficiency leads to central nervous system dysfunction manifested as confusion, apathy, disorientation, and eventually coma and death.

WATER SOLUBLE VITAMINS [CONTINUED]

Vitamin	Deficiency	Recommended daily intake	Food sources	Toxicity
Vitamin B_{12}	Pernicious Anemia: macrocytic anemia, nervous system disturbances; paresthesia (tingling and numbness in limbs), difficulty walking, loss of bowel and bladder control, dementia	Infants: 0.4 – 0.5 µg Children: 0.9 – 1.2 µg Adolescents: 1.8 µg Men & Women: 2.4 µg Pregnant Women: 2.6 µg Lactating Women: 2.8 µg	Meat, fish, poultry, ready-to-eat fortified breakfast cereals, eggs, fermented dairy products (cheese, yogurt, etc).The use of fortified foods and supplements are recommended for adults 51 and over.	None reported
Vitamin C	Scurvy: fatigue, poor wound healing, pinpoint hemorrhages around hair follicles on back of arms & legs, bleeding gums & joints	Infants: 40 – 50 mg Children: 15 – 25 mg Adolescents: 45 – 75 mg Men: 90 mg Women: 75 mg Pregnant Women: 80 – 85 mg Lactating Women: 115 –120 mg Smokers: + 35 mg	Citrus fruits, strawberries, broccoli, greens	Megadoses over 2 g/day causes nausea, abdominal cramps, and diarrhea.

Pellagra is rarely seen in industrialized countries, where it may be observed in people with rare disorder of tryptophan metabolism (Hartnup's disease), alcoholics, and those with diseases that affect food intake.

Recommended intake is expressed as milligrams of niacin equivalents (NE) to account for niacin synthesized from tryptophan. High doses taken orally as nicotinic acid at 1.5 to 2 grams per day can decrease **cholesterol** and **triglyceride** levels, and along with diet and exercise can slow or reverse the progression of **heart disease**. The nicotinamide form of niacin in multivitamin and B-complex tablets do not work for this purpose. Supplementation should be under a physician's guidance.

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

triglyceride: a type of fat

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

Pantothenic Acid (Vitamin B_5)

Pantothenic acid is stable in moist heat. It is destroyed by vinegar (acid), baking soda (alkali), and dry heat. Significant losses occur during the processing and refining of foods. Pantothenic acid is released from coenzyme A in food in the small intestine. After absorption, it is transported to tissues, where coenzyme A is resynthesized. Coenzyme A is essential for the formation of energy as adenosine triphosphate (ATP) from carbohydrate, protein, alcohol, and **fat**. Coenzyme A is also important in the synthesis of **fatty acids**, cholesterol, **steroids**, and the **neurotransmitter** acetylcholine, which is essential for transmission of nerve impulses to muscles.

Dietary deficiency occurs in conjunction with other B-vitamin deficiencies. In studies, experimentally induced deficiency in humans has resulted in headache, **fatigue**, impaired muscle coordination, abdominal cramps, and vomiting.

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fatty acids: molecules rich in carbon and hydrogen; a component of fats

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic processes

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

fatigue: tiredness

Biotin (Vitamin B_8)

Biotin is the most stable of B vitamins. It is commonly found in two forms: the free vitamin and the protein-bound coenzyme form called biocytin. Biotin is absorbed in the small intestine, and it requires digestion by enzyme biotinidase, which is present in the small intestine. Biotin is synthesized by **bacteria** in the large intestine, but its absorption is questionable. Biotin-containing coenzymes participate in key reactions that produce energy from carbohydrate and synthesize fatty acids and protein.

bacteria: single-celled organisms without nuclei, some of which are infectious

Avidin is a protein in raw egg white, which can bind to the biotin in the stomach and decrease its absorption. Therefore, consumption of raw whites is of concern due to the risk of becoming biotin deficient. Cooking the egg white, however, destroys avidin. Deficiency may develop in infants born with a **genetic** defect that results in reduced levels of biotinidase. In the past, biotin deficiency was observed in infants fed biotin-deficient formula, so it is now added to infant formulas and other baby foods.

genetic: inherited or related to the genes

Vitamin B_6

Vitamin B_6 is present in three forms: pyridoxal, pyridoxine, and pyridoxamine. All forms can be converted to the active vitamin-B_6 coenzyme in the body. Pyridoxal phosphate (PLP) is the predominant biologically active form. Vitamin B_6 is not stable in heat or in alkaline conditions, so cooking and food processing reduce its content in food. Both coenzyme and free forms are absorbed in the small intestine and transported to the liver, where they are phosphorylated and released into circulation, bound to albumin for transport to tissues. Vitamin B_6 is stored in the muscle and only excreted in urine when intake is excessive.

PLP participates in amino acid synthesis and the interconversion of some amino acids. It **catalyzes** a step in the synthesis of **hemoglobin**, which is needed to transport **oxygen** in blood. PLP helps maintain blood **glucose** levels by facilitating the release of glucose from liver and muscle **glycogen**. It also plays a role in the synthesis of many neurotransmitters important for brain function. This has led some physicians to prescribe megadoses of B_6 to patients with **psychological** problems such as depression and mood swings, and to some women for premenstrual syndrome (PMS). It is unclear, however, whether this therapy is effective. PLP participates in the conversion of the amino acid tryptophan to niacin and helps avoid niacin deficiency. Pyridoxine affects immune function, as it is essential for the formation of a type of white blood cell.

catalyze: cause to happen more rapidly

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

oxygen: O_2, atmospheric gas required by all animals

glucose: a simple sugar; the most commonly used fuel in cells

glycogen: storage form of sugar

psychological: related to thoughts, feelings, and personal experiences

Populations at risk of vitamin-B_6 deficiency include alcoholics and elderly persons who consume an inadequate diet. Individuals taking medication to treat Parkinson's disease or **tuberculosis** may take extra vitamin B_6 with physician supervision. Carpal tunnel syndrome, a nerve disorder of the wrist, has also been treated with large daily doses of B_6. However, data on its effectiveness are conflicting.

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

Folic Acid, Folate, Folacin (Vitamin B_9)

Folacin or folate, as it is usually called, is the form of vitamin B_9 naturally present in foods, whereas folic acid is the synthetic form added to **fortified** foods and supplements. Both forms are absorbed in the small intestine and stored in the liver. The folic acid form, however, is more efficiently absorbed and available to the body. When consumed in excess of needs, both forms are excreted in urine and easily destroyed by heat, oxidation, and light.

fortified: altered by addition of vitamins or minerals

All forms of this vitamin are readily converted to the coenzyme form called tetrahydrofolate (THFA), which plays a key role in transferring single-carbon methyl units during the synthesis of **DNA** and **RNA**, and in interconversions of amino acids. Folate also plays an important role in the synthesis of neurotransmitters. Meeting folate needs can improve mood and mental functions.

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

RNA: ribonucleic acid, used in cells to create proteins from genetic information

Folate deficiency is one of the most common vitamin deficiencies. Early symptoms are nonspecific and include tiredness, irritability, and loss of appetite. Severe folate deficiency leads to macrocytic **anemia**, a condition in which cells in the **bone marrow** cannot divide normally and red blood cells remain in a large immature form called *macrocytes*. Large immature cells also appear along the length of the **gastrointestinal** tract, resulting in abdominal pain and diarrhea.

anemia: low level of red blood cells in the blood

bone marrow: dividing cells within the long bones that make the blood

gastrointestinal: related to the stomach and intestines

Pregnancy is a time of rapid cell multiplication and DNA synthesis, which increases the need for folate. Folate deficiency may lead to **neural** tube defects such as spina bifida (failure of the spine to close properly during the first month of pregnancy) and anencephaly (closure of the neural tube during fetal **development**, resulting in part of the cranium not being formed). Seventy percent of these defects could be avoided by adequate folate status before conception, and it is recommended that all women of childbearing age consume at least 400 micrograms (µg) of folic acid each day from fortified foods and supplements. Other groups at risk of deficiency include elderly persons and persons suffering from alcohol abuse or taking certain prescription **drugs**.

neural: related to the nervous system

development: the process of change by which an organism becomes more complex

drugs: substances whose administration causes a significant change in the body's function

Vitamin B_{12}

Vitamin B_{12} is found in its free-vitamin form, called cyanocobalamin, and in two active coenzyme forms. Absorption of vitamin B_{12} requires the presence of *intrinsic factor*, a protein synthesized by acid-producing cells of the stomach. The vitamin is absorbed in the terminal portion of the small intestine called the ileum. Most of body's supply of vitamin B_{12} is stored in the liver.

Vitamin B_{12} is efficiently conserved in the body, since most of it is secreted into **bile** and reabsorbed. This explains the slow development (about two years) of deficiency in people with reduced intake or absorption. Vitamin B_{12} is stable when heated and slowly loses its activity when exposed to light, oxygen, and acid or alkaline environments.

bile: substance produced in the liver which suspends fats for absorption

Vitamin B_{12} coenzymes help recycle folate coenzymes involved in the synthesis of DNA and RNA, and in the normal formation of red blood cells. Vitamin B_{12} prevents degeneration of the myelin sheaths that cover nerves and help maintain normal electrical conductivity through the nerves.

Vitamin-B_{12} deficiency results in *pernicious anemia*, which is caused by a genetic problem in the production of intrinsic factor. When this occurs, folate function is impaired, leading to macrocytic anemia due to interference in normal DNA synthesis. Unlike folate deficiency, the anemia caused by vitamin-B_{12} deficiency is accompanied by symptoms of nerve degeneration, which if left untreated can result in **paralysis** and death.

paralysis: inability to move

Since vitamin B_{12} is well conserved in the body, it is difficult to become deficient from dietary factors alone, unless a person is a strict **vegan** and consumes a diet devoid of eggs and dairy for several years. Deficiency is usually observed when B_{12} absorption is hampered by disease or surgery to the stomach or ileum, damage to **gastric mucosa** by alcoholism, or prolonged use of anti-ulcer medications that affect secretion of intrinsic factor. Age-related decrease in stomach-acid production also reduces absorption of B_{12} in elderly persons. These groups are advised to consume fortified foods or take a supplemental form of vitamin B_{12}.

vegan: person who consumes no animal products, including milk and honey

gastric: related to the stomach

mucosa: moist exchange surface within the body

Choline

For many years, choline was not considered a vitamin because the body makes enough of it to meet its needs in most age groups. However, research now shows that choline production in the body is not enough to cover requirements. Choline is not considered a B vitamin because it does not have a coenzyme function and the amount in the body is much greater than other B vitamins. Choline not only helps maintain the structural integrity of membranes surrounding every cell in the body, but also can play a role in nerve signaling, cholesterol transport, and energy metabolism. An "adequate intake" is 550 milligrams per day for men and 425 milligrams per day for women. Choline is widely found in foods, so it is unlikely that a dietary deficiency will occur.

Vitamin C (Ascorbic Acid)

In 1746, James Lind, a British physician, conducted the first **nutrition** experiment on human beings in an effort to find a cure for **scurvy**. However, it was not until nearly 200 years later that ascorbic acid, or vitamin C, was discovered. Vitamin C participates in many reactions by donating electrons as hydrogen **atoms**. In a reducing reaction, the electron in the hydrogen atom donated by vitamin C combines with other participating **molecules**, making vitamin C a reducing agent, essential to the activity of many enzymes. By neutralizing **free radicals**, vitamin C may reduce the risk of heart disease, certain forms of **cancer**, and cataracts.

Vitamin C is needed to form and maintain collagen, a fibrous protein that gives strength to connective tissues in skin, cartilage, bones, teeth, and joints. Collagen is also needed for the healing of wounds. When added to meals, vitamin C increases intestinal absorption of **iron** from plant-based foods. High concentration of vitamin C in **white blood cells** enables the **immune system** to function properly by providing protection against **oxidative** damage from free radicals generated during their action against bacterial, viral, or **fungal** infections. Vitamin C also recycles oxidized vitamin E for reuse in cells, and it helps folic acid convert to its active form, (THF). Vitamin C helps synthesize carnitine, adrenaline, **epinephrine**, the neurotransmitter **serotonin**, the thyroid hormone thyroxine, bile acids, and **steroid** hormones.

A deficiency of vitamin C causes widespread connective tissue changes throughout the body. Deficiencies may occur in people who eat few fruits and vegetables, follow restrictive diets, or abuse alcohol and drugs. Smokers also have lower vitamin-C status. Supplementation may be prescribed by physicians to speed the healing of bedsores, skin **ulcers**, fractures, burns, and after surgery. Research has shown that doses up to 1 gram per day may have small effects on duration and severity of the common cold, but not on the prevention of its occurrence. SEE ALSO VITAMINS, FAT-SOLUBLE.

Kiran B. Misra

nutrition: the maintenance of health through proper eating, or the study of same

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

atoms: fundamental particles of matter

molecule: combination of atoms that form stable particles

free radical: highly reactive molecular fragment, which can damage cells

cancer: uncontrolled cell growth

iron: nutrient needed for red blood cell formation

white blood cell: immune system cell that fights infection

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

fungal: of or from fungi

epinephrine: hormone that promotes "fight or flight;" also called adrenaline

serotonin: chemical used by nerve cells to communicate with one another

steroid: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

Bibliography

Insel, Paul; Turner, Elaine R.; and Ross, Don (2002). *Nutrition.* Sudbury, MA: Jones and Bartlett.

Wardlaw, Gordon M.; Hampl, Jeffrey S.; and Disilvestro, Robert A. (2004). *Perspectives in Nutrition*, 6th edition. New York: McGraw-Hill.

Whitney, Eleanor Noss, and Rolfes, Sharon Rady (2002). *Understanding Nutrition*, 9th edition. Belmont, CA: Wadsworth/Thomson Learning.

Waist-to-Hip Ratio

Waist-to-hip ratio is defined as the measurement of waist circumference divided by hip circumference (for example, a waist measurement of 33 and a hip measurement of 44 give a ratio of .75). It is used as a risk-factor assessment tool for **heart disease**, **hypertension**, and type-2 **diabetes**. Excess body fat is considered a risk factor for the degenerative diseases, particularly abdominal fat, and the waist-to-hip ratio is used to determine the risk. A waist circumference of more than 40 inches in men and more than 35 inches in women, or a waist-to-hip ratio of more than 1.0 for men and more than 0.8 for women, indicate an increased risk for the above diseases. SEE ALSO ANTHROPOMORPHIC MEASUREMENTS; WEIGHT MANAGEMENT.

Simin B. Vaghefi

Water

Water is a colorless and odorless liquid made up of **molecules** containing two **atoms** of hydrogen and one atom of **oxygen**. Water is essential for all life to exist, as it makes up more than 70 percent of most living things. While a human can survive more than a week without food, a person will die within a few days without water.

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

diabetes: inability to regulate level of sugar in the blood

molecule: combination of atoms that form stable particles

atoms: fundamental particles of matter

oxygen: O_2, atmospheric gas required by all animals

Functions

Water serves as a solvent for **nutrients** and delivers nutrients to cells, while it also helps the body eliminate waste products from the cells. Both the spaces between cells (intercellular spaces) and the spaces inside cells (intracellular spaces) are filled with water. Water lubricates joints and acts as shock absorbers inside the eyes and spinal cord. Amniotic fluid, which is largely water, protects the fetus from bumps and knocks.

nutrient: dietary substance necessary for health

Water also helps the body maintain a constant temperature by acting as a thermostat. When a person is too hot, whether from being in a hot **environment** or from intense physical activity, the body sweats. When sweat evaporates, it lowers the body temperature and restores **homeostasis**.

environment: surroundings

homeostasis: regulation of the proper internal state

Sources of Water

About 70 percent of the earth's surface is covered with water. The amount of water in a human body depends on age, gender, body type, and level of physical activity. The bodies of infants up to about twelve months of age contain about 58 percent water; the bodies of children six to seven years of age are 62 percent water; teenage boys are about 59 percent water; and teenage girls are about 45 percent water. The body of an adult male is approximately 62 percent water, while an adult female is 51 percent water. Physically active individuals generally have more water in their bodies than those who are less physically active. Because they sweat more, active people need to replenish water more often, thus raising their water level. A trained male runner may have up to 71 percent water in his body, while a female gymnast may have 70 percent. **Obese** individuals, on the other hand, have a lower percentage of water in their bodies (about 48%). Morbidly

obese: above accepted standards of weight for sex, height, and age

Pakistani villagers pull water from a deep well. Overpumping of groundwater has depleted the water resources of Pakistan and many other nations around the world. *[© Reuters NewMedia Inc./Corbis. Reproduced by permission.]*

obese individuals are only about 36 percent water. In addition, the older one gets, the less water is retained in one's cells. As a result, old skin looks drier and wrinkles appear.

Recommendations

The most efficient way for the body to get water is for a person to drink water. It is recommended that an adult drink eight to ten eight-ounce glasses of water a day. Athletes and active teens should drink at least ten to twelve glasses of water daily. However, many foods and beverages contain water, which can make up part of this daily intake. Fresh fruits and vegetables, cooked vegetables, canned and frozen fruits, soups, stews, juices, and milk are all sources of water. Most fruits and vegetables contain up to 90 percent water, while meats and cheeses contain at least 50 percent. **Metabolic** processes in the human body generate about 2.5 liters of water daily.

metabolic: related to processing of nutrients and building of necessary molecules within the cell

Water Balance

Water balance refers to the balance between the amount of water consumed and the amount of water excreted. The body's water content needs to be constant for optimal functioning. Cells are bathed in **interstitial** fluids (fluids from between cells) that contain nutrients. These fluids also carry metabolic wastes away from the cells. Intracellular fluids facilitate chemical reactions inside the cells, and they help maintain cell structure by adhering to the cell's larger molecules, such as **proteins** and **glycogen**. Body fluids contain solutes (chemical compounds that are soluble in water), which separate into charged particles, or ions, when dissolved in water. Intracellular fluids are high in potassium and phosphate ions, while interstitial fluids are high in sodium and chloride ions. These ions help to maintain the amount of fluids both within and outside the cells. Water molecules follow the solutes moving across cell membranes from a lower to higher solute concentration to maintain homeostasis.

interstitial: between the tissues

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

glycogen: storage form of sugar

Water facilitates a number of critical body functions, from lubricating joints to carrying away cellular waste. Physical activity speeds fluid loss via perspiration. Athletes who do not drink enough water can easily become dehydrated, which can impair physical and mental functioning. Here, soccer star David Beckham drinks from a water bottle during a practice session. *[AP/Wide World Photos. Reproduced by permission.]*

Water Intake Regulation

When the body has lost a lot of water, the concentration of solutes in the blood becomes too high. The solutes attract water from the salivary glands, making the mouth dry and causing a person to feel thirsty. The sense of thirst is a craving for water or other fluids. When water loss is slow, a person may have time to feel thirsty enough to replenish the water loss. In cases where the water loss is excessive and **acute**, however, and replenishment is not adequate, a state of dehydration can occur. Dehydration is a state in which the body has lost so much water that normal physiologic functions cannot take place, resulting in symptoms such as fainting and **nausea**.

acute: rapid-onset and short-lived

nausea: unpleasant sensation in the gut that precedes vomiting

Heat, intense physical activity (profuse sweating), diarrhea, vomiting, and excessive urination can all cause excessive fluid loss. A runner can sweat off six cups of fluid in an hour. Mild dehydration occurs with a loss of 5 percent or less of a person's bodily fluids, moderate dehydration is a loss of 5 to 10 percent of a person's bodily fluids, and severe dehydration is a loss of 10 to 15 percent of fluids. Severe dehydration can cause death. Some clinical signs of dehydration include dry skin, less frequent urination, **fatigue**, light-headedness, dark-colored urine, dry mouth, and lack of skin elasticity. Often, increased fluid intake and replacement of lost **electrolytes** are sufficient oral rehydration therapy for mild dehydration. However, the cause of dehydration has to be addressed for further improvement. In cases of severe dehydration, it may be necessary to hospitalize the person and restore fluid balance through **intravenous** fluid replacement.

fatigue: tiredness

electrolyte: salt dissolved in fluid

intravenous: into the veins

Water Excretion Regulation

The brain and kidneys regulate the amount of water excreted by the body. When the blood volume is low, the concentration of solutes in the blood is high. The brain responds to this situation by stimulating the **pituitary gland** to release an antidiuretic **hormone** (ADH), which signals the kidneys to reabsorb and recirculate water. When the individual needs more water, the kidneys will excrete less and even reabsorb some.

pituitary gland: gland at the base of the brain that regulates multiple body processes

hormone: molecules produced by one set of cells that influence the function of another set of cells

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

enzyme: protein responsible for carrying out reactions in a cell

When excessive fluid loss occurs, the blood volume will fall, as will **blood pressure**. The kidneys respond by secreting an **enzyme** called rennin. Rennin activates the blood protein angiotensinogen to convert to angiotensin, which causes the blood vessels to constrict and blood pressure to rise. Angiotensin also activates the adrenal glands to release a hormone called aldosterone. Aldosterone causes the kidneys to retain sodium and water. When the body needs water, less is excreted and more is retained.

Water Intoxication

edema: accumulation of fluid in the tissues

Water intoxication occurs when there is too much fluid in the body. Excess fluid may collect in bodily tissue, particularly in the feet and legs, a condition called **edema**. Excess consumption of fluids, as well as kidney disorders that reduce urine output, may contribute to water intoxication. The symptoms of water intoxication are confusion, convulsions, and, in extreme cases, death. SEE ALSO DEHYDRATION; DIARRHEA; NUTRIENTS; ORAL REHYDRATION THERAPY.

Kweethai C. Neill

Bibliography

Whitney, Eleanor N., and Rolfes, Sharon R. (2002). *Understanding Nutriton*, 9th edition. Belmont, CA: Wadsworth/Thomson Learning.

Shils Maurice, E., and Young, Vernon R. (1988). *Modern Nutrition in Health and Disease*, 7th edition. Philadelphia, PA: Lea and Febinger.

Weight Loss Diets

overweight: weight above the accepted norm based on height, sex, and age

obese: above accepted standards of weight for sex, height, and age

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

physiological: related to the biochemical processes of the body

basal metabolic rate: rate of energy consumption by the body during a period of no activity

nutrient: dietary substance necessary for health

diet: the total daily food intake, or the types of foods eaten

With over 50 percent of the population of the United States and other industrialized countries being either **overweight** or **obese**, a great number of people want to lose weight. However, weight loss is not easy—and not often successful.

Weight gain is a result of consumed **energy** in the form of high-calorie foods eaten in excess of the body's need for energy. An adult's body needs energy to provide for its **physiological** functions, including heart, kidney, and liver function; blood circulation; respiration; muscle tone; and constant body temperature, called **basal metabolic rate** (BMR), as well as the energy spent in physical activity. An adult woman who is moderately active needs about 2,000 calories per day to meet all her **nutrient** requirements and maintain a healthy weight. She must therefore choose her **diet** carefully, avoiding fast foods and any other high-fat, high-sugar foods, eating a variety of fruits, vegetables, and whole-grain foods, and exercising regularly to avoid depositing excess body fat.

When energy consumption exceeds energy expenditure, excess energy is stored as fat in the body. A person usually gains weight gradually, adding less than a pound per month depending on the level of physical activity and amount and type of food eaten. It is very unusual to gain weight suddenly or at a faster rate than one pound per week. To be successful, the weight loss must also be gradual. Weight loss of one to two pounds per week is recommended, accompanied by a nutrient-dense diet with adequate amounts of high-fiber, whole-grain foods, and exercise.

Eating too few calories may cause the loss of lean muscle tissue as the body withdraws glycogen stored in muscles to fuel the nervous system. The ideal weight-loss diet eliminates excess fat but not muscle, which requires moderate diet restriction and increased physical activity. *[Photograph by Michael Keller. Corbis. Reproduced by permission.]*

In any weight loss attempt the goal is to lose the excess fat that has been accumulated in the body, rather than to lose weight. Therefore, strategies must be chosen carefully to achieve the goal of losing fat. Research has proven that the only long-term way to reduce body fat (and not body **protein** and water, which can be quick but ineffective) is to reduce the intake of high-fat and sugary foods and to exercise regularly. A successful weight loss diet must include adequate amounts of all essential nutrients that the body needs to maintain health. It is important to reduce the fat and concentrated **carbohydrates** (sugar, candy, high-fat and high-sugar desserts, fried foods, fatty meats, and whole-fat dairy products) in the diet, to reduce the intake of red meat and cheese as much as possible, and to avoid soft drinks (soda) and alcohol. However, if such a diet contains less than 1,600 calories per day, health will be compromised. It is also important to exercise regularly (at least thirty minutes per day, or more if the goal is to lose fat faster).

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

In spite of reports appearing in popular news magazines and newspapers on high-protein diets, scientific researchers in the field of **nutrition** believe that although high-protein diets may reduce food intake by inducing early satiety and increasing the thermic effect of foods temporarily, the long-term possibility of kidney problems, bone mineral loss, and other unknown long-term risk factors make these diets unsuitable for weight loss.

nutrition: the maintenance of health through proper eating, or the study of same

Losing weight at a rate of about one to two pounds per week is safe and doable. It takes a deficit of about 3,500 calories to lose a pound of weight, which can be accomplished in a week by cutting out 500 Kcalories per day. However, a young girl who eats 2,000 calories a day and cuts back to 1,500 calories per day may end up being deficient in **iron** and **calcium**. A better strategy would be to reduce calorie intake by 250 and burn the other 250 through exercise. That would equal about three miles of race walking or thirty minutes of bicycling each day. With this strategy, a very adequate, balanced, and normal diet can be followed—one that provides all the necessary nutrients. Individuals can vary the foods they eat without getting tired of "being on a diet." Developing a regular exercise habit will not only aid weight loss but will help a person feel better.

iron: nutrient needed for red blood cell formation

calcium: mineral essential for bones and teeth

Fad Diets and Weight Cycling

Many fad diets promise fast weight loss with little effort. However, any program that offers quick and easy results must be viewed with suspicion. If there were any way to easily lose weight there would not be so many overweight and obese people around. Many people fall for these promises and start to lose weight (not fat), but they soon become tired or give themselves a vacation from dieting and gain the lost weight back, plus some more. Remembering their initial weight loss, they then go back on the diet and lose some of the gained weight, but not all of it. Repeating this cycle several times they end up gaining weight because each time they went off the diet they gained a little more weight than what they had lost.

This practice is called "weight cycling" or "yo-yo dieting." As an individual starts reducing his or her food energy intake, body cells sense the reduced energy and nutrients and start economizing in terms of energy expenditure in BMR. Therefore, less heat is produced by the body and less involuntary activity and physiological functioning are performed. As soon as the individual resumes his or her pre diet food habit, more fat is deposited in the body, resulting in a faster rate of weight gain. Repeating this cycle a few times results in a net weight gain rather than weight loss. Under these conditions the body composition also changes, and the percentage of body fat is increased. This increases the risk of degenerative diseases such as **obesity**, **type II diabetes**, **cardiovascular** disease, **hypertension**, and **cancer**.

obesity: the condition of being overweight, according to established norms based on sex, age, and height

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

cardiovascular: related to the heart and circulatory system

hypertension: high blood pressure

cancer: uncontrolled cell growth

In order to avoid these problems, an individual interested in losing weight should follow these recommendations:

- Do not believe or follow any of the fad diets that promise easy and quick weight loss, because there is no such thing.
- Combine weight reduction programs with exercise, which not only utilizes more energy, but also increases lean body tissue (muscle fibers), which in turn increases BMR.
- Make sure that one's diet is varied, adequate in all essential nutrients, and includes adequate numbers of servings of fruits, vegetables, and whole-grain products.
- Try to lose body fat rather than body weight by following an exercise program that includes resistance training as well as **aerobic** activity.
- Be patient and lose weight gradually. Remember, weight gain did not happen fast, and neither will weight loss.
- Avoid weight cycling. SEE ALSO DIETING; FAD DIETS; OBESITY; YO-YO DIETING.

Simin B. Vaghefi

aerobic: designed to maintain adequate oxygen in the bloodstream

Bibliography

Eisenstein, J.; Roberts, S.; Dallal, G.; and Saltzman, E. (2002). "High-Protein Weight-Loss Diets: Are They Safe and Do They Work? A Review of the Experimental and Epidemiological Data." *Nutrition Review* 60:189–197.

Weight Management

Obesity is a **chronic** condition, meaning it is unlikely to be cured, so **behavioral** interventions are needed to help people change their habits and

obesity: the condition of being overweight, according to established norms based on sex, age, and height

chronic: over a long period

behavioral: related to behavior, in contrast to medical or other types of interventions

improve their quality of life and their **psychological** functioning. The goal of weight management for **obese** people is to help them improve their unhealthful dietary and **sedentary** habits.

psychological: related to thoughts, feelings, and personal experiences

obese: above accepted standards of weight for sex, height, and age

sedentary: not active

stress: heightened state of nervousness or unease

Weight-Management Strategies

Behavioral change interventions typically include a number of specific strategies, including self-monitoring, stimulus control, cognitive restructuring, **stress** management, social support, rewards, problem solving, physical activity, and relapse prevention. These interventions make it easier for people to stay on a healthful eating plan and a regular exercise program.

Self-monitoring.

The most important behavioral strategy for obese people to follow is self-monitoring—the observing and recording of behavioral patterns, followed by feedback on the behaviors. The obese person should keep a written notebook of all food that is ingested. This is best done on a regular basis, with entries written in a log as soon as possible after the food is eaten. Feedback means looking up and recording the number of **calories** that each food contained. In addition, it is also helpful to record the time of day that food is eaten, as well as one's mood, location, and other people present.

calorie: unit of food energy

The number of minutes engaged in brisk walking or other physical activity should be recorded in the same notebook. In addition, a bathroom scale should be used to record one's weight on a daily basis. The primary goal of self-monitoring is to serve as a reminder of one's eating and exercise patterns. Results of such record keeping are clear: people who self-monitor lose more weight than those who do not. If a person uses only one weight-management strategy, it should be self-monitoring.

Stimulus control.

Stimulus control involves identifying the major barriers that are associated with unhealthful eating habits and sedentary patterns. Modifying these barriers by controlling environmental stimuli can help persons manage their weight-control behaviors. For example, one of the most common barriers to weight loss is a lack of time to exercise. Strategies to help persons find time during the day to exercise, such as setting their alarm clock to wake them up 45 minutes earlier and laying out exercise clothes and shoes before going to bed, are therefore important. When people get up earlier and exercise for even a few days, they tend to feel good about themselves and slowly develop the exercise habit. Other common stimulus-control strategies include avoiding high-risk places (such as a donut shop or **fast-food** restaurant), parking at the far end of the supermarket parking lot, and cleaning out the refrigerator and throwing out all high-calorie foods.

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

Cognitive restructuring.

Cognitive restructuring means changing the way people think about themselves. For example, some people think that they can lose a lot of weight quickly, such as thirty pounds in thirty days. Cognitive restructuring involves helping people set more realistic goals, such as losing about one pound a week and focusing on quality of life and improved health, not just cosmetic goals such as looking better.

Stress management.

Stress is one of the major predictors of abandoning a weight-loss or weight-control regimen. It triggers unhealthful eat-

One of the most important behavioral changes associated with weight management is the development of a regular, vigorous exercise routine. Not only does such a routine help burn calories, but it can profoundly improve a person's overall sense of well-being. *[William Thomas Cain/Getty Images. Reproduced by Permission.]*

binge: uncontrolled indulgence

ing patterns and is often associated with **binge** eating. Stress management involves teaching people to identify stressful situations and to learn to counteract the stress or tension. Strategies like brisk walking or jogging, meditating, or learning a relaxation response such as deep breathing can help reduce stress and provide distraction from the stress-producing situation.

Social support. Good friends, family members, education classes, community programs, and other social activities can serve as good social-support

networks. People with good support networks do better in weight management than people trying to make changes on their own. For example, walking with neighbors in the morning helps build relationships and may help people handle stressful situations in a better way.

Rewards. Rewards for behavior change can help motivate people and reinforce healthful diets and exercise. Rewarding weight loss should be discouraged, however, because some people tend to use unhealthy strategies to achieve their goals. It is better to encourage specific behaviors, such as a certain number of minutes of exercise per day. Small rewards for small behavior changes make good sense for most people.

Problem solving. Problem solving involves identifying and correcting high-risk situations involving one's eating and exercise habits. High-risk situations are usually emotional or social. For example, being invited to a new restaurant may make a person feel anxious. A problem-solving approach may involve calling the restaurant ahead of time and asking for healthful, calorie-controlled suggestions. Bringing a low-calorie vegetable plate to a party may make it easier to stay away from the high-calorie fried chicken wings. Problem solving means planning ahead for high-risk situations. SEE ALSO APPETITE; CRAVINGS; EATING HABITS; EXERCISE; FAD DIETS; WEIGHT LOSS DIETS.

John P. Foreyt

A skin fold test measures the thickness of a fold of skin using calipers. With this data it is possible to estimate what percentage of a person's body mass is fat. *[Photograph by Sean Aidan; Eye Ubiquitous/Corbis. Reproduced by permission.]*

Bibliography

Perri, Michael, and Foreyt, John P. (2003). "Preventing Weight Regain after Weight Loss." In *Handbook of Obesity*, edited by George Bray and Claude Bouchard. New York: Marcel Dekker.

Poston, Walker, S. C.; Hyder, M. L.; O'Bryne, K. K.; and Foreyt, John P. (2000). "Where Do Diets, Exercise, and Behavior Modification Fit in the Treatment of Obesity?" *Endocrine* 13:187–192.

Wadden, Thomas A., and Stunkard, Albert J., eds. (2002). *Handbook of Obesity Treatment*. New York: Guildford Press.

Wellness

Wellness is a state of being in good health, both physically and mentally, and of being free of (and not at risk for) illness. To maintain wellness, individuals need to follow a regimen of periodic risk assessment and adopt behavior changes that lead to a lower risk of acquiring certain diseases. Wellness is the goal behind efforts at health promotion and disease prevention and includes physical fitness, optimal **nutrition**, and spiritual, social, and emotional health.

wellness: related to health promotion

nutrition: the maintenance of health through proper eating, or the study of same

Wellness exists on a continuum ranging from disease and disability to optimal health (the illness/wellness continuum). The promotion of wellness is intended to encourage people to change their high-risk behaviors in order to enjoy a disease-free and fulfilling life. Prescribed changes in behavior can result in the development of an individual's full potential. SEE ALSO HEALTH.

Simin B. Vaghefi

In her 1903 book titled *Education,* Ellen G. White wrote, "Grains, fruits, nuts, and vegetables, in proper combination, contain all the elements of nutrition; and when properly prepared, they constitute the diet that best promotes both physical and mental strength." *[AP/Wide World Photos. Reproduced by permission.]*

nutrition: the maintenance of health through proper eating, or the study of same

diet: the total daily food intake, or the types of foods eaten

drugs: substances whose administration causes a significant change in the body's function

White, Ellen G.

American religious leader and writer
1827–1915

Ellen Gould White was born eight miles east of Portland, Maine, in 1827, during a time characterized by the news analyst and commentator John Harvey as "an era of medical ignorance bordering on barbarism ... when doctors were still bloodletting and performing surgery with unwashed hands." With little education, Ellen White became a prolific writer and a strong advocate of good **nutrition**.

Her parents, Robert and Eunice Harmon, had eight children, including Ellen's twin sister, Elizabeth. They were followers of William Miller, who espoused the second coming of Christ, and part of the Millerite movement, which later led to the founding of the Seventh-day Adventist Church. In 1846, Ellen married James White, who was a preacher and a cofounder of the Seventh-day Adventist Church. The couple had three sons, and they eventually made their home in Battle Creek, Michigan.

Though shy and reluctant, Ellen White was to become a popular lecturer on temperance. Initially unaccustomed to being vegetarian, she became convinced that she should adopt a meatless **diet** (though this was not required by the Church). Other foods, such as coffee and strong cheese, also were eliminated from her table. Not all her books were about health, however. Over her lifetime, she produced a steady amount of work, some devotional, some historical, and some educational in nature.

On June 6, 1863, White had a vision that included instructions on such health-related matters as the use of **drugs**, tobacco, tea, coffee, flesh foods, fresh air, and self-control regarding one's diet. Speaking of this experience, she said, "I saw that it was a sacred duty to attend to our health, and to arouse others to their duty.... We have a duty to speak, to come out against intemperance of every kind.... I saw that we should not be silent upon the subject of health, but should wake up minds to the subject" (Robinson, p. 77–78).

During her prolific lifetime, White produced some 125 books and pamphlets, as well as thousands of articles. While she agreed with other health advocates on many issues, she resolved to write out the principles given to her in her visions. Two of her books, *The Ministry of Healing* (1905), and *Counsels on Diet and Food* (1938), address nutrition, health, and temperance issues.

White promoted the use of natural remedies, advocated dress reform, promoted moderation, and was a strong guiding force in the development of the Western Health Reform Institute, which would become the Battle Creek Sanitarium. In 1903, when John Harvey Kellogg offered his book *The Living Temple* as a means to raise money for the rebuilding of the Battle Creek Sanitarium, she objected to both his plans to rebuild and to pantheistic ideas presented in the book.

In later years she was instrumental in providing vision and inspiration for the building of hospitals in Paradise Valley, Glendale, and Loma Linda, California.

White also traveled and spoke to large gatherings throughout her lifetime, spending ten years in California (1881–1891) and nine years in Australia (1891–1900). She then moved to a home near St. Helena, California,

where she lived until her death on July 16, 1915. SEE ALSO BATTLE CREEK SANITARIUM, EARLY HEALTH SPA; RELIGION AND DIETARY PRACTICES; VEGETARIANISM.

Louise E. Schneider

Bibliography

Coon, Roger (1993). "Reexamining the Adventist Health Message—1: The Good Old Days." *Adventist Review* 10–12.

Graybill, Ron (1992). "The Whites Come to Battle Creek: A Turning Point in Adventist History." *Adventist Heritage.*

Robinson, Dores Eugene (1943). *The Story of Our Health Message.* Nashville, TN: Southern Publishing Association.

Internet Resources

White, Arthur L. "Ellen G. White: A Brief Biography." Available from <http://www.whiteestate.org>

Whole Foods/Diet

The term *whole foods* refers to foods that have not been processed or refined, including whole grains, beans, nuts, seeds, fruits, and vegetables. Whole foods contain compounds known as **phytochemicals** that may reduce the risk for many diseases. In addition, whole grains, such as brown rice and whole wheat, include the whole kernel of the germ, which includes elements such as **fiber** that make them more nutritious than refined grains.

phytochemical: chemical produced by plants

fiber: indigestible plant material which aids digestion by providing bulk

The typical North American **diet**, however, is high in **processed foods** like white bread, potato chips, and desserts made with white flour and white sugar. In these foods, the fiber, **vitamins**, **minerals**, and phytochemicals normally found in whole foods are missing, at least in part. While processed foods used in moderation can be part of a healthful diet, a whole-foods diet provides **nutrients** and health benefits that the typical American diet does not provide. SEE ALSO FIBER; PLANT-BASED DIETS; VEGETARIANISM.

diet: the total daily food intake, or the types of foods eaten

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

mineral: an inorganic (non-carbon-containing) element, ion or compound

nutrient: dietary substance necessary for health

Cheryl A. Flynt

WIC Program

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is funded and administered by the Food and Nutrition Service of the United States Department of Agriculture in partnership with states and local agencies. Its purpose is to serve as an adjunct to good health care during critical times of growth and **development** in order to prevent the occurrence of health problems. It serves pregnant and breastfeeding women, as well as children up to five years of age. Eligibility criteria include poverty and an identified medical or nutritional risk. Program benefits include nutritious foods, nutrition education, and referrals to maternal and child health services.

development: the process of change by which an organism becomes more complex

History

As an amendment to the Child Nutrition Action of 1972, Congress created the Special Supplemental Food Program for Women, Infants, and Children

The WIC program provides aid recipients with checks, much like food stamps, that can be exchanged for certain foods. The foods allowed include cereal, juice, and other nutritious items essential to growing children's health. 45 percent of babies born in the United States get food aid from WIC.

Food Stamp Participation, 1970-1995

Year	Number of Recipients in millions	Cost
1970	4.3 million	$577 million
1975	17.1	4.6 billion
1980	21.1	9.2
1985	19.9	11.7
1990	20.1	15.5
1995	26.6	24.6

(WIC) as a pilot project. Support came from evidence of the importance of maternal nutrition for positive pregnancy outcomes, and of the potential for permanent physical damage to **malnourished** infants and small children. To further define the intent of the program, nutrition education became a mandated part of the program in 1975. By 1975 the WIC program served approximately 500,000 participants in forty-eight states, Puerto Rico, the Virgin Islands, and two Tribal Organizations. WIC's name was changed under the Healthy Meals for Healthy Americans Act of 1994. Now known as the Special Supplemental Nutrition Program for Women, Infants, and Children, the program serves more than 7 million women and children and covers every state, the District of Columbia, Puerto Rico, the Virgin Islands, American Samoa, Guam, and thirty-three Tribal Indian Organizations, as well as eligible Department of Defense personnel overseas.

malnourished: lack of adequate nutrients in the diet

How the Program Works

The mission of the WIC program is to safeguard the health of low-income women, infants, and preschool children who are at nutritional risk by providing at no cost: (1) healthful foods to supplement diets, (2) information on healthful eating, and (3) referrals to health care. Income guidelines include those families whose gross income falls at or below 185 percent of the U.S. Poverty Income Guidelines. These guidelines change annually, so that for 2002-2003 a family of two could earn up to $22,089 annually, or $425.00 weekly. Nutritional risk is classified into two major categories: (1) medically based risks, such as **anemia**, underweight or **overweight**, and insufficient growth; and (2) diet-based risks, such as inadequate dietary patterns.

anemia: low level of red blood cells in the blood

overweight: weight above the accepted norm based on height, sex, and age

iron: nutrient needed for red blood cell formation

fortified: altered by addition of vitamins or minerals

WIC currently serves 45 percent of all babies born in the United States. As the name of the program implies, babies up to twelve months of age are considered infants. They are eligible to receive **iron-fortified** infant formula, infant juice, and dry infant cereals. Children up to five years of age receive iron-fortified cereal, fruit and vegetable juices that are a good source of vitamin C, eggs, milk, cheese, peanut butter, and dried beans and peas. Pregnant women receive larger packages of the same foods that children receive. Following pregnancy, mothers who exclusively breastfeed their babies may receive more foods, including raw carrots and canned tuna, and they are eligible up to one year after the birth of their baby. Those women who do not breastfeed may be eligible up to six months after the birth of their baby. The WIC foods may be obtained at grocery stores. Further, participants can obtain fresh, locally grown fruits, vegetables, and herbs at WIC-authorized Farmers' Markets during the summer and fall harvest months in

A new mother receives counseling at a WIC clinic. Other services available at the clinics include dental care, immunizations and various health screenings. *[Photo by Ken Hammond. © USDA Photography Center.]*

some locations. WIC foods supply **nutrients** that are generally considered lacking in the diets of low-income populations, such as **protein**, **calcium**, iron, and **vitamins** A and C.

nutrient: dietary substance necessary for health

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

calcium: mineral essential for bones and teeth

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

Mandatory provision of nutrition education sets the WIC program apart from other federally funded food programs. The focus of the education is to address participants' specific nutrition needs and to positively affect nutrition and health habits. Education for pregnant women focuses on making food choices that will allow optimal weight gain for good fetal growth. Funding for promotion and support of breastfeeding became a requirement of the program starting in 1989. Parents and caregivers are educated on healthy feeding relationships and the importance of offering age-appropriate, healthful foods to foster proper growth and development. In addition to food and nutrition education, the WIC program encourages the use of prenatal and other medical and social services. Referrals are frequently made to physicians and to other social assistance and health programs, including dental care, alcohol and drug assistance, child care, and housing.

Outcomes and Evaluation

The WIC program has been deemed a success because it has achieved its initial goals, and because other beneficial outcomes have been identified. The initial goals of increasing length of pregnancies, decreasing early births and low birth weights, increasing use of prenatal care and decreasing the **incidence** of iron-deficiency anemia in infants and children have all been achieved. This is partially due to a higher intake of ten nutrients, including the targeted nutrients iron and vitamin C. Increased rates of breastfeeding, as well as improved growth rates, have also been attributed to the WIC program. WIC program enrollment has also significantly improved the nutritional status of pregnant women. Unexpected benefits include a savings in health care costs from $1.77 to $3.13 for each dollar spent on WIC. Further,

incidence: number of new cases reported each year

in terms of school achievement, WIC children have improved vocabulary scores and memory of numbers.

New Directions

Due to the success of the program, other issues that affect this population have been added to the services of WIC clinic visits. Participant screening now includes issues such as dental care; lead screening; physical, sexual, or verbal abuse; alcohol, drug, and tobacco use; voter registration; immunizations; and family reading practices. This "melting pot" of health and education initiatives has placed the WIC program in a position of being an important partner in promoting the health and nutritional status of mothers and children. SEE ALSO COMMODITY FOODS; INFANT NUTRITION; PREGNANCY; PRESCHOOLERS AND TODDLERS, DIET OF.

Isabel Parraga
Sharon Doughten

Internet Resources

U.S. Department of Agriculture, Food and Nutrition Service. "The WIC Program." Available from <http: //www.fns.usda.gov/wic>

Wilson, Owen

American pediatrician
1870–1960

development: the process of change by which an organism becomes more complex

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

A portrait of Owen Wilson. In the preface of "The Care and Feeding of Southern Babies," Wilson said that other similar works focused on childrearing in cooler climates, and therefore were inapplicable to infants in the southern United States. *[Eskind Library, Vanderbilt University.]*

A native of Tennessee, Owen Wilson was a pioneer in pediatric medicine. Born on July 20, 1870, he entered Vanderbilt University in 1884, at the age of fourteen, and graduated with an engineering degree in 1889. He immediately enrolled in Vanderbilt University's Medical School, and graduated two years later. Wilson pursued additional training at New York Polyclinic Medical School and Hospital.

After practicing with a prominent Nashville surgeon for several years, Wilson decided to specialize in children's diseases. He established a large pediatric practice in Nashville and served as Professor of Pediatrics at Vanderbilt University Medical School from 1909 through 1942.

In 1926, Wilson published a book entitled *The Care and Feeding of Southern Babies: A Guide for Mothers, Nurses, and Baby Welfare Workers in the South*. Wilson believed that babies in the southern United States, because of climate and family food habits, required different feeding guidelines than those generally given in the early twentieth century. In his book, Wilson offered instruction on the care and feeding of children from birth until age three, and he included tables of height, weight, and child **development**, as well as some recipes. Only three hundred copies of this book were published. Wilson suffered from a fatal **heart attack** on May 10, 1960. SEE ALSO BEIKOST; BREASTFEEDING; INFANT NUTRITION.

Karen Bryla

Internet Resources

Vanderbilt University Medical Center. "Infant Feeding." Available from <http://www.mc.vanderbilt.edu/biolib/hc/nh4.html>

Vanderbilt University Medical Center. "Owen Wilson." Available from <http://www.mc.vanderbilt.edu/biolib/hc/Month/october.html>

Women's Nutritional Issues

Women have special nutritional needs due to hormonal changes that occur with menstruation, pregnancy, lactation, and **menopause**, all of which alter the recommended daily intake of **nutrients**. Of the many diseases that affect women, five have a scientific-based connection to **nutrition**: iron-deficiency **anemia**, **osteoporosis**, **heart disease**, type 2 **diabetes**, and some types of **cancer**. In addition, many women look to nutrition for the management of premenstrual and **menopausal** symptoms.

menopause: phase in a woman's life during which ovulation and menstruation end

nutrient: dietary substance necessary for health

nutrition: the maintenance of health through proper eating, or the study of same

anemia: low level of red blood cells in the blood

osteoporosis: weakening of the bone structure

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

diabetes: inability to regulate level of sugar in the blood

cancer: uncontrolled cell growth

menopausal: related to menopause, the period during which women cease to ovulate and menstruate

Anemia

Iron-deficiency anemia is a very common nutritional disorder among females following the beginning of the menstrual cycle. Iron deficiency is also common among females with poor diets or very low body weight. The recommended intake of iron for females is 15 to 18 milligrams (mg) per day. Good sources of iron include red meat, dark green leafy vegetables, **legumes**, and **fortified** breads and cereals.

legumes: beans, peas and related plants

fortified: altered by addition of vitamins or minerals

Nutrition for Pregnancy and Breastfeeding

Good nutrition is important during pregnancy and breastfeeding, as there is an increased need for **calories** and for most nutrients. A particularly important nutrient during pregnancy is folic acid, one of the **B vitamins**. Folic acid reduces the chance of having a baby with birth defects of the brain and spinal cord. Experts recommend that women of childbearing age consume 400 micrograms (μg) of folic acid every day. Pregnant women should consume 600 μg per day. Good sources of folic acid include dark green leafy vegetables, oranges and orange juice, dried beans and peas, and fortified breads and cereals.

calorie: unit of food energy

B vitamins: a group of vitamins important in cell energy processes

Adequate **calcium** intake during both pregnancy and breastfeeding is also important, since calcium is drawn from the mother. The recommended intake of calcium during pregnancy and lactation is 1,000 mg a day. A pregnant or lactating teenager needs 1,300 mg of calcium a day. Before becoming pregnant, a woman should discuss folic acid or calcium supplementation with a physician, as well as multivitamin supplementation.

calcium: mineral essential for bones and teeth

Hormonal changes during pregnancy may trigger a condition called gestational diabetes. Gestational diabetes is characterized by high levels of sugar in the blood. The condition can be diagnosed by a screening test between the twenty-fourth and twenty-eighth week of pregnancy. Changes in **diet** and exercise are often sufficient to keep blood sugar levels in the normal range. For most women, the condition goes away after the birth of the baby. Women who have gestational diabetes are more likely to develop type 2 diabetes later in life.

diet: the total daily food intake, or the types of foods eaten

PMS and Menopause

Many women seek medical help for premenstrual syndrome (PMS). While nutrition advice often varies, there is insufficient scientific evidence that any diet modifications will prevent or relieve PMS symptoms. A combination of good nutrition, exercise, and **stress** management may be the best way to relieve the symptoms of PMS.

stress: heightened state of nervousness or unease

isoflavones: estrogen-like compounds in plants

Soy has garnered much attention in recent years as a dietary treatment for menopausal symptoms. Soy is a rich source of **isoflavones**, an estrogen-like substance found in plants. Some studies suggest that regularly eating moderate amounts of soy-based food products can help decrease menopausal symptoms; however, other studies do not support the idea. More research is needed to gain a better understanding of the effects of soy on menopausal symptoms.

metabolism: the sum total of reactions in a cell or an organism

During menopause, a woman's **metabolism** slows down and weight gain can occur. The accumulation of body fat around the abdomen also increases. Exercise and careful food choices can minimize both of these occurrences.

Chronic Diseases

overweight: weight above the accepted norm based on height, sex, and age

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

As women age, the risk of developing chronic disease increases. Women over age forty-five who are **overweight**, physically inactive, and have a family history of diabetes are more likely to develop type 2 diabetes. Maintaining a healthy weight, eating a varied and balanced diet, and engaging in an active **lifestyle** can reduce the risk of developing type 2 diabetes. Diabetes carries many risks with it, including eye disease, nerve disease, kidney disease, and heart disease.

Women are at a higher risk of developing osteoporosis as they age than men are. Osteoporosis is an irreversible disease in which the bones become porous and break easily. There are many factors that contribute to this disease, including **genetics**, diet, **hormones**, age, and lifestyle factors. The disease usually has no symptoms until a fracture occurs.

genetics: inheritance through genes

hormone: molecules produced by one set of cells that influence the function of another set of cells

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

Diets low in calcium, **vitamin D**, or magnesium—or high intakes of caffeine, alcohol, sodium, phosphorous, or **protein**—may increase the chance of developing osteoporosis. Good nutrition and weight-bearing exercise, such as walking, hiking, or climbing stairs, helps to build strong bones.

Good sources of calcium include low-fat dairy products such as cheese, yogurt, and milk; canned fish with bones, such as salmon and sardines; dark green leafy vegetables; and calcium-fortified foods such as orange juice, bread, and cereal. The recommended intake of calcium for women ages nineteen to fifty is 1,000 mg per day. Women over the age of fifty should consume 1,200 mg of calcium per day.

obese: above accepted standards of weight for sex, height, and age

sedentary: not active

Breast cancer is the most common type of cancer among U.S. women other than skin cancer. **Obese**, **sedentary** women are more likely to develop breast cancer, and dietary factors may possibly play a role in its development. Some studies suggest that excessive fat intake may increase breast-cancer risk, either by raising estrogen levels in a woman or by altering immune function. Diets that include adequate amounts of fruits, vegetables, and other fiber-rich foods may protect against breast cancer. However, controversy exists as to whether diet is actually a contributing factor. Excessive alcohol consumption does appear to raise the risk of breast cancer in women.

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

The risk of developing heart disease begins to rise once a woman reaches menopause, and it increases rapidly after age sixty-five. Dietary risk factors involved in the cause or prevention of heart disease include dietary **antioxidants**, dietary fiber, and the type and amount of fat in the diet. Antioxidants are non-nutrient compounds in foods that protect the body's cells from damage. They are found in fruits and vegetables. Soluble fiber, such as the fiber

Women over the age of 45 are susceptible to a variety of chronic conditions including type 2 diabetes, osteoporosis, breast cancer, and heart disease. Proper nutrition and physical activity can help prevent these diseases. *[Corbis. Reproduced by permission.]*

in oatmeal, helps to lower blood **cholesterol** levels, while levels of cholesterol in the blood increase in response to diets high in total fat and/or **saturated fat**. A high level of cholesterol in the blood is a risk factor for heart disease.

Hypertension, or **high blood pressure**, is related to heart disease. After menopause, women with hypertension outnumber men with the condition. Weight control, an active lifestyle, a diet low in salt and fat, and with plenty of fruits and vegetables may help to prevent hypertension.

Good nutrition is the cornerstone of good health for a woman, but the many phases of a woman's life require nutritional adjustments. Learning and following dietary recommendations, and making the appropriate nutritional adjustments, can improve a woman's quality of life and reduce the risk of chronic disease. SEE ALSO ADULT NUTRITION; MENOPAUSE; OSTEOPOROSIS; PREGNANCY; PREMENSTRUAL SYNDROME; WEIGHT MANAGEMENT.

Beth Fontenot

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down that unsaturated fats

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

Bibliography

Grosvenor, Mary B., Smolin, Lora A. (2002). *Nutrition: From Science to Life*. Philadelphia, PA: Harcourt College Publishers.

Mitmesser, Susan Hazels (2003). "Nutrition Needs and Cardiovascular Risk in Women." *Today's Dietitian* 5(10):30–33.

Internet Resources

American Dietetic Association. "Women's Health and Nutrition." Available from <http://www.eatright.org>

Food and Nutrition Information Center. "Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA)." Available from <http://www.nal.usda.gov/fnic>

March of Dimes. "Folic Acid FAQ." Available from <http://www.marchofdimes.com>

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. "Information for Pregnant Women." Available from <http://www.cfsan.fda.gov>

WebDietitian. "Nutrition in Women's Health." Available from <http://www.webdietitian.com>

WHO and SARS

As Severe Acute Respiratory Syndrome (SARS) broke out in China in 2002, some of the earliest alerts were provided by the Global Public Health Intelligence Network (GPHIN), an automated system that WHO uses to scan Web sites and electronic discussion groups for signs of disease outbreaks that could lead to epidemics. Another WHO system, the Global Outbreak Alert and Response Network (GORAN) links 112 existing networks to monitor and respond to outbreaks of infectious diseases. As SARS came to light, WHO drew on these resources to establish a virtual network of eleven leading laboratories. Using a shared Web site and daily teleconferences to pool information and coordinate activities, they worked to identify the cause of the disease and develop a diagnostic test. WHO's quick response in issuing global alerts and travel advisories and in coordinating international resources have been credited with helping to efficiently contain the spread of the disease.

—Paula Kepos

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

nutrition: the maintenance of health through proper eating, or the study of same

parasitic: feeding off another organism

viral disease: disease caused by viruses, including flu, colds, AIDS, hepatitis, and others

drugs: substances whose administration causes a significant change in the body's function

World Health Organization (WHO)

The World Health Organization (WHO), headquartered in Geneva, Switzerland, is an international group of one hundred and ninety-one member states devoted to the maintenance and improvement of the health of all people throughout the world. Member states are divided into six geographic regions: Southeast Asia, the Eastern Mediterranean, the Americas, Africa, the Western Pacific, and Europe. The director general of the organization oversees the mission to preserve, maintain, and improve health through education, nutritional support, health activities, management of disease outbreaks, response to emergencies, and funding programs.

History and Mission

In 1945, three physicians, Drs. Szeming Sze of China, Karl Evang of Norway, and Geraldo de Paula Souza of Brazil, proposed the formulation of a single health organization that would address the health needs of the world's people. Their joint declaration to establish an international health organization was approved when the constitution of the WHO was adopted in 1946.

The preamble to the constitution defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." The initial priorities for world health care included initiatives to address **malaria**, maternal and child health, **tuberculosis**, venereal diseases, **nutrition** and environmental sanitation, public health administration, **parasitic** diseases, **viral diseases**, mental health, and other activities.

WHO Programs

The WHO provides preventive health and improvement of nutritional status through programs that address:

1. Health education
2. Food, food safety, and nutrition
3. Safe water and basic sanitation
4. Immunizations
5. Prevention and control of local endemic diseases
6. Treatment of common diseases and injuries
7. Provision of essential **drugs.**

Special programs include the Applied Nutrition Program, which began in 1960 and attempts to improve the nutritional health of people worldwide. Strategic action plans have been developed to promote breastfeeding, support production of foods that improve local diets, distribute supplementary foods, and provide health education. These plans include multiple factors that address the specific needs of each region. The targets of action to accomplish the plans are nutritonal education, safe diets, and healthy choices for living.

Food safety is another major focus of WHO special programs. Through the Food Safety Program, contaminants of water and food are identified, with efforts targeted at providing clean sources of food and/or water. Environmental health centers serve as the clearinghouse for activities to support

In May 2002, 192 nations gathered as the World Health Organization held its 55th annual World Health Assembly. One of the key resolutions to emerge from the assembly was a commitment to help poorer nations obtain needed medicines at discounted rates. *[Copyright World Health Organization (WHO)/P. Virot]*

improvement of **undernutrition** of infants, deficiencies of iodine, vitamin A, and thiamine; **anemia**, and other nutritional concerns.

Together with UNICEF, the WHO has been successful in overseeing programs to promote breastfeeding and improve the health and nutritional status of pregnant women, infants, and mothers with young children. Hospitals and regional centers have played an important part in the success of this endeavor.

Finally, programs aimed at improving the land and planting crops such as cereals, rice, corn, and potatoes have been introduced in all regions. These programs include production of nutritionally adequate foods to feed those

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

anemia: low level of red blood cells in the blood

in each region, while also providing education and work opportunities for the people of each region.

Ruth Waibel

Bibliography

Sze, Seming (1982). *The Origins of the World Health Organization: A Personal Memoir 1945–1948*. Boca Raton, FL: LISZ.

Sze, Szeming (1988). "WHO: From Small Beginnings." *World Health Forum* 9(1):29–34.

Internet Resources

World Health Organization (1988). "Fifty Years of the World Health Organization in the Western Pacific." Available from <http://www.wpro.who.int/public policy/50th>

World Health Organization (2001). "Report of the Commission on Macroeconomics and Health 2001." Available from <http://www.cmhealth.org>

X

Xerophthalmia

Xerophthalmia is a severe drying of the eye surface caused by a malfunction of the tear glands. Also found in people with immune disorders, it occurs most commonly because of decreased intake or **absorption** of vitamin A. Symptoms include night blindness and eye irritation. In addition to the eyes being very dry, there is a loss of luster on their surface. At later stages, the corneas become soft, with increased **opacity**.

absorption: uptake by the digestive tract

opacity: impermeability to light

Rarely seen in industrialized countries, xerophthalmia remains the leading cause of childhood blindness in the developing world. Up to ten million cases occur among children every year due to a dietary deficiency of vitamin A, and 5 percent of these children become blind.

Xerophthalmia is treated with artificial eye moisturizers and vitamin A supplementation. In 1999 a genetically engineered form of rice was created that contains up to 20 percent beta-carotene, a rich source of vitamin A. It is hoped that this grain, known as *golden rice*, will alleviate much of the world's vitamin A deficiency. However, critics maintain that the volume of rice needed to reach the daily recommended amount of vitamin A is too excessive to be practical. In addition, lingering concerns about the safety of genetically engineered foods may affect its use. SEE ALSO BETA-CAROTENE; CAROTENOIDS; VITAMINS, FAT-SOLUBLE.

Chandak Ghosh

Internet Resources

National Institutes of Health Clinic Center. "Vitamin A and Carotenoids." Available from <www.cc.nih.gov>

Merck Manual. "Vitamin A Deficiency." Available from <www.merck.com/pubs/mmanual>

Y

Yo-Yo Dieting

Yo-yo dieting, or weight cycling, is the repeated losing and regaining of weight. This phenomenon is very common in societies that place an em-

phasis on being thin. People who lose weight through dieting often regain weight in a short time, and they often add more weight than they lost. Yo-yo dieting may increase the risk of developing **heart disease**, **hypertension**, and **diabetes**. It may also increase emotional distress and contribute to a sense of failure and low self-esteem. SEE ALSO WEIGHT LOSS DIETS; WEIGHT MANAGEMENT.

Frances M. Berg

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

hypertension: high blood pressure

diabetes: inability to regulate level of sugar in the blood

Bibliography

Lissner, L.; Odell, P.; D'Agostino, D.; and Stoke, J.; et al. "Variability of Body Weight and Health Outcomes in the Framingham Population." *New England Journal of Medicine* 324:1839–1844.

Brownell, K., and Rodin, J. (1994). "Medical, Metabolic, and Psychological Effects of Weight Cycling." *Archives of Internal Medicine* 154:1325–1330.

This page intentionally left blank

Glossary

absorption: uptake by the digestive tract

acid reflux: splashing of stomach acid into the throat

acidity: measure of the tendency of a molecule to lose hydrogen ions, thus behaving as an acid

acidosis: elevated acid level in the blood

acupuncture: insertion of needles into the skin at special points to treat disease

acute: rapid-onset and short-lived

adequate intake: nutrient intake that appears to maintain the state of health

adipose tissue: tissue containing fat deposits

aerobic: designed to maintain adequate oxygen in the bloodstream

allergen: a substance that provokes an allergic reaction

allergic reaction: immune system reaction against a substance that is otherwise harmless

allergy: immune system reaction against substances that are otherwise harmless

amenorrhea: lack of menstruation

Americanized: having adopted more American habits or characteristics

amine: compound containing nitrogen linked to hydrogen

amino acid: building block of proteins, necessary dietary nutrient

anabolic: promoting building up

anaerobic: without air, or oxygen

anaphylaxis: life-threatening allergic reaction, involving drop in blood pressure and swelling of soft tissues especially surrounding the airways

anemia: low level of red blood cells in the blood

angioplasty: reopening of clogged blood vessels

anorexia nervosa: refusal to maintain body weight at or above what is considered normal for height and age

anthropometric: related to measurement of characteristics of the human body

antibiotic: substance that kills or prevents the growth of microorganisms

antibody: immune system protein that protects against infection

antioxidant: substance that prevents oxidation, a damaging reaction with oxygen

anxiety: nervousness

appendicitis: inflammation of the appendix

aqueous: water-based

artery: blood vessel that carries blood away from the heart toward the body tissues

arthritis: inflammation of the joints

assisted-living: facility that provides aid in meal preparation, cleaning, and other activities to help maintain independent living

asthma: respiratory disorder marked by wheezing, shortness of breath, and mucus production

asymptomatic: without symptoms

atherosclerosis: build-up of deposits within the blood vessels

atole: a porridge made of corn meal and milk

atoms: fundamental particles of matter

ayurvedic: an Indian healing system

B vitamins: a group of vitamins important in cell energy processes

bacteria: single-celled organisms without nuclei, some of which are infectious

bactericidal: a substance that kills bacteria

bacteriostatic: a state that prevents growth of bacteria

basal metabolic rate: rate of energy consumption by the body during a period of no activity

basal metabolism: level of body energy consumption and chemical processes in the absence of exertion

behavioral: related to behavior, in contrast to medical or other types of interventions

bile: substance produced in the liver which suspends fats for absorption

binge: uncontrolled indulgence

bioavailability: availability to living organisms, based on chemical form

biochemical: related to chemical processes within cells

biodiversity: richness of species within an area

biological: related to living organisms

biotin: a portion of certain enzymes used in fat metabolism; essential for cell function

biotoxin: poison made by living organisms

blood clotting: the process by which blood forms a solid mass to prevent uncontrolled bleeding

blood pressure: measure of the pressure exerted by the blood against the walls of the blood vessels

body mass index: weight in kilograms divided by square of the height in meters times 100; a measure of body fat

bone marrow: dividing cells within the long bones that make the blood

botanical: related to plants

botulism: poisoning from the bacterium Clostridium botulinum

bowel: intestines and rectum

brain allergy: allergy whose symptoms affect brain function

bulimia: uncontrolled episodes of eating (bingeing) usually followed by self-induced vomiting (purging)

calcium: mineral essential for bones and teeth

calorie: unit of food energy

cancer: uncontrolled cell growth

candidal: related to the yeast Candida

candidiasis: a yeast infection

carbohydrate: food molecule made of carbon, hydrogen, and oxygen, including sugars and starches

carbohydrate metabolism: breakdown and use of sugars and starches in the body

carcinogen: cancer-causing substance

cardiovascular: related to the heart and circulatory system

cardiovascular disease: disease affecting the heart and/or circulatory system

caries: cavities in the teeth

carotenoid: plant-derived molecules used as pigments

carrageenan: a thickener derived from red seaweed

catabolism: breakdown of complex molecules

catalyze: cause to happen more rapidly

cataract: clouding of the lens of the eye

cellulose: carbohydrate made by plants; indigestible by humans

chiropractic: manipulation of the spine and other bones for healing

cholera: bacterial infection of the small intestine causing severe diarrhea, vomiting, and dehydration

cholesterol: multi-ringed molecule found in animal cell membranes; a type of lipid

chronic: over a long period

chronic disease: diseases that occur over a long period, in contrast to acute diseases

clinical: related to hospitals, clinics, and patient care

cloning: creation of an exact genetic copy of an organism

congenital: present from birth

Congregate Dining: a support service that provides a meal at a central location on a specified day

constipation: difficulty passing feces

consumerism: reliance on buying, rather than making, items necessary for living

contraindicated: not recommended

convenience food: food that requires very little preparation for eating

coronary heart disease: disease of the coronary arteries, the blood vessels surrounding the heart

cretinism: arrested mental and physical development

crossbreeding: breeding between two different varieties of an organism

cuisine: types of food and traditions of preparation

cytoplasm: contents of a cell minus the nucleus

deamination: removal of an NH2 group from a molecule

dehydration: loss of water

dementia: loss of cognitive abilities, including memory and decision making

dentition: formation of the teeth

deoxyribonucleic acid: DNA, the molecule that makes up genes

dependence: a condition in which attempts to stop use leads to withdrawal symptoms, including irritability and insomnia

depression: mood disorder characterized by apathy, restlessness, and negative thoughts

DETERMINE: checklist used to identify nutritionally at-risk individuals

development: the process of change by which an organism becomes more complex

diabetes: inability to regulate level of sugar in the blood

diet: the total daily food intake, or the types of foods eaten

dietary assessment: analysis of nutrients in the diet

Dietary Reference Intakes: set of guidelines for nutrient intake

diphtheria: infectious disease caused by Cornybacterium diphtheriae, causing damage to the heart and other organs

disaccharide carbohydrate: molecule composed of two linked sugars

diuretic: substance that depletes the body of water

diversity: the variety of cultural traditions within a larger culture

diverticulosis: presence of abnormal small sacs in the lining of the intestine

DNA: deoxyribonucleic acid; the molecule that makes up genes, and is therefore responsible for heredity

drugs: substances whose administration causes a significant change in the body's function

dyslipidemia: disorder of fat metabolism

dysmorphia: the belief that one's body is different (fatter, thinner, etc.) than it really is

eating disorder: behavioral disorder involving excess consumption, avoidance of consumption, self-induced vomiting, or other food-related aberrant behavior

ecological: related to the environment and human interactions with it

eczema: skin disease causing itching and flaking

edema: accumulation of fluid in the tissues

efficacy: effectiveness

electrolyte: salt dissolved in fluid

elemental: made from predigested nutrients

elimination diet: diet in which particular foods are eliminated to observe the effect

endotoxin: toxic substance produced and stored within the plant tissue

enema: substance delivered via the rectum

energy: technically, the ability to perform work; the content of a substance that allows it to be useful as a fuel

enrichment: addition of vitamins and minerals to improve the nutritional content of a food

enteric: pertaining to the intestine; delivered via a tube into the intestine

entrepreneur: founder of a new businesses

environment: surroundings

environmental illness: illness due to substances in the environment

enzymatic: related to use of enzymes, proteins that cause chemical reactions to occur

enzyme: protein responsible for carrying out reactions in a cell

epinephrine: hormone that promotes "fight or flight;" also called adrenaline

epithelial cell: sheet of cells lining organs throughout the body

Escherichia coli: common bacterium found in human large intestine

essential fatty acids: particular molecules made of carbon, hydrogen, and oxygen that the human body must have but cannot make itself

estradiol: female hormone; a type of estrogen

estrogen: hormone that helps control female development and menstruation

etiology: origin and development of a disease

eukaryots: organisms whose cells contain nuclei

failure to thrive: lack of normal developmental progress or maintenance of health

famine: extended period of food shortage

fast food: food requiring minimal preparation before eating, or food delivered very quickly after ordering in a restaurant

fat: type of food molecule rich in carbon and hydrogen, with high energy content

fat-soluble: able to be dissolved in fats, including the membranes of cells

fatigue: tiredness

fatty acids: molecules rich in carbon and hydrogen; a component of fats

fermentation: reaction performed by yeast or bacteria to make alcohol

fiber: indigestible plant material that aids digestion by providing bulk

folate: one of the B vitamins, also called folic acid

food additive: substance added to foods to improve nutrition, taste, appearance, or shelf-life

food poisoning: illness caused by consumption of spoiled food, usually containing bacteria

fortification: addition of vitamins and minerals to improve the nutritional content of a food

fortified: altered by addition of vitamins or minerals

free radical: highly reactive molecular fragment, which can damage cells

functional food: food whose health benefits are claimed to be higher than those traditionally assumed for similar types of foods

fungal: of or from fungi

galactosemia: inherited disorder preventing digestion of milk sugar, galactose

gamma rays: very high energy radiation, more powerful than x rays

gastric: related to the stomach

gastric mucosa: lining of the stomach

gastrointestinal: related to the stomach and intestines

gastrointestinal system: the digestive tract (mouth to anus) plus associated organs

gastrointestinal tract: the continuous tube through which food passes including throat, stomach, and intestines

gene: DNA sequence that codes for proteins, and thus controls inheritance

gene expression: use of a gene to make the protein it encodes

genetic: inherited or related to the genes

genetic engineering: manipulation of genes to change the characteristics of a living organism

globalization: development of world-wide economic system

glucagon: hormone that promotes release of sugar from the liver to raise the level of blood sugar

glucose: a simple sugar; the most commonly used fuel in cells

gluten: a protein found in wheat

glycerol: simple molecule that forms a portion of fats

glycogen: storage form of sugar

glycolysis: cellular reaction that begins the breakdown of sugars

growth factor: protein that stimulates growth of surrounding cells

growth hormone: hormone produced by the pituitary gland that increases the rate of growth

growth spurts: periods of rapid growth

guar gum: a thickener made from a tropical bean

Harris-Benedict equation: a formula for calculating a person's minimum energy expenditure

HDL: high density lipoprotein, a blood protein that carries cholesterol

health-promotion: related to advocacy for better health, preventive medicine, and other aspects of well-being

heart attack: loss of blood supply to part of the heart, resulting in death of heart muscle

heart disease: any disorder of the heart or its blood supply, including heart attack, atherosclerosis, and coronary artery disease

heavy metal: lead, chromium, and other metals found in the middle section of the periodic table of the elements

hemoglobin: the iron-containing molecule in red blood cells that carries oxygen

hemorrhoids: swollen blood vessels in the rectum

hepatitis: liver inflammation

hepatitis B: viral disease affecting the liver

herbal: related to or made from herbs

high blood pressure: elevation of the pressure in the bloodstream maintained by the heart

high potency: a claim about vitamin or mineral content, defined as 100% or more of the Recommended Daily Intake

homeostasis: regulation of the proper internal state

hookworm: parasitic nematode that attaches to the intestinal wall

hormone: molecules produced by one set of cells that influence the function of another set of cells

hydration: degree of water in the body

hydrolyze: to break apart through reaction with water

hygiene: cleanliness

hype: advertising and brash claims

hypercholesterolemia: high levels of cholesterol in the blood

hyperglycemia: high level of sugar in the blood

hyperlipidemia: high levels of lipids (fats or cholesterol) in the blood

hypertension: high blood pressure

hypertrophy: excess increase in size

hypoglycemia: low blood sugar level

hypoglycemic: related to low level of blood sugar

immune system: the set of organs and cells, including white blood cells, that protect the body from infection

immunocompromised: having a weakened immune system

immunologic: related to the immune system, which protects the body from infection

incidence: number of new cases reported each year

incisor: chisel-shaped tooth used for cutting; one of the types of primary teeth

indigestion: reduced ability to digest food

infectious diseases: diseases caused by viruses, bacteria, fungi, or protozoa, which replicate inside the body

informed consent: agreement to a procedure after understanding the risks

injera: spongy flat bread

insoluble: not able to be dissolved in water

insulin: hormone released by the pancreas to regulate level of sugar in the blood

internship: training program

interstitial: between the tissues

intestines: the two long tubes that carry out the bulk of the processes of digestion

intravenous: into the veins

iron: nutrient needed for red blood cell formation

isoflavones: estrogen-like compounds in plants

job sharing: splitting a single job among two or more people

junk food: food with high fat and sugar content, without correspondingly high amounts of protein, vitamins, or minerals

keto-acid: an acid compound containing the reactive CO group

ketoacidosis: accumulation of ketone bodies along with high acid levels in the body fluids

ketones: chemicals produced by fat breakdown; molecule containing a double-bonded oxygen linked to two carbons

ketosis: build-up of ketone bodies in the blood, due to fat breakdown

kidney stones: deposits of solid material in kidney

killer-cell: type of white blood cell that helps protect the body from infection

kinetic: related to speed of reaction

Krebs cycle: cellular reaction that breaks down numerous nutrients and provides building blocks for other molecules

kwashiorkor: severe malnutrition characterized by swollen belly, hair loss, and loss of skin pigment

lactic acid: breakdown product of sugar in the muscles in the absence of oxygen

lactose intolerance: inability to digest lactose, or milk sugar

learned behaviors: actions that are acquired by training and observation, in contrast to innate behaviors

leavening: yeast or other agents used for rising bread

legumes: beans, peas, and related plants

lifestyle: set of choices about diet, exercise, job type, leisure activities, and other aspects of life

lipid: fats, waxes, and steroids; important components of cell membranes

lipoprotein: blood protein that carries fats

listeriosis: infectious disease caused by Listeria bacteria

long-term care facilities: hospitals or nursing homes in which patients remain for a long time for chronic care, rather than being treated and quickly discharged

lymph node: pocket within the lymph system in which white blood cells reside

lymph system: system of vessels and glands in the body that circulates and cleans extracellular fluid

lymphatic system: group of ducts and nodes through which fluid and white blood cells circulate to fight infection

macrobiotic: related to a specific dietary regimen based on balancing of vital principles

macronutrient: nutrient needed in large quantities

macular degeneration: death of cells of the macula, part of the eye's retina

malabsorption: decreased ability to take up nutrients

malaise: illness or lack of energy

malaria: disease caused by infection with Plasmodium, a single-celled protozoon, transmitted by mosquitoes

malignant: spreading to surrounding tissues; cancerous

malnourished: lack of adequate nutrients in the diet

malnutrition: chronic lack of sufficient nutrients to maintain health

marasmus: extreme malnutrition, characterized by loss of muscle and other tissue

meditation: stillness of thought, practiced to reduce tension and increase inner peace

menopausal: related to menopause, the period during which women cease to ovulate and menstruate

menopause: phase in a woman's life during which ovulation and menstruation end

menstrual cycles: the build-up and sloughing off of the lining of the uterus in women commencing at puberty and proceeding until menopause

metabolic: related to processing of nutrients and building of necessary molecules within the cell

metabolic activities: sum total of the body's biochemical processes

metabolism: the sum total of reactions in a cell or an organism

metabolism-free radical: highly reactive molecular fragment, which are created through metabolism, or processing of nutrients

metabolite: the product of metabolism, or nutrient processing within the cell

metabolize: processing of a nutrient

microflora: microscopic organisms present in small numbers

micronutrient: nutrient needed in very small quantities

microorganisms: bacteria and protists; single-celled organisms

mineral: an inorganic (non-carbon-containing) element, ion, or compound

miscarriage: loss of a pregnancy

mitochondria: small bodies within a cell that harvest energy for use by the cell

molar: grinding tooth toward the rear of the mouth

molecule: combination of atoms that form stable particles

monocultural: from a single culture

monoglyceride: breakdown product of fats

morbidity: illness or accident

mucosa: moist exchange surface within the body

muscle wasting: loss of muscle bulk

mycotoxin: poison produced by a fungus

myoglobin: oxygen storage protein in muscle

nandrolone: hormone related to testosterone

nausea: unpleasant sensation in the gut that precedes vomiting

needs assessment: formal procedure for determining needs

nervous system: the brain, spinal cord, and nerves that extend throughout the body

neural: related to the nervous system

neural tube defects: failures of proper development of the spinal cord

neurological: related to the nervous system

neuropathy: malfunction of nerve cells

neurotransmitter: molecule released by one nerve cell to stimulate or inhibit another

NHANES: National Heath and Nutrition Examination Survey

niacin: one of the B vitamins, required for energy production in the cell

nitrite: NO_2, used for preservatives

nitrogen: essential element for plant growth

nonpathogenic: not promoting disease

nonpolar: without a separation if charge within the molecule; likely to be hydrophobic

nutrient: dietary substance necessary for health

nutrient deficiencies: lack of adequate nutrients in the diet

nutrition: the maintenance of health through proper eating, or the study of same

nutritional deficiency: lack of adequate nutrients in the diet

nutritional requirements: the set of substances needed in the diet to maintain health

obese: above accepted standards of weight for sex, height, and age

obesity: the condition of being overweight, according to established norms based on sex, age, and height

opacity: impermeability to light

opportunistic infections: infections not normally threatening, which gain a foothold in people with weakened immune systems

oral-pharyngeal: related to mouth and throat

osteoarthritis: inflammation of the joints

osteoblast: cell that forms bone

osteomalacia: softening of the bones

osteopathic: related to the practice of osteopathy, which combines standard medical therapy with manipulation of the skeleton to correct problems

osteoporosis: weakening of the bone structure

over-the-counter: available without a prescription

overweight: weight above the accepted norm based on height, sex, and age

oxidative: related to chemical reaction with oxygen or oxygen-containing compounds

oxygen: O_2, atmospheric gas required by all animals

paralysis: inability to move

parasite: organism that feeds off of other organisms

parasitic: feeding off another organism

parasitic diseases: diseases caused by parasites, including amebic diseases, Giardia, roundworms, and others

pasteurization: heating to destroy bacteria and other microorganisms, after Louis Pasteur

pathogen: organism that causes disease

pH: level of acidity, with low numbers indicating high acidity

phenylketonuria: inherited disease marked by the inability to process the amino acid phenylalanine, causing mental retardation

phospholipid: a type of fat used to build cell membranes

phosphorus: element essential in forming the mineral portion of bone

physiological: related to the biochemical processes of the body

physiology: the group of biochemical and physical processes that combine to make a functioning organism, or the study of same

phytate: plant compound that binds minerals, reducing their ability to be absorbed

phytochemical: chemical produced by plants

phytoestrogen: plant-derived estrogen compound

pituitary gland: gland at the base of the brain that regulates multiple body processes

plaque: material forming deposits on the surface of the teeth, which may promote bacterial growth and decay

plasma: the fluid portion of the blood, distinct from the cellular portion

plateaus: periods during which growth is greatly reduced

pluralistic: of many different sources

pneumonia: lung infection

polar: containing regions of positive and negative charge; likely to be soluble in water

polyunsaturated: having multiple double bonds within the chemical structure, thus increasing the body's ability to metabolize it

potable: safe to drink

pre-renal: kidney disease caused by change in the blood supply to the kidney

prevalence: describing the number of cases in a population at any one time

preventive medicine: treatment designed to prevent disease, rather than waiting for it to occur before intervening

processed food: food that has been cooked, milled, or otherwise manipulated to change its quality

proscription: prohibitions, rules against

prostaglandin: hormone that helps regulate inflammation and other tissue processes

prostate: male gland surrounding the urethra that contributes fluid to the semen

protein: complex molecule composed of amino acids that performs vital functions in the cell; necessary part of the diet

protein digestion: breakdown of proteins into amino acids in the digestive tract

psoriasis: skin disorder characterized by red, dry, scaly skin

psychological: related to thoughts, feelings, and personal experiences

psyllium: bulk-forming laxative derived from the Plantago psyllium seeds

puberty: time of onset of sexual maturity

reactivity: characteristic set of reactions undergone due to chemical structure

Recommended Dietary Allowances: nutrient intake recommended to promote health

renal failure: inability of the kidneys to cleanse the blood

respiratory system: the lungs, throat, and muscles of respiration, or breathing

rice genome: the set of genes possessed by rice

rickets: disorder caused by vitamin D deficiency, marked by soft and misshapen bones and organ swelling

ritual: ceremony or frequently repeated behavior

RNA: ribonucleic acid, used in cells to create proteins from genetic information

salmonellosis: food poisoning due to Salmonella bacteria

saturated fat: a fat with the maximum possible number of hydrogens; more difficult to break down than unsaturated fats

scurvy: a syndrome characterized by weakness, anemia, and spongy gums, due to vitamin C deficiency

sedentary: not active

serotonin: chemical used by nerve cells to communicate with one another

serum: noncellular portion of the blood

serum estrone: blood level of estrone, a steroid hormone that is one of the estrogens, a type of female hormone

shock: state of dangerously low blood pressure and loss of blood delivered to the tissues

sideroblastosis: condition in which the blood contains an abnormally high number of sideroblasts, or red blood cells containing iron granules

sleep apnea: difficulty breathing while sleeping

smallpox: deadly viral disease

smog: air pollution

social group: tribe, clique, family, or other group of individuals

socioeconomic status: level of income and social class

staples: essential foods in the diet

steroid: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

steroid hormones: class of hormones composed of carbon rings, necessary for sexual development and mineral balance

steroids: group of hormones that affect tissue build-up, sexual development, and a variety of metabolic

sterol: building blocks of steroid hormones; a type of lipid

stillbirth: giving birth to a dead fetus

stress: heightened state of nervousness or unease

stroke: loss of blood supply to part of the brain, due to a blocked or burst artery in the brain

subcutaneous: beneath the skin

sucrose: table sugar

temperate zone: region of the world between the tropics and the arctic or Antarctic

testosterone: male sex hormone

thalassemia: inherited blood disease due to defect in the hemoglobin protein

thermogregulate: regulate temperature

tofu: soybean curd, similar in consistency to cottage cheese

tolerance: development of a need for increased amount of drug to obtain a given level of intoxication

toxicant: harmful substance

toxins: poisons

trace: very small amount

trans-fatty acids: type of fat thought to increase the risk of heart disease

triglyceride: a type of fat

tuber: swollen plant stem below the ground

tuberculosis: bacterial infection, usually of the lungs, caused by Mycobacterium tuberculosis

tularemia: bacterial infection by Francisella tularensis, causing fever, skin lesions, and other symptoms

type II diabetes: inability to regulate the level of sugar in the blood due to a reduction in the number of insulin receptors on the body's cells

typhoid: fever-causing bacterial infection due to Salmonella typhi; transmitted contaminated food or water

typhus: bacterial disease transmitted by infected rodents

ulcer: erosion in the lining of the stomach or intestine due to bacterial infection

uncharged: neither positively nor negatively charged

undernutrition: food intake too low to maintain adequate energy expenditure without weight loss

uric: from urine

vaccine: medicine that promotes immune system resistance by stimulating pre-existing cells to become active

vegan: person who consumes no animal products, including milk and honey

viral disease: disease caused by viruses, including flu, colds, AIDS, hepatitis, and others

virus: noncellular infectious agent that requires a host cell to reproduce

vitamin: necessary complex nutrient used to aid enzymes or other metabolic processes in the cell

vitamin D: nutrient needed for calcium uptake and therefore proper bone formation

wasting: loss of body tissue often as a result of cancer or other disease

water-soluble: able to be dissolved in water

wean: cease breast-feeding

wellness: related to health promotion

white blood cell: immune system cell that fights infection

yeast allergy: allergy to yeasts used in baking or brewing

zinc: mineral necessary for many enzyme processes

How to go to your page

Index

*Page numbers in **bold** indicate the main article on a subject. Page numbers in italics indicate illustrations. The number preceding the colon indicates the volume number, and the number after the colon indicates the page number. The letter t after a page number indicates a table.*

A

Absorption
  defined, 1:10
  See also Digestion and absorption
Acesulfame potassium, 1:46
Acetyl coenzyme A, 1:96, 2:55, 56, 57
Acid reflux, defined, 1:256
Acidity, defined, 1:86
Acidosis, defined, 1:149
Acquired immunodeficiency syndrome. *See* HIV/AIDS
Activity disorder, 1:184
Acupuncture, 1:*32*, 2:66
  defined, 1:30
Acute, defined, 1:63
Acute diarrhea, 1:149, 150
Acute rheumatic heart disease, 1:272
ADA. *See* American Dietetic Association (ADA)
Addiction, exercise. *See* Exercise addiction
Addiction, food, **1:1**
  See also Eating disorders
Additives and preservatives, **1:1–4,** 1:*3*
  fat substitutes as additives, 1:212, 213
  and hyperactivity, 1:29
  and quackery, 2:162
  safety regulations, 1:2–4
  uses, 1:2
Adenosine triphosphate (ATP)
  carbohydrate metabolism, 2:55
  catabolism, 2:157
  cellular metabolism, 2:54
  as energy unit, 2:92, 241
  glycolysis, 1:96–97
  protein metabolism, 2:55–56
  thiamine, 1:62
Adequate Intake (AI), 1:155, 2:151, 152
  defined, 2:59
Adipose tissue
  defined, 1:68
  See also Body fat distribution
Administrative dietitians, 1:168
Adolescent nutrition, **1:4–7**
  body image, 1:69
  calcium, 1:84–85
  eating and snacking patterns, 1:5–6
  eating disorders, 2:193
  fat intake, 2:192
  high-risk groups, 1:6–7
  marketing strategies aimed at adolescents, 2:38
  nutritional needs, 1:5, *6*, *6*, 2:*103*
  obesity, 2:192–193
  popular culture, 2:192
  pregnancy weight gain, 2:144
  vegetarianism, 2:230
  See also School-aged children, diet of
ADRA (Adventist Development and Relief Agency International), 1:175*t*
Adult nutrition, **1:7–10,** 1:*9*, 84–85
  See also Aging and nutrition
Adventist Development and Relief Agency International (ADRA), 1:175*t*
Adverse reaction, 1:26
Advertising, 2:38–40
Advocacy nongovernmental organizations, 2:83
Aerobic, defined, 1:198
African Americans, diet of, **1:10–15**
  cancer, 2:167
  childhood obesity, 1:121
  diabetes, 1:144, 146
  dietary influences, 1:12–13
  elderly, 2:168
  future, 1:14
  hypertension, 1:14, 14*t*, 290, 2:167
  legacy, 1:*11*, 11–12
  origins, 1:10–11
  poverty and health, 1:13–14, 14*t*
  regional diet, 1:12, 2:166–168
  and television, 2:167–168
  See also Caribbean Islanders, diet of
Africans, diets of, **1:15–20**
  African diet, 1:16
  and African-American diet, 1:10–11
  biotechnology, 1:17
  early history of Africa, 1:15–16
  East Africa, 1:18
  food security, 1:19
  North Africa, 1:16–17, *17*
  nutrition and disease, 1:19
  Southern Africa, 1:18
  underweight, 2:35
  West Africa, 1:17–18
  See also Caribbean Islanders, diet of
Aging and nutrition, **1:20–23**
  African Americans, 2:168
  body mass index, 1:73
  calcium, 1:85, 86
  commodity foods, 1:129
  dietary problems, 1:*21*, 21–22
  medical, physical, and functional problems, 1:22–23
  nutrient-drug interactions, 2:89
  Nutrition Screening Initiative, 1:20–21
  social problems, 1:22
  vegetarianism, 2:230–231
  vitamin D, 2:235
  water, 2:50, 246
  See also Meals On Wheels; Recommended Dietary Allowances

AHA. *See* American Heart Association (AHA)
AI. *See* Adequate Intake (AI)
AIDS. *See* HIV/AIDS
Alanine, 2:155, 156*t*
Albumin, and calcium transport, 1:84
Alcohol and health, **1:23–26,** 1:23*t*, *25*
absorption, 1:172
alcoholism, 1:24–25
cancer, 1:89
college students, 1:25, 124
gastric ulcers, 1:172
heart disease, 1:274
high-risk groups, 1:25
hypertension, 1:290
nutrient-drug interactions, 2:89, 90
pregnancy, 1:220–221
Russia, 1:*119*, 120
Wernicke-Korsakoff syndrome, 2:238
wine as functional food, 1:240, 242*t*
See also Fetal alcohol syndrome (FAS)
Aldosterone, 2:248
Alimentary canal, 1:*171*
Alitame, 1:48
Allergen, defined, 1:26
Allergic reaction, defined, 1:27
Allergies and intolerances, **1:26–30**
controversies, 1:29
definitions, 1:26
food allergy, 1:*27*, 27–28, *38*
food intolerance, 1:*27*, 28
genetically modified foods, 1:66, 67, 246
peanut allergies, 1:29
rice allergies, 2:182
treatment, 1:29
Allergy, defined, 1:26
Alliance for Food Security, 1:238
Alpha tocopherol. *See* Vitamin E
Alpha-carotene, as carotenoid, 1:113
Alternative medicines and therapies, **1:29–34,** 2:161
alternative medicine, complementary medicine, and integrative medicine, 1:30
Dietary Supplement Health and Education Act (1994), 1:31–32, 33
modality selection, 1:33–34
modality types, 1:30–31, 31*t*, *32*
supplement facts label, 1:32–33
See also Dietary supplements; Macrobiotic diet
Alzheimer's disease, 2:75
AMA (American Medical Association), 1:4, 68, 97
Amalyse, 1:169, 170
Amenorrhea, 1:41, 219, 2:218–219
defined, 1:41
American Academy of Pediatrics, 2:112, 153
American Association of Advertising Agencies, 2:40
American Association of Diabetes Educators, 2:44
American Cancer Society, 1:92
American College of Cardiology, 2:30
American Dental Association, 2:10–11
American dietary trends. *See* Dietary trends, American
American Dietetic Association (ADA), **1:34**
biotechnology, 1:68
Commission on Accreditation for Dietetics Education, 1:105, 2:44, 105
Commission on Dietetic Registration, 1:106, 168, 2:44, 105
fat substitutes, 1:213
fiber intake, 1:221
functional foods, 1:243
medical nutrition therapy protocols, 2:45
vegetarianism, 2:230
American Farm Bureau Federation, 1:248
American Heart Association (AHA)
cardiac arrest, 1:*273*
fad diets, 1:205–206
lipid profile, 2:30
Mediterranean diet, 1:259–260
men and heart disease, 2:52
American Indians. *See* Native Americans
American Institute for Cancer Research, 2:117
American Marketing Association, 2:37
American Medical Association (AMA), 1:4, 68, 97
American Psychiatric Association
anorexia nervosa, 1:70–71
binge eating disorder, 1:63–64
bulimia nervosa, 1:71
eating disorders, 1:176, 177
American Public Health Association (APHA), **1:35**
American School Food Service Association (ASFSA), **1:35,** 2:*195*, 196–197
See also School food service
American School Health Association (ASHA), **1:35–36,** 1:130
Americanized, defined, 1:116
Amine, defined, 1:4
Amino acids, **1:36–38,** 1:36*t*
defined, 1:31
essential, 1:36, 36*t*, 38, 2:155–156
food sources, 1:37–38
functions of proteins, 1:37
maize, 1:134
metabolism disorders, 2:5–6
nonessential, 1:36, 36*t*, 2:155–156
protein, 2:55–56, 92, 155–156, 156*t*
structure, 1:36–37
supplements for sports nutrition, 2:218
See also Nutrients; Protein
Amylase, 1:96
Amylopectin, 1:94
Amylose, 1:94
Anabolic, defined, 1:190
Anabolic agents, as ergogenic aids, 1:190–192, *191*
Anabolism, 2:54, 157
Anaerobic, defined, 1:198
Anaphylaxis, defined, 1:28
"The Anatomy Lesson of Dr. Nicolaes Tulp" (Rembrandt), 2:224, *224*
Andorra, life expectancy in, 2:28
Android fat distribution, 1:68–69
Androstenedione, as ergogenic aid, 1:191, *191*
Anemia, **1:38–41**
Asia, 1:56
defined, 1:5
hypochromic, 1:38, 39*t*
iron-deficiency, 1:38–40, 2:153
macrocytic, 1:38, 39*t*, 2:243
megaloblastic, 1:40
microcytic, 1:38, 39*t*
normochronic, 1:38, 39*t*
nutritional deficiency, 2:103
other causes, 1:40
pernicious, 1:40, 2:243
sickle-cell, 1:*39*
treatment, 1:40–41
types and causes, 1:39*t*
women, 2:259
Angioplasty, defined, 1:59
Angiotensin, 2:248
Angular cheilosis, 2:111
Animal proteins, 2:156
Animals, biotechnology in, 1:65–66
Anorexia nervosa, **1:41–42**
binge eating/purging type, 1:177
body image, 1:*70*, 70–71

defined, 1:41
diagnosis, 1:177
inpatient hospitalization, 1:180
malnutrition, 2:140
medication, 1:181
prevalence, 1:184
restricting type, 1:177
treatment outcomes, 1:181
See also Eating disorders
Anthropometric, defined, 1:42
Anthropometric measurements, **1:42,** 2:35, 99–101, 100*t*
See also Body mass index; Nutritional assessment; Waist-to-hip ratio
Anti-aging products, as quackery, 2:162
Antibacterial soaps, 2:3
Antibiotics
defined, 1:91
nutrient-drug interactions, 2:89
resistance to, 1:246
and vitamin K, 2:236
Antibody, defined, 1:37
Antidepressants
for eating disorders, 1:180–181
nutrient-drug interactions, 2:89
Antigens, 1:37
Antigua, 1:110
Antimicrobial agents, as food additive, 1:2
Antioxidants, **1:42–44,** 1:*43*
and cancer prevention, 1:91
carotenoids as, 1:112
defined, 1:1
as food additive, 1:2, 242*t*
as functional food, 1:242*t*
health benefits and food sources, 1:44*t*
vitamin E as, 2:237
Ants, 2:202, *202*
Anxiety, defined, 1:1
APHA (American Public Health Association), 1:35
Apollo space program, 2:212
Appendicitis, defined, 1:8
Appert, Nicholas, 1:4
Appetite, 1:22, **1:44–45,** 2:89
See also Hunger
Apples/apple juice, glycemic index, 1:251*t*
Aquavit, 2:188
Aqueous, defined, 1:216
Arepa, 2:202–203
Argentina, 2:201, 203
Arginine, 2:156*t*
Ariboflavinosis, 2:238
Arteries, hardening of. *See* Atherosclerosis
Arteriosclerosis, **1:45–46**
See also Atherosclerosis; Cardiovascular disease (CVD)
Artery, 1:99, *101*
defined, 1:45
Arthritis
defined, 1:22
remedies as quackery, 2:162
Artificial colors, 1:2
Artificial flavors and flavor enhancers, 1:2
Artificial sweeteners, **1:46–48,** 1:*47*
American dietary trend, 1:160, *160*
FDA-approved artificial sweeteners, 1:46–47
pending FDA approval, 1:48
sugar alcohols, 1:47
See also Generally recognized as safe; Phenylketonuria
Ascorbic acid. *See* Vitamin C
ASFSA (American School Food Service Association), 1:35, 2:*195*, 196–197
ASHA (American School Health Association), 1:35–36, 130
Asian Americans, diets of, **1:48–52**
childhood obesity, 1:122
fiber, 1:221
food habits, 1:*49*, 49–51
traditional Asian diet, 1:50*t*
See also Asians, diet of
Asian Diet Pyramid, 1:51, *57*
Asian Indians, diet of, 1:50*t*, 55
Asians, diet of, **1:52–59,** 1:*57*
body image, 1:*163*
East Asia, 1:53–54
food security, 1:55
fruit, 1:52–53, 54
merits and weaknesses, 1:50*t*
micronutrient deficiency, 1:55–56
nutritional transition, 1:56–57
obesity, 1:*163*
osteomalacia, 2:122
other common ingredients, 1:53
rice, 1:52, *53*
South Asia, 1:55
Southeast Asia, 1:54–55
underweight, 2:35
See also Asian Americans, diets of
Asparagine, 2:156*t*
Aspartame, 1:46
Aspirin, 2:88*t*
Assisted-living, defined, 1:22
Asthma, defined, 1:4
Asymptomatic, defined, 1:149
Atherosclerosis, **1:59,** 1:100, 217, 273–274
defined, 1:59
See also Arteriosclerosis; Cardiovascular disease (CVD)
Athletes. *See* Female athlete triad; Sports nutrition
Atkins, Robert, 1:97, *204*
Atkins Diet, 1:97, 203*t*, 204, *204*, 206
Atole, defined, 1:113
Atoms, defined, 1:47
ATP. *See* Adenosine triphosphate (ATP)
Australia
food-borne illness, 2:118
life expectancy, 2:28
skin cancer, 1:88
Avidin, 2:242
Ayurvedic, defined, 1:30

B

B vitamins
defined, 1:115
and oral health, 2:111
See also specific B vitamins by name
Baby bottle tooth decay, **1:59–60,** 2:10–11, 111, 153
See also Oral health
BAC (blood alcohol concentration), 1:23
Bacillus cereus, 2:120*t*
Baciullus thuringiensis, 1:246–247
Bacteria
defined, 1:1
and food-borne illness, 2:119
Bactericidal, defined, 1:1
Bacteriostatic, defined, 1:1
Bad cholesterol. *See* Low-density lipoprotein (LDL)
Bagels, glycemic index, 1:251*t*
Bam (Iran) earthquake, 2:226
Bananas, 1:110, 251*t*
"Bangers and mash," 2:*85*
Banting, William, 1:205
Baraka, Amiri, 1:12
Barbados, 1:110
Barbecue, 1:12
Basal metabolic rate (BMR)
adults, 1:8, *9*
defined, 1:8
menopause, 2:48
and weight loss, 2:248, 250
Battle Creek Sanitarium, **1:60–62,** 1:*61*, 2:16, 17, 254
See also Kellogg, John Harvey; White, Ellen G.
Beauty pageant contestants, 1:69

Beckham, David, 2:*247*
Behavioral, defined, 1:91
Beikost, **1:62,** 2:*9*, 10–11
Belize, 1:110
Benign tumors, 1:90
Beriberi, **1:62**
  Funk, Casimir, 1:244
  nutritional deficiency, 2:103
  and rice, 2:181
  and thiamine, 2:238
  Tulp, Nicolaas, 2:224
Berndtson, Keith, 1:279–280
Beta-carotene, **1:62–63**
  as antioxidant, 1:43, 44*t*
  as carotenoid, 1:113, 2:232, 234
  and golden rice, 2:182, 264
  and lung cancer, 2:234
  risks, 1:*157*
  supplements during pregnancy, 2:36
  See also Carotenoids; Vitamin A
Beta-hydroxy beta-methylbutyrate (HMB), 1:190
Beta-oxidation, 2:56
Beverages
  with antioxidants, 1:242*t*
  Caribbean Islands, 1:108
  chocolate, 1:81*t*
  glycemic index, 1:251*t*
  nutrient-drug interactions, 2:*89*, 90
Bezoars, **1:63**
Bile, defined, 1:169
Binge, defined, 1:41
Binge eating, **1:63–64**
  diagnosis, 1:177–178
  as eating disturbance, 1:182, 184
  and malnutrition, 2:140
  medication, 1:181
  prevalence, 1:184
  See also Bulimia nervosa; Eating disorders
Bioavailability, **1:64,** 2:59
  defined, 1:64
  See also Nutrients
Biochemical, defined, 1:152
Biodiversity, defined, 1:67
Biological, defined, 1:45
Biologics Control Act (1902), 2:73
Biotechnology, **1:64–68**
  Africa, 1:17
  in animals, 1:65–66
  food production concerns, 1:66–67
  food safety, 1:67–68, 237
  genetic engineering, 1:65, *66*
  and global health, 1:67
  safety and labeling, 1:67–68
  See also Genetically modified foods
Bioterrorism, and food safety, 1:237–238, 2:172
Biotin (vitamin B_8), 2:94, 240*t*, 241–242
  defined, 1:169
Biotoxin, defined, 2:120
Biphosphonates, 2:124
Birth control pills, 2:88*t*
Birth defects, 2:142–143, 234, 243
Bleaching agents, as food additive, 1:2
Blood, and space physiology, 2:212
Blood alcohol concentration (BAC), 1:23
Blood clotting, defined, 1:83
Blood pressure, 1:99, *100*
  defined, 1:13
Blood proteins, 2:158
Blood soup, 2:80
BMI. *See* Body mass index (BMI)
BMR. *See* Basal metabolic rate (BMR)
Body fat distribution, **1:68–69**
  and body mass index, 1:72–73
  measuring with calipers, 2:101, 102, *253*
  menopause, 2:48
  nutritional assessment, 2:100–101
  as physical fitness component, 1:200
  See also Waist-to-hip ratio
Body image, **1:69–71,** 1:*70*, *163*, 179, *179*
  See also Eating disorders
Body mass index (BMI), **1:71–74,** 1:*72*, 73*t*
  and cardiovascular disease, 1:101
  children, 1:121
  defined, 1:42
  in nutritional assessment, 2:100
  and obesity, 2:105, 125, 140
  and overweight, 2:125, 140
  and pregnancy, 2:142, 143, 143*t*, 146
  and underweight, 2:225
  See also Obesity
Bolivia, 2:202, 203
Bone loss
  and menopause, 2:48
  and space travel, 2:210–211, 215
Bone marrow, defined, 1:40
Boron, as ergogenic aid, 1:190
Botanical, defined, 1:31
Botulism, 2:1, 3–4
  defined, 2:1
Bovine somatotropin (BST), 1:65–66, *262*
Bovine spongiform encephalopathy (BSE), 2:118–119, *119*, 187
Bowel, defined, 1:91
Brain allergy, defined, 1:29
Brazil, 2:201, 202
Breadfruit, 1:108, 2:127, 130, *130*
Breads
  glycemic index, 1:251*t*
  marketing strategies, 2:38
  Mediterranean diet, 1:257
Breakfast
  School Breakfast Program, 1:284, 2:97, 190–191, 194
  sports nutrition, 2:216
Breast cancer
  and estrogen replacement therapy, 2:48, *49*
  and letrozol, 2:75
  and physical activity, 1:92
  and soy, 2:208
  women's nutritional issues, 2:260
  See also Cancer
Breastfeeding, **1:74–78,** 1:77
  benefits, 1:75, 75*t*, 2:146
  breast implants and breast reduction, 1:76–77
  contraindications, 1:77
  and diarrhea, 1:150, 151
  infant nutrition, 2:8–9, 11
  mastitis, 2:41, *41*
  nutrition for, 1:76, 2:259
  physiology, 1:76
  policies and recommendations, 1:77–78
  and rickets, 2:184
  supplementing with formula, 2:38–39
  Ten Steps to Successful Breastfeeding program, 2:226
  trends, 1:75–76
  and vegetarianism, 2:230
  and vitamin D, 2:235
  and vitamin K, 2:236
  WIC program, 2:255, 256, 257
  See also Formula feeding; Infant nutrition
Breastfeeding caries. *See* Baby bottle tooth decay
Bright-light therapy, 2:149, *149*
Brillat-Savarin, Jean Anthelme, 1:*78*, **1:78–79**
British Virgin Islands, 1:110
Broth, 2:80
Brush border enzymes, 2:157
BSE (bovine spongiform encephalopathy), 2:118–119, *119*, 187
BST (bovine somatotropin), 1:65–66, *262*
Buddhist food practices, 2:175, 176, 178*t*

Bulgaria, 1:118
Bulimia, defined, 1:70
Bulimia nervosa, **1:79–80**
body image, 1:71
diagnosis, 1:177
history, 1:181
inpatient hospitalization, 1:180
and malnutrition, 2:140
medication, 1:181
nonpurging type, 1:177
prevalence, 1:184
purging type, 1:177
treatment outcomes, 1:181
See also Binge eating; Eating disorders
Burgers, cultural influences on, 1:187–188
Bush, George W., and stem cell research, 2:75
Bush tea, 1:109

C

CACFP (Child and Adult Care Food Program), 1:129, 284
CAD. *See* Coronary artery disease (CAD)
CADE (Commission on Accreditation for Dietetics Education), 1:105, 2:44, 105
Caffeine, **1:80–83**
effect on body, 1:80
effect on mood, 2:66
as ergogenic aid, 1:192
in food and drugs, 1:81, 81*t*
and health, 1:*82*, 82–83
and hypertension, 1:290
nutrient-drug interactions, 2:*89*
during pregnancy, 2:145
religious proscriptions, 2:176
Cajun cooking, 1:12–13
Calcidiol, 2:235
Calciferol. *See* Vitamin D
Calcification, 2:183, 185
Calcitonin, 1:84, 2:124
Calcitriol, 2:183, 235
Calcium, **1:83–87**
adolescents, 1:5, *6*
and caffeine, 1:82
deficiency, 1:84, 2:61
defined, 1:5
disease prevention and treatment, 2:61
functions, 2:60
and lactose intolerance, 2:22–23
lead poisoning prevention, 2:24, 26
in orange juice, 1:242*t*, 243
and osteomalacia, 2:122
and osteoporosis, 1:10, 85, *85*, 2:61, 124
during pregnancy, 2:145
for premenstrual syndrome, 2:148
preschoolers and toddlers, 2:152, 153
requirements and supplementation, 1:84–87, *85*, 86*t*
and soy, 2:208
and space travel, 2:210, 215
sports nutrition, 2:217
supplements, 2:59
toxicity, 1:84, 2:61
in vegetarianism, 2:230
and vitamin D, 2:235
women, 2:259, 260
See also Osteoporosis
Calcium carbonate, 1:86*t*
Calcium citrate, 1:86*t*
Calcium glubionate, 1:86*t*
Calcium gluconate, 1:86*t*
Calcium lactate, 1:86*t*
Calcium phosphate, 1:86*t*
Calipers, skinfold, 2:101, 102, *253*
Calories, **1:87**
adolescents, 1:5
alcoholic beverages and mixers, 1:23*t*
American dietary trends, 1:160, 161
defined, 1:5
effect on mood, 2:66*t*
infant nutrition, 2:8
international dietary trends, 1:162
and marasmus, 2:36, 37
needs of obese, 2:105
preschoolers and toddlers, 2:151–152, 152*t*
during space travel, 2:214
sports nutrition, 2:216
and vegetarianism, 2:230, 231
See also Protein-energy malnutrition (PEM)
CAM (complementary and alternative medicine), 1:30, 2:148–149
See also Alternative medicines and therapies
Cambodians, diet of, 1:50*t*
Campaigning nongovernmental organizations, 2:83
Campylobacter jejuni, 2:1, 119, 120*t*
Canadians, Recommended Nutrient Intakes for, 1:155
Cancer, **1:87–92**
African Americans, 2:167
breast, 1:92, 2:48, *49*, 75, 208, 260
and caffeine, 1:82
carcinogenesis process, 1:90–91
causes, 1:88–90, *90*
colon, 1:91, 92
cures as quackery, 2:163
defined, 1:3
and diet, 1:91, 92
and food additives, 1:3–4
growth and spread, 1:88, *89*
lung, 2:234
macrobiotic diet, 2:*32*, 33
men, 2:51, *52*
nutrition for people with cancer, 1:92
and pesticides, 2:116, 117
and physical activity, 1:91
prevalence, 1:88
prevention, 1:91, 2:234
prostate, 1:91, 2:208, 234
and saccharin, 1:47
and soy, 2:208
types, 1:88
and vitamin C, 2:134, 167
See also Antioxidants; Phytochemicals
Cancer Prevention Study (2002), 2:199
Candidal, defined, 2:154
Candidiasis, defined, 2:108
Canning, discovery of, 1:4
Capillaries, 1:99
Capsaicin intolerance, 1:28
Carbohydrate-based fat substitutes, 1:212, 212*t*, 217–218
Carbohydrates, **1:93–99**
absorption, 1:172
carbohydrate-modified diets, 1:97, 98
chemical structure, 1:93
complex, 1:94–96, *95*, 2:91
counting, 1:98
defined, 1:8
and diabetes, 1:98
digestion and absorption, 1:96
and eating disturbances, 1:184
effect on mood, 2:66*t*
exchange system, 1:98
glycolysis, 1:96–97
low-carb diets, 1:97
metabolism, 2:6–7, 54–55
as nutrient, 2:91–92
recommended intake, 1:93, 97
simple, 1:93–94, 94*t*, 2:91
sports nutrition, 2:216
See also Glycemic index
Carcinogen, 1:89
defined, 1:4

Carcinogenesis process, 1:90–91
Carcinoma, 1:88
Cardiac arrest, 1:272, *273*, 2:75
Cardiovascular, defined, 1:8
Cardiovascular disease (CVD), **1:99–104,** 1:*102*
  Asia, 1:56, 57
  atherosclerosis, 1:100
  and caffeine, 1:82
  Central Europe and Russia, 1:117–118, 119–120
  coronary artery disease, 1:100, *101*
  hypertension, 1:99–100, *100*, 103
  and lipid profile, 2:28
  and lycopene, 2:234
  preventing, 1:100–103
  stroke, 1:100
  See also Arteriosclerosis; Atherosclerosis; Heart disease
Cardiovascular fitness, 1:200
The Care and Feeding of Southern Babies (Wilson), 2:258, *258*
CARE (Cooperative for Assistance and Relief Everywhere), 1:175*t*
Careers in dietetics, **1:104–107**
  knowledge and skills, 1:106
  practice roles, 1:104–105
  registration and licensure, 1:106
  training, 1:105–106
  See also Dietetic technician, registered (DTR); Dietitian; Nutritionist
Caribbean Cooperation in Health, 1:111
Caribbean Food and Nutrition Institute (CFNI), 1:111
Caribbean Islanders, diet of, **1:107–112**
  European settlement, 1:107–108, *108*
  foods of the islands, 1:*108*, 108–110, 110*t*
  health issues, 1:110–111, 112
  public health initiatives, 1:111–112
Caries, 2:110, 111–112, 153
  defined, 1:46
  See also see Baby bottle tooth decay
Carotenoids, 1:43, **1:112–113,** 2:232, 234
  defined, 1:42
  See also Antioxidants; Beta-carotene; Vitamin A
Carpal tunnel syndrome, 2:242
Carrageenan, defined, 1:212
Carrots, glycemic index, 1:251*t*
Catabolism, 2:54, 157
  defined, 1:150
Catalyze, defined, 2:242
Cataracts, 2:234, 238
  defined, 1:56
Catholic food practices, 2:176, *176*, 178–179, 178*t*
Cavities, 2:110, 111–112, 153
  See also see Baby bottle tooth decay
CBOs (community-based organizations), 2:83
CCK (cholecystokinin), 1:170, 216
CDC. *See* U.S. Centers for Disease Control and Prevention (CDC)
CDE (Certified Diabetes Educator), 1:105
CDR. *See* Commission on Dietetic Registration (CDR)
Celebrities, in advertising, 2:*39*
Cellulose, defined, 1:95
Central Americans and Mexicans, diets of, **1:113–117**
  changes in dietary practices, 1:116
  cooking methods, 1:114–115
  dishes, 1:115
  fruits and vegetables, 1:114
  influence of Central American and Mexican culture, 1:116
  nutritional benefits, 1:115
  nutritional limitations, 1:115–116
  traditional dietary habits, 1:113–114, *114*
  See also Hispanics and Latinos, diet of; South Americans, diet of
Central Europeans and Russians, diets of, **1:117–121,** 1:120*t*
  Central Europe, 1:117–118
  former Soviet Union (Russian Federation), 1:118, *119*
  lifestyle and nutrition, 1:118–120, *119*
  See also Northern Europeans, diet of; Southern Europeans, diet of
Ceramic cookware, and lead poisoning, 2:25
Cereal
  Battle Creek Sanitarium, 1:60–61, *61*
  marketing strategies, 2:37, *39*
  Mediterranean diet, 1:257
Cerebrovascular accident (CVA), 1:100, 147
Certification
  nutritionists, 1:105, 266, 2:105
  organic foods, 2:114
Certified Diabetes Educator (CDE), 1:105
Certified health education specialist (CHES), 1:266
Certified in Nutrition Support (CNS), 1:105
CFNI (Caribbean Food and Nutrition Institute), 1:111
CFNP (Community Food and Nutrition Program), 1:285
Champagne, 2:87
Channel One, 2:191
Chasteberry, 2:148
CHD (congenital heart disease), 1:272, 2:48, *49*
Check Out for Children program, 2:227
Chelating agents, as food additive, 1:2
Chelation therapy, for lead poisoning, 2:26–27
CHES (certified health education specialist), 1:266
Chewing difficulties, 1:21, 2:110, 111
Child and Adult Care Food Program (CACFP), 1:129, 284
Child Nutrition Act (1972), 2:255–256
Childhood obesity, **1:121–123,** 1:*122*, 2:153, 192–193
  See also Obesity
Children
  African-American, 2:166–167
  and caffeine, 1:82
  calcium requirements, 1:84–85, 86
  dental caries, 2:110, 111–112
  diarrhea, 1:149–151
  fiber requirements, 1:221–222
  food insecurity, 1:*229*, 229–230
  homeless, 1:283–284
  iron requirements, 1:39
  kwashiorkor, 2:21
  lead poisoning, 2:24, 25, *25*, 26
  malnutrition, 2:33–34, *34*, 35, *36*
  marasmus, 2:35–36
  marketing strategies aimed at, 2:38, *38*
  Mexican-American, 2:168
  nutritional deficiency, 2:*103*
  obesity, 2:153
  overweight, 2:153, 192–193
  protein requirement, 2:159
  and vegetarianism, 2:230
  white American, 2:166–167
  See also Adolescent nutrition; Preschoolers and toddlers, diet of; School-aged children, diet of
Chile, 2:201, 202, 203
China
  food-borne illness, 2:118
  functional foods, 1:241
Chinese, diet of, 1:50*t*, 53, 221
Chinese Americans, diet of, 1:50
Chiropractic, defined, 1:30
Chitin, as ergogenic aid, 1:192
Chloride, 2:60, 61

Chocolate
caffeine in, 1:81*t*
effect on mood, 2:*65*, *66*
Cholecystokinin (CCK), 1:170, 216
Cholera, 2:75
defined, 2:73
Cholesterol
and cardiovascular disease, 1:103
defined, 1:33
and fat intake, 1:217
Healthy Eating Index, 1:268
metabolism, 2:57–58, 77
optimal, borderline, and high levels, 2:29*t*, 30
and rice, 2:181–182
and saturated fatty acids, 2:93
Cholesterol, bad. *See* Low-density lipoprotein (LDL)
Cholesterol, good. *See* High-density lipoprotein (HDL)
Cholesterol to HDL ratio, 2:29*t*, 30
Choline, 2:244
Christmas, 2:189
Chromium, 1:191, 2:62
Chronic, defined, 1:6
Chronic diarrhea, 1:149
Chronic diseases
Asian Americans, 1:51
women's nutritional issues, 2:260–261, *261*
Chronic rheumatic heart disease, 1:272
Church World Service (CWS), 1:175*t*
Chylomicrons, 1:216, 2:29
Chyme, 1:169–170, 171
Chymosin, 1:65
Cigarettes. *See* Smoking
Circadian rhythms, 2:65–66
Cirrhosis of the liver, 1:24, *25*
Citric acid cycle, 1:96–97, 2:55
Clinical, defined, 1:62
Clinical dietitians, 1:104–105, 168
Cloning, defined, 1:66
Clostridium botulinum, 2:1, 120*t*
Clostridium perfringens, 2:1, 119, 120*t*
CNS (Certified in Nutrition Support), 1:105
Cobalamin, 1:40
Coca-Cola, 2:136, *136*
Coconuts, 1:53, 110
Code of Federal Regulations, 1:232, 233
Cod-liver oil, 2:46, *47*, 234–235
Coenzyme A, 2:241
Coffee
caffeine, 1:81, 81*t*
South America, 2:201, 202, 203
Cognitive restructuring, and weight management, 2:251
Colcannon, 2:86
Cold, common
and hand washing, 2:3
and vitamin C, 2:134, 244
Collagen, 2:244
College students, diets of, **1:123–127,** 1:*124*, *126*
alcohol use, 1:25, 124
eating patterns and serving sizes, 1:123
female students, 1:124–125
food and nutrient intake, 1:123–125
male students, 1:124
recommendations for improvement, 1:125–126
Colombia, 2:201, 202, *202*
Colon cancer, 1:91, 92
Color Additives Amendment (1960), 1:2–3
Color food additives, 1:2–4
Colostrum, 1:76
Columbus, Christopher, 2:78, 79
Combs, Sean "P. Diddy," 2:*217*
Comfort foods, 1:137
Commission on Accreditation for Dietetics Education (CADE), 1:105, 2:44, 105
Commission on Dietetic Registration (CDR), 1:106, 168, 2:44, 105
Commodity foods, **1:127–130,** 1:*129*
Commodity Supplemental Food Program, 1:127, 2:97
for disaster relief, 1:128
Emergency Food Assistance Program, 1:128
Food and Nutrition Service (FNS), 1:127, 128
Food Distribution Program on Indian Reservations, 1:128
other programs, 1:128–129
See also Nutrition programs in the community; WIC program
Commodity Supplemental Food Program (CSFP), 1:127, 2:97
Common cold
and hand washing, 2:3
and vitamin C, 2:134, 244
Communion, 2:176, *176*
Community Food and Nutrition Program (CFNP), 1:285
Community gardens, 2:222
Community nutrition programs, 2:96–99, *98*
Community Nutritionists, 1:105
Community-based organizations (CBOs), 2:83
Community-supported agriculture (CSA), 2:222
Complementary and alternative medicine (CAM), 1:30, 2:148–149
See also Alternative medicines and therapies
Complete proteins, 2:156
Complex carbohydrates, 1:94–96, *95*, 2:91
Comprehensive School Health Program (CSHP), **1:130–132,** 1:*131*
Compulsive overeating. *See* Binge eating
Congenital, defined, 1:40
Congenital heart disease (CHD), 1:272, 2:48, *49*
Congenital lactose intolerance, 2:22
Congregate Dining, defined, 1:22
Constipation
and calcium, 1:84
defined, 1:8
Consumerism, defined, 2:139
Contaminated water, 1:150, 173, 174–175, 2:*228*
Continuing Survey of Food Intakes by Individuals (CSFII), 1:160, *269*, 2:72
Contraindicated, defined, 1:192
Convenience foods, **1:132–133**
American dietary trend, 1:160
defined, 1:51
popular culture, 2:141
See also Fast foods
Convention on the Rights of the Child, 2:226, 227–228
Cooking difficulties, 1:22
Cool down, in exercise, 1:201
Cooperative for Assistance and Relief Everywhere (CARE), 1:175*t*
Copper, 2:62, 63
Corn, genetically modified, 1:245, 246–247, 248
Corn flakes cereal, 2:16, *17*
Corn- or maize-based diets, 1:*133*, **1:133–136**
maize varieties, 1:133–134
Native Americans, 2:79
protein quality, 1:134
vitamins, 1:134–136, *135*
See also Rice-based diets
Cornaro, Luigi, 1:255
Coronary artery disease (CAD), 1:272–274
as cardiovascular disease, 1:100, *101*
and fat intake, 1:217
and omega-6 fatty acids, 2:109

Coronary artery disease *(continued)*
prevention, 1:274, *274*
risk factors, 1:274
See also Cardiovascular disease (CVD)
Coronary heart disease
defined, 1:99
and estrogen, 2:48
Coumadin, 2:88*t*, 236, 237
Cous-cous, 1:17
Cows, in Hinduism, 2:176–177, *177*
Cravings, **1:136–139,** 1:*138*
causes, 1:136–138
conquering, 1:138–139
as eating disturbance, 1:184
during pregnancy, 1:136, 2:146
See also Eating disorders
Creatine, as ergogenic aid, 1:190, 2:218
Creole cooking, 1:12–13
Cretinism, defined, 1:252
Creutzfeldt-Jakob disease, 2:118–119
Crossbreeding, 1:65, 245
defined, 1:65
Cruveilhier, Jean, 1:79
Cruveilhier's disease, 1:79, 172
CSA (community-supported agriculture), 2:222
CSFII (Continuing Survey of Food Intakes by Individuals), 1:160, *269*, 2:72
CSFP (Commodity Supplemental Food Program), 1:127, 2:97
CSHP (Comprehensive School Health Program), 1:130–132, *131*
Cuban Americans. *See* Hispanics and Latinos, diet of
Cuisine, defined, 1:12
Cultural competence, **1:139–142**
attaining, 1:140, *140*, 141
and healthcare, 1:139–140
organizational responsibilities, 1:140–142
Curry, 1:109
Cuy, 2:*202*
CVA (cerebrovascular accident), 1:100, 147
CVD. *See* Cardiovascular disease (CVD)
CWS (Church World Service), 1:175*t*
Cyclamate, 1:48
Cyclospora cayetanensis, 2:1, 120
Cysteine, 2:156*t*
Cytoplasm, defined, 1:96
Cytotoxic testing, for food allergies, 1:29

D

Dairy products
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:257
with probiotics, 1:242*t*
See also Milk
DALE (Disability Adjusted Life Expectancy), 2:28
DASH (Dietary Approach to Stop Hypertension), 1:100, 290–291
Deamination, 2:157
defined, 2:56
Defibrillators, 1:*273*
Deficiencies
calcium, 1:84, 2:61
fluoride, 2:63
iodine, 1:56, 2:35, 63, 159–160
iron, 1:38–40, 56, 2:24, 26, 62–63, 153
magnesium, 2:61
minerals, 2:61, 62–63
niacin (vitamin B_3), 2:103
nutritional, 1:38, 2:102–104, *103*
potassium, 2:61
selenium, 2:63
sodium, 2:61
thiamine (vitamin B_1), 1:62, 2:103, 181
vitamin A, 1:56, 2:233*t*, 234, 264
vitamin C, 1:119, 120, 2:219–220, *220*
vitamin E, 2:233*t*, 237
vitamin K, 2:94, 233*t*, 236
zinc, 2:63
See also Vitamin D deficiency
Dehydration, **1:142–143**
defined, 1:142
and fasting, 2:175
and food-borne illness, 2:3, 4
occurrence, 2:247
sports nutrition, 2:217, *217*
See also Oral rehydration therapy
Delaney Clause, 1:3
Dementia, defined, 1:135
Denaturation, of proteins, 1:37
Dent corn, 1:133
Dental caries, 2:110, 111–112, 153
See also see Baby bottle tooth decay
Deoxyribonucleic acid (DNA)
and cancer, 1:90, 91
defined, 1:245
Human Genome Project, 2:75
Dependence, defined, 1:24
Depression
defined, 1:22
and eating disorders, 1:178
and serotonin, 2:66–67, 75
DERA (Disaster Preparedness and Emergency Response Association), 1:175*t*
Dermatitis, 2:135, *135*
DETERMINE, defined, 1:21
Developing countries
breastfeeding, 2:146
diarrhea, 1:149–151
fast food, 1:*165*
food insecurity, 1:228, 229–230
food-borne illness, 2:118
hunger, 1:287
kwashiorkor, 2:20
lead poisoning, 2:24, 26
malnutrition, 2:34, *34*
maternal mortality rate, 2:42
oral health, 2:111
undernutrition, 2:111, 141
underweight, 2:35
vitamin A deficiency, 2:234
water pasteurization, 2:133
Development, defined, 1:272
DEXA (dual energy X-ray absorbitometry) scans, 2:124
DHS (U.S. Department of Homeland Security), 2:172
Diabetes, defined, 1:5
Diabetes mellitus, **1:143–148**
adolescents, 1:6
African Americans, 1:14, 14*t*
and carbohydrates, 1:98, 2:54
complications, 1:146
exchange system, 1:98
gestational diabetes, 1:145, 2:146, 259
glycemic index, 1:250, 251
and heart disease, 1:147, 274
Hispanic Americans, 1:277
and hyperglycemia, 1:287–288
and hypoglycemia, 1:292
men, 2:51
Native Americans, 2:81
Pacific Islander Americans, 2:126
prevalence, 1:143–144, 164
and socioeconomic status, 2:167
and stroke, 1:147
treatment, 1:*144*, *145*, 147–148, 2:77
types, 1:144–146
women, 2:260
See also Exchange system; Hyperglycemia; Insulin
Diabetic ketoacidosis (DKA), 1:146
Diabetic retinopathy, 1:146
Diarrhea, 1:*149*, **1:149–151**
acute, 1:149, 150

causes, 1:149, 150*t*
chronic, 1:149
developing countries, 1:149–151
HIV/AIDS patients, 1:280
traveler's, 1:149
treatment, 1:151, 2:113
See also Oral rehydration therapy
Diastolic pressure, 1:99, *100*, 288
Diet, **1:151–152**
defined, 1:7
high-fiber, 1:222, 2:37
high-protein, 2:249
influence on health, 1:*163*, 164
low-carb, 1:97
macrobiotic, 2:31–33, *32*
whole foods, 1:242*t*, 2:255
See also Eating habits
Diet and Health, 1:154
Dietary Approach to Stop Hypertension (DASH), 1:100, 290–291
Dietary assessment, **1:152,** 2:214
See also Nutritional assessment
Dietary directors, 1:168
Dietary Goals for the United States, 1:153–154
Dietary Guidelines, **1:153–154**
early dietary advice, 1:153
evolution, 1:153–154
versus food guides, 1:153
and Healthy Eating Index, 1:267
and Howard Johnson's restaurants, 2:16
and hypertension, 1:290
school food service, 2:194
school-aged children, 2:191
See also Food Guide Pyramid
Dietary Reference Intakes (DRIs), **1:155**
defined, 1:20
elderly, 1:20
National Academy of Sciences, 2:67
preschoolers and toddlers, 2:151
See also Recommended Dietary Allowances (RDAs)
Dietary Supplement Health and Education Act (DSHEA) (1994), 1:31–32, 33, 156, 157–158, 241–243, 2:74
Dietary supplements, **1:155–159**
American dietary trend, 1:159
baby boomers, 1:156
as biologically-based treatment, 1:31
controversies, 1:157–158
dangerous ergogenic aids, 1:193
Food and Drug Administration, 1:33, 156, 158, 2:59–60
and medical nutrition therapy, 2:43
minerals, 2:59–60, *60*
and popular culture, 2:141
preschoolers and toddlers, 2:153
and quackery, 2:161–162, 163–164
regulation, 1:156–157
selecting, 1:33–34
supplement facts label, 1:32–33
See also Alternative medicines and therapies; Vitamins, fat-soluble; Vitamins, water-soluble
Dietary trends, American, **1:159–162**
away-from-home foods, 1:163–164
by decade, 1:161*t*
dietary patterns, 1:159
nutritional adequacy, 1:161–162
obesity, 1:164
portion sizes, caloric intake, and obesity, 1:160
sweet, quick, and easy, 1:160, *160*
Dietary trends, international, **1:162–165**
food safety, 1:164–165
influence of diet on health, 1:*163*, 164
Westernization of dietary patterns, 1:163–164, *165*
Dietetic technician, registered (DTR), 1:104, 106, **1:166**
See also Careers in dietetics
Dietetics, **1:166–167**
See also Careers in dietetics
Dieting, **1:167–168**
chronic, 1:185
and eating disorders, 1:179
and eating disturbances, 1:184–185
and popular culture, 2:141
and weight cycling, 1:184–185
Dietitian, 1:106, *168*, **1:168–169**
See also Careers in dietetics; Nutritionist
Diets, corn- or maize-based. *See* Corn- or maize-based diets
Diets, fad. *See* Fad diets
Diets, rice-based. *See* Rice-based diets
Digestion and absorption, **1:169–173,** 1:*171*
absorption, 1:172
difficulties, 1:22
factors affecting, 1:250
fat-soluble vitamins, 2:232
fiber, 1:221, 222
GI tract physiology, 1:169
nutrients into blood or to heart, 1:172
protective factors, 1:170–171
protein, 2:157
from stomach to small intestine, 1:169–170
See also Glycemic index (GI)
Dilantin, 2:88*t*
Dipeptides, 1:37
Diphtheria, defined, 2:132
Direct additives, 1:1
Direct Relief International (DRI), 1:175*t*
Disability Adjusted Life Expectancy (DALE), 2:28
Disaccharide carbohydrate, defined, 2:21
Disaccharides, 1:93–94, 94*t*
Disaster Preparedness and Emergency Response Association (DERA), 1:175*t*
Disaster relief organizations, **1:173–176,** 1:175*t*
commodity foods, 1:128
disease risks, 1:174–176
health risks, 1:173–174, *174*
needs assessment, 1:173
See also Emergency Nutrition Network; Famine
Discourse on a Sober and Temperate Life (Cornaro), 1:255
Disease
and exercise, 1:199–200
infectious, 1:35, 2:234
and minerals, 2:60–61, 62
and obesity, 1:217
risks after disasters, 1:174–176
vector-borne, 1:176
Disease-risk reduction claims. *See* Health claims
The Diseases of Children and Their Remedies (Rosenstein), 2:186, *186*
Dispensable amino acids, 1:36, 36*t*, 2:155–156
Diuretics, 1:291
defined, 1:142
Diversity, defined, 1:10
Diverticulosis, defined, 1:8
DKA (diabetic ketoacidosis), 1:146
DNA
and cancer, 1:90, 91
defined, 1:40
Human Genome Project, 2:75
Dominica
popular dishes, 1:110
public health initiative, 1:111
Dopamine, effect on mood, 2:64, 66*t*
Double-blind, placebo-controlled food challenge, 1:28
Dowager's hump, 2:124, *124*
Dr. Atkins' New Diet Revolution, 1:97, 203*t*, 204, *204*, 206

DRI (Direct Relief International), 1:175*t*
Drinking water. *See* Water
DRIs. *See* Dietary Reference Intakes (DRIs)
Drug-nutrient interactions. *See* Nutrient-drug interactions
Drugs
  defined, 1:3
  function, 2:88
DSHEA. *See* Dietary Supplement Health and Education Act (DSHEA) (1994)
DTR (dietetic technician, registered), 1:104, 106, 166
Dual energy X-ray absorbitometry (DEXA scans), 2:124
Duodenum, 1:170
Dyazide, 2:88*t*
Dysentery, 1:149, 2:3
Dyslipidemia, defined, 1:122
Dysmorphia, 1:70, 71
  defined, 1:70

E

E. coli. *See* Escherichia coli
EAR (Estimated Average Requirement), 1:155
Earthquake (Bam, Iran), 2:226
East Africans, diet of, 1:18
East Asians, diet of, 1:53–54
Eastern Orthodox Christianity food practices, 2:176, 178*t*
Eating disorder not otherwise specified (EDNOS), 1:178
Eating disorders, **1:176–182,** 1:*179*, *180*
  adolescents, 1:6, 2:193
  athletes, 1:125
  body image, 1:69–71, *70*
  causes, 1:179
  college students, 1:124–125
  defined, 1:41
  diagnosis, 1:176–178
  in female athlete triad, 1:219, 2:218
  Fiji, 2:131
  history, 1:181
  and malnutrition, 2:140
  outcomes, 1:181
  prevalence, 1:178, 184
  risk factors, 1:178–179
  treatment modalities, 1:179–181
  See also Anorexia nervosa; Bulimia nervosa
Eating disturbances, **1:182–185,** 1:*183*
  binge eating, 1:63–64, 177–178, 181, 182, 184, 2:140
  chronic dieting, 1:185
  cravings, 1:136–139, *138*, 184
  excessive exercising, 1:184
  weight cycling, 1:184–185, 2:250, 264–265
  See also Eating disorders
Eating habits, **1:186–188**
  exposure to foods, 1:187, *187*
  food choice influences, 1:*186*, 187–188
  obtaining, storing, using, and discarding food, 1:187
  what people eat, 1:187
  why and how people eat, 1:186
  See also Popular culture, and food
Ebola vaccine, 2:75
Eclampsia, 1:289
Ecological, defined, 1:188
Ecuador, 2:201, *202*, 203
Eczema, defined, 2:5
Edamame, 2:208, 210
Edema, 2:158, 248
  defined, 1:289
EDNOS (eating disorder not otherwise specified), 1:178
Efficacy, defined, 1:156
EFNEP (Expanded Food Nutrition and Education Program), 1:202–203
Eggs, 1:*241*, 242*t*, 2:242
El Salvador, 1:113
Elderly. *See* Aging and nutrition
Electrolytes
  defined, 1:37
  for dehydration, 2:4
  HIV/AIDS patients, 1:280
Electronic pasteurization, 2:13–14
Elemental, defined, 1:84
Elimination diet, defined, 1:28
The Emergency Food Assistance Program (TEFAP), 1:128, 284–285
Emergency Health Kits, 1:174
Emergency Nutrition Network (ENN), **1:189**
  See also Disaster relief organizations
Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES), 1:225
EMPRES (Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases), 1:225
Endorphins, effect on mood, 2:*65*, 66
Endotoxins
  defined, 1:245
  in genetically modified foods, 1:246–247
Enema, defined, 2:61
Energy, defined, 1:5
Energy boosters (ergogenic aids), 1:192
Energy needs. *See* Calories
Energy therapies, 1:31, 31*t*
England, 2:84, *85*
Enhanced foods, as functional food type, 1:242*t*
ENN (Emergency Nutrition Network), 1:189
Enriched foods, as functional food type, 1:242*t*
Enrichment, 1:239
  defined, 1:2
Enteral nutrition, 1:281
Enteric, defined, 2:35
Entrepreneur, defined, 1:61
Environment, defined, 1:22
Environmental illness, defined, 1:29
Enzymatic, defined, 1:65
Enzymes
  and biotechnology, 1:65
  brush border, 2:157
  defined, 1:24
  and protein, 2:158
  role, 1:37
EPA (U.S. Environmental Protection Agency), 2:172
Ephedra, 1:192, 2:218
Epiglottis, 1:169, 170
Epinephrine, defined, 2:244
Epithelial cells, defined, 1:88
Erectile dysfunction, 2:53
Ergogenic aids, **1:189–193**
  anabolic agents, 1:190–192, *191*
  dangerous supplements, 1:193
  energy boosters, 1:192
  weight loss agents, 1:192
  See also Dietary supplements; Sports nutrition
Errors of metabolism, inborn. *See* Inborn errors of metabolism
ERT. *See* Estrogen replacement therapy (ERT)
Erythrocyte, 1:38, 2:212
Erythrosine, 1:3–4
Escherichia coli, 2:1–2, 3, 118, 119, 120*t*
  defined, 2:1
Essential amino acids, 1:36, 36*t*, 38, 2:155–156
Essential fatty acids, 2:94, 108–109
  defined, 1:210
Essential hypertension, 1:289

Estimated Average Requirement (EAR), 1:155
Estradiol, defined, 1:191
Estrogen
and coronary heart disease, 2:48
defined, 1:92
female athletes, 2:218–219
versus isoflavones, 2:14
Estrogen replacement therapy (ERT), 2:48, *49*, 124, 208
Ethiopian refugees, 2:*165*
Ethnicity, and body mass index, 1:73
Etiology, defined, 2:33
Etiquette, and eating habits, 1:186
Europe, food additive and preservative regulation, 1:4
European Union
artificial sweeteners, 1:48
genetically modified foods, 1:248
organic foods, 2:115
European Union Scientific Committee for Food, 1:4, 47
Europeans, Central. *See* Central Europeans and Russians, diets of
Europeans, Northern. *See* Northern Europeans, diet of
Europeans, Southern. *See* Southern Europeans, diet of
Evaporated milk, 2:10
Exchange system, 1:147, **1:193–197,** 1:287
advantages and disadvantages, 1:194–196
definition, 1:194
history, 1:196–197, 196*t*, 197*t*
using, 1:195
See also Diabetes
Exercise, **1:198–201**
aerobic, 1:198
anaerobic, 1:198
benefits, 1:198–199, *199*
and cancer, 1:91
and cardiovascular disease, 1:100–101, 103
childhood obesity, 1:122
defined, 1:198
and dehydration, 1:143
and diabetes, 1:147, 287–288
and disease prevention, 1:199–200
and endorphins, 2:66
excessive, 1:184
and heart disease, 1:274
and insulin, 2:13
and menopause, 2:48, 50
and obesity, 2:106
physical fitness components, 1:200
and pregnancy, 2:144–145
for premenstrual syndrome, 2:148
recommended, 1:201
and space travel, 2:211–212
strategies, 2:251
trends, 1:161
and weight management, 1:205–206, 2:107, 249, 251, *252*
See also Sports nutrition
Exercise addiction, **1:201–202,** 1:*202*
Expanded Food Nutrition and Education Program (EFNEP), **1:202–203**
"Extra lean," as nutrient content claim, 1:265*t*
Extracellular fluid compartment, 1:37

F

Fad diets, 1:167, **1:203–206,** 1:203*t*, *204*, 2:141, 250
See also Dieting; Weight loss diets
FAE (fetal alcohol effects), 1:25, 220
Failure to thrive, **1:206–207**
defined, 1:167
See also Infant nutrition
Famine, **1:207–208,** 1:*208*
defined, 1:19
See also Food insecurity
FAO (Food and Agriculture Organization), 1:118, 224–225, 248
Farmers markets, 2:97, 222, 256–257
FAS (fetal alcohol syndrome), 1:25, *220*, 220–221
Fast foods, 1:*209*, **1:209–210**
American dietary trend, 1:160
Caribbean Islands, 1:110
defined, 1:111
developing countries, 1:*165*
and health, 2:*52*
popular culture, 2:139–140, *140*
Saudi Arabia, 1:*165*
school-aged children, 2:192
See also Convenience foods
Fasting, **1:210**
and dehydration, 2:175
and gastric acidity, 2:175
and lipid profile, 2:29–30
religion and dietary practices, 2:174–175, 176, 177, 178–179
See also Dieting; Religion and dietary practices
Fasting hypoglycemia, 1:292
Fat substitutes, **1:210–214,** 1:217–219
carbohydrate-based, 1:212, 212*t*, 217–218
categories, 1:*211*, 212–213, 212*t*
described, 1:211–212
effectiveness, 1:213–214, 213*t*
fat-based, 1:212*t*, 213, 218–219
protein-based, 1:212, 212*t*, 218
safety, 1:213
See also Artificial sweeteners; Fats
Fat-free products, 1:219
Fatigue, defined, 1:5
Fats, **1:214–219,** 1:*217*
absorption, 1:172
actual and recommended intake, 1:216–217, *218*
adolescents, 2:192
and cancer, 1:91
and cardiovascular disease, 1:101–102
defined, 1:7
fat-replacement strategies, 1:217–219
function, metabolism, and storage, 1:215–216
Healthy Eating Index, 1:267–268
Mediterranean diet, 1:259, 260
metabolism, 1:216, 2:56–57
as nutrient, 1:210–211, 216, 2:92–94
sports nutrition, 2:216
See also Fat substitutes; Lipid profile
Fat-soluble vitamins. *See* Vitamins, fat-soluble
Fatty acids
defined, 1:31
metabolism disorders, 2:7
FDA. *See* U.S. Food and Drug Administration (FDA)
FDAMA (Food and Drug Administration Modernization Act) (1997), 1:264–265
FD&C Red No. 3, 1:3–4
FD&C Yellow No. 3, 1:4
FDPIR (Food Distribution Program on Indian Reservations), 1:128
Federal Food, Drug, and Cosmetic Act (1938), 1:241–243
Color Additives Amendment (1960), 1:2–3
Food Additives Amendment (1958), 1:2
Federal Register, 1:232
Federation Internationale de Football Association (FIFA), 2:227–228
Feijoda completa, 2:202
Female athlete triad, 1:125, **1:219–220,** 2:218–219
See also Eating disorders; Osteoporosis; Sports nutrition
Females. *See* Women's nutritional issues

Fermentation
as biotechnology technique, 1:65
defined, 1:4
Fertilizers, 2:221
Fetal alcohol effects (FAE), 1:25, 220
Fetal alcohol syndrome (FAS), 1:25, *220*, **1:220–221**
See also Alcohol and health; Pregnancy
Fetus, 2:*145*
FH (Food for the Hungry), 1:175*t*
Fiber, **1:221–223**
actual and recommended intake, 1:221–222
and cancer, 1:91
and cardiovascular disease, 1:103
as complex carbohydrate, 1:94–96, 2:91
defined, 1:8
food content, 1:222*t*
as functional food, 1:242*t*
high-fiber diets, 1:222
insoluble, 1:221
intake during menopause, 2:50
in juices, 1:242*t*
recommended intake, 1:97
soluble, 1:221
types, 1:221
FIFA (Federation Internationale de Football Association), 2:227–228
Fight-or-flight response, 1:138
Fiji, 2:131
Filipinos, diet of, 1:50*t*, 54–55
Finland, vitamin C deficiency in, 1:120
Fish
as functional food, 1:242*t*
and omega-3 fatty acids, 2:108, 109, *109*
Pacific Islanders, 2:130
Scandinavia, 2:188, *188*
Fish stew, 2:204
FITT (Frequency, Intensity, Time, Type) principle, 1:200–201
Flavonoids, and heart disease, 1:240
Flaxseed, as functional food, 1:242*t*
Flexibility, as physical fitness component, 1:200
Flint corn, 1:133
Flower corn, 1:133
Fluids
compartments for, 1:37
pregnancy, 2:144
and protein, 2:158
space travel, 2:214
sports nutrition, 2:*217*, 217–218, 218*t*
Fluoride
deficiency, 2:63
disease prevention and treatment, 2:62
infant nutrition, 2:8
and oral health, 2:112
toxicity, 2:63
Fluorosis, 2:63
FMNV (foods of minimum nutritional value), 2:195, 196
FNS. *See* U.S. Food and Nutrition Service (FNS)
Folate, 2:240*t*, 242–243
and anemia, 1:40
defined, 1:38
fortification of food, 1:242*t*, 2:72
and pregnancy, 1:40, 2:142–143
women, 2:259
Folic acid. *See* Folate
Folk remedies
African Americans, 1:13
lead poisoning, 2:26
Follicular hyperkeratosis, 2:234
Food additives
defined, 1:2
See also Additives and preservatives
Food Additives Amendment (1958), 1:2
Food Aid for Development and the World Food Programme, 1:223–224, *224*
See also Famine; Food insecurity; United Nations
Food and Agriculture Organization (FAO), 1:118, **1:224–225,** 1:248
See also Famine; Food insecurity; United Nations
Food and Agriculture Organization Joint Expert Committee on Food Additives, 1:4
Food and Drug Administration Modernization Act (FDAMA) (1997), 1:264–265
Food Code, 1:235–236
Food Distribution Program on Indian Reservations (FDPIR), 1:128
Food for the Hungry (FH), 1:175*t*
Food Guide Pyramid, **1:225–228,** 1:*227*
alternative pyramids, 1:226–227
and DASH eating plan, 1:291
design and recommendations, 1:225–226
and Dietary Guidelines, 1:153, 154
elderly, 1:20
and Healthy Eating Index, 1:267
nutrients, 2:*93*
school-aged children, 2:191
uses, 1:226
Vegetarian Food Guide Pyramid, 2:231
See also Dietary Guidelines
Food Guide Pyramid for Young Children, 2:151, 191
Food habits. *See* Eating habits
Food insecurity, **1:228–231,** 1:*229*
Africa, 1:19
after disasters, 1:173–174, *174*
Asia, 1:55
and hunger, 1:287
See also Famine; Hunger; Malnutrition
Food jags, 2:153
Food labels, **1:231–235**
dietary supplements, 1:156
fat content, 1:216, *217*, 219
Food and Drug Administration, 1:232–233, 234, 237, 241–243, 2:161
functional foods, 1:241–243
genetically modified foods, 1:67–68, 248
ingredient list, 1:232
and marketing strategies, 2:39
net quantity of contents, 1:232
Nutrition Facts statement, 1:233, *234*
nutrition labeling, 1:232–234, 233*t*
organic foods, 1:237, 2:114
overview, 1:231–232
Percent Daily Value, 1:233*t*, 234
Product Identity statement, 1:232
required nutrients, 1:233–234
serving size, 1:234
See also Health claims; Regulatory agencies
Food poisoning
defined, 1:164
See also Illnesses, food-borne
Food safety, **1:235–239**
additives and preservatives, 1:2–4
biotechnology, 1:67–68, 237
bioterrorism, 1:237–238, 2:172
control and oversight, 1:235–236
fat substitutes, 1:213
food-borne illness, 1:236, *237*
genetically modified foods, 1:246–248
international dietary trends, 1:164–165
organic foods, 2:116–117
pesticides, 1:236–237
regulation history and purpose, 1:238–239, 238*t*

World Health Organization, 2:172–173, 262–263
See also Biotechnology; Genetically modified foods; Irradiation; Pesticides
Food Safety Initiative Activity, 2:172
Food security. *See* Food insecurity
Food Stamp Program, 1:127, 128, 284, 2:97, 256*t*
Food-based dietary guidelines, 2:205
Food-borne illness. *See* Illnesses, food-borne
Food-borne organisms. *See* Organisms, food-borne
Food-for-Growth program, 1:223
Food-for-Life program, 1:223
Food-for-Work program, 1:223–224, *224*
Foods of minimum nutritional value (FMNV), 2:195, 196
Formula feeding, 1:242*t*, 2:9–10, 38–39
See also Breastfeeding; Infant nutrition
Fortification, **1:239,** 1:242*t*, 2:72
defined, 1:2
See also Functional foods
Fortified, defined, 1:2
Fractures, and osteoporosis, 2:124, 125
Framingham Heart Study, 1:103
France
diet, 2:86–87
food-borne illness, 2:118, 119
life expectancy, 2:28
organic foods, 2:115
See also French paradox
Franchising, 2:15, *15*
"Free," as nutrient content claim, 1:265*t*
Free food, in exchange system, 1:195
Free radicals
and antioxidants, 1:42, 43–44
and carotenoids, 2:234
and cigarette smoke, 1:*43*
defined, 1:42
French Guiana, 2:203
French paradox, **1:239–240,** 2:84
See also France; Heart disease
French Wine Coca, 2:135–136
Frequency, Intensity, Time, Type (FITT) principle, 1:200–201
Fructose, 1:93, 94*t*
Fruit juice
glycemic index, 1:251*t*
nutrient-drug interaction, 2:89
and oral health, 2:111–112
Fruits
Asia, 1:52–53, 54
and cancer prevention, 1:91
Caribbean Islands, 1:108–109, 110
Central America and Mexico, 1:114
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:257
FTC (U.S. Federal Trade Commission), 2:164
Functional foods, **1:240–243,** 1:*241*
antioxidants, 1:43–44
defined, 1:43
future, 1:243
popular culture, 2:141
regulations, 1:241–243
types, 1:242*t*
See also Antioxidants; Phytochemicals
Fungal, defined, 1:279
Funk, Casimir, 1:*244*, **1:244–245**
See also Vitamins, fat-soluble; Vitamins, water-soluble

G

Galactose, 1:93, 2:6, 21
Galactosemia, 2:6
defined, 1:75
Gallbladder, 1:170
Gamma butyrolactone and gamma hydroxy butyric acid (GBL/GHB), 1:193
Gamma rays, defined, 2:13
Garlic, 1:242*t*, 2:*161*
Gasoline, leaded, 2:24, 25
Gastric, defined, 1:79
Gastric acidity, 2:175
Gastric ulcer, 1:79, 172
Gastrointestinal, defined, 1:27
Gastrointestinal tract physiology, 1:169
GAVI (Global Alliance for Vaccines and Immunizations), 2:227
GBL/GHB (gamma butyrolactone and gamma hydroxy butyric acid), 1:193
GDNNPP (Global Database on National Nutrition Policies and Programmes), 1:249–250
Gemini space program, 2:212
Gene expression, defined, 2:55
Generally Recognized as Safe (GRAS), **1:245**
artificial sweeteners, 1:46–47
fat substitutes, 1:212, 213
sugar alcohols, 1:47
See also Food safety
Genes
and cancer, 1:90
defined, 1:24
and obesity, 2:106
Genetic, defined, 1:38
Genetic engineering, 1:65, *66*
Genetically modified foods, **1:245–248**
acceptance, 1:*247*, 248
examples, 1:245–246
labeling, 1:248
potatoes, 1:245, 246–247
rice, 1:*66*, 68, 245, 246–247, 2:182, 264
safety, 1:237, 246–248
soybeans, 1:245
tomatoes, 1:65, 245–246
See also Biotechnology; Food safety
Genetics, defined, 2:47
Genistein, 2:208
Germany
herbal therapy, 1:157
organic foods, 2:115
Gestational diabetes, 1:145, 2:146, 259
GI (glycemic index), 1:250–252, 251*t*, 2:13
See also Carbohydrates; Diabetes mellitus
GI tract physiology, 1:169
Giardia lamblia, 2:120, 120*t*
Ginger, for seasickness, 1:33
Gingivitis, 2:*112*
Ginseng, as ergogenic aid, 1:192
Give Me Five program, 2:227
Glandular fever, 2:*12*
Glickman, Dan, 2:*151*
Glisson, Francis, 1:*249*, **1:249**
Global Alliance for Vaccines and Immunizations (GAVI), 2:227
Global Database on National Nutrition Policies and Programmes (GDNNPP), **1:249–250**
Global Movement for Children program, 2:228
Global Outbreak Alert and Response Network (GORAN), 2:262
Global Polio Eradication Initiative, 2:227
Global Public Health Intelligence Network (GPHIN), 2:262
Globalization, defined, 1:116
Glossitis, 2:111
Glucagon, 1:170
Gluconeogenesis, 2:55, 57
Glucose
defined, 1:28

Glucose *(continued)*
and diabetes, 1:*144*, 147
as energy source, 2:91–92
and inborn errors of metabolism, 2:6, 7
and insulin, 1:37, *37*
and lactose intolerance, 2:21
metabolism, 2:54
and pregnancy, 2:144
as simple carbohydrate, 1:93, 94*t*
Glutamine, 2:156*t*
Gluten, defined, 2:42
Glycemic index (GI), **1:250–252,** 1:251*t*, 2:13
See also Carbohydrates; Diabetes mellitus
Glycerol, 2:57
defined, 2:29
Glycine, 2:155, 156*t*
Glycogen
as complex carbohydrate, 1:94
defined, 1:94
and sports nutrition, 2:216
storage diseases, 2:6–7
Glycogenesis, 2:55
Glycogenolysis, 2:55
Glycolysis, 1:96–97, 2:55, 57, 157
defined, 1:93
GMP (Good Manufacturing Practice), 1:158
GnRH (gonadotropin-releasing hormone) agonists, 2:149
Goiter, 1:*252*, **1:252–253**
Goldberger, Joseph, 1:*253*, **1:253–254,** 2:73
See also Pellagra
Golden rice, 1:*66*, 68, 245, 246–247, 2:182, 264
Gonadotropin-releasing hormone (GnRH) agonists, 2:149
Good cholesterol. *See* High-density lipoprotein (HDL)
Good Manufacturing Practice (GMP), 1:158
"Good source," as nutrient content claim, 1:265*t*
GORAN (Global Outbreak Alert and Response Network), 2:262
"Got Milk?" advertisements, 2:37–38
GPHIN (Global Public Health Intelligence Network), 2:262
GR (Green Revolution), 1:261–262, 2:182
Graham, Sylvester, **1:254–255**
Grains, as functional food, 1:242*t*
Grapefruit, glycemic index, 1:251*t*
Grapes/grape juice, 1:240, 242*t*
GRAS. *See* Generally Recognized as Safe (GRAS)
Grazing, **1:255–256**
See also Eating habits; Snacking
Greece, life expectancy in, 2:28
Greeks and Middle Easterners, diet of, **1:256–261,** 1:*257*
culture, 1:259
food preparation and storage, 1:258, 259*t*
Mediterranean Basin, 1:256
nutrition and disease, 1:259–260
present day, 1:258
traditional, 1:256–258
Green Revolution (GR), **1:261–262,** 2:182
Grenada
popular dishes, 1:110
public health initiative, 1:112
Growth charts, **1:262,** 2:72
Growth factor, defined, 1:91
Growth hormone, 1:246, **1:262–263**
See also Ergogenic aids
Growth spurts, defined, 1:86
Guadeloupe, 1:110
Guar gum, defined, 1:212
Guatemala, 1:113
Guinea pigs, 2:*202*
Gumbo, 1:11, *11*, 13
Gums, as dietary fiber, 1:96
Guthrie test, 2:*5*
Guyana, 1:110, 2:203
Gynoid fat distribution, 1:68

H

HACCP (Hazard Analysis Critical Control Point) system, 1:236, 2:121, 172
Haggis, 2:85
Halal foods, 1:258, 259*t*, 2:177
Hand washing, 2:3, 12, 120, 121
Hardening of the arteries. *See* Atherosclerosis
Harris-Benedict equation, 2:101, 102
defined, 2:101
Harvey, William, 1:205
Hawaiians. *See* Pacific Islander Americans, diet of; Pacific Islanders, diet of
Hazard Analysis Critical Control Point (HACCP) system, 1:236, 2:121, 172
HDL
defined, 1:191
See also High-density lipoprotein (HDL)
Head Start program, 2:98
Health, **1:263**
See also Health promotion
Health, or How to Live (Graham), 1:255
Health claims, **1:263–266**
dietary supplements, 1:156
food labels, 1:232
functional foods, 1:242, 243
general requirements, 1:265
"healthy," 1:264
and marketing strategies, 2:37–38
nutrient content claims, 1:264, 265*t*
soy protein, 1:243, 2:207
types, 1:265–266
See also Food labels; Regulatory agencies
Health communication, **1:266**
Health education, 1:131, **1:266–267**
Health promotion, **1:267**
defined, 1:106
"Healthy," on food labels, 1:264
Healthy Eating Index (HEI), **1:267–269,** 1:*268*
Healthy People (1979), 1:269
Healthy People 2000 report, 1:210, 270, 271
Healthy People 2010 report, **1:269–271,** 1:*270*
African Americans, 1:14
childhood obesity, 1:121
dental caries, 2:110
exercise, 1:198, 201
Heart attack, 1:272, *273*, 2:75
defined, 1:59
Heart disease, **1:271–275,** 1:*273*, *274*
adolescent risk, 1:6
congenital, 1:272
coronary artery disease, 1:272–274
defined, 1:5
and diabetes, 1:147
French paradox, 1:239–240
and hypertension, 1:*289*
men, 2:51–53, *52*
myocardial infarction, 1:272, 2:75
Native Americans, 2:81
and omega-3 fatty acids, 2:108–109
Pacific Islander Americans, 2:126–127
rheumatic, 1:272
and soy, 2:207–208
women, 2:260–261
See also Atherosclerosis; Cardiovascular disease (CVD)
Heartburn, during pregnancy, 2:146
Heavy metal, defined, 2:23
HEI (Healthy Eating Index), 1:267–269, *268*

Height and weight tables, 2:99–100, 100*t*
Hemicellulose, 1:95
Hemoglobin, defined, 1:38
Hemorrhoids, defined, 1:8
Henrich, Christy, 1:*180*
Hepatitis, defined, 1:24
Hepatitis A, 2:118, 119, 120*t*
Hepatitis C, and breastfeeding, 2:146
Herbal, defined, 1:54
Herbicide-resistant weeds, 1:246
Herbs
  as dietary supplement, 1:156, 157, 2:49
  in food and beverages, as functional food, 1:242*t*
  in menopause, 2:49
HGH (human growth hormone), 1:262–263
HHANES (Hispanic Health and Nutrition Examination Survey), 2:69
HHS. *See* U.S. Department of Health and Human Services (HHS)
HHS (hyperosmolar hyperglycemia state), 1:146
"High," as nutrient content claim, 1:265*t*
High blood pressure
  defined, 1:14
  See also Hypertension
High potency, defined, 1:33
High-density lipoprotein (HDL)
  and cardiovascular disease, 1:103
  cholesterol/HDL ratio, 2:29*t*, 30
  HDL/LDL ratio values, 2:30*t*
  in lipid profile, 2:29, 30
  optimal, borderline, and high levels, 2:29*t*
  and soy, 2:207
High-fiber diets, 1:222, 2:37
High-protein diets, 2:249
High-quality proteins, 2:156
High-yield variety (HYV) seeds, 1:261–262
Hindu food practices, 2:175, 176–177, *177*, 178*t*
Hispanic Health and Nutrition Examination Survey (HHANES), 2:69
Hispanics and Latinos, diet of, **1:275–279,** 1:278*t*
  acculturation, 1:276–278, 2:169
  characteristics, 1:275–276, *277*
  childhood obesity, 1:121
  diet-related disease, 1:14*t*
  regional diet, 2:168–169
  socioeconomic status, 2:168, 169
  See also Central Americans and Mexicans, diets of
Histidine, 2:156*t*
HIV/AIDS, **1:279–282,** 1:*281*
  antiretrovital drugs, 2:76
  breastfeeding, 2:146
  complications, 1:280
  cures as quackery, 2:163
  ethical considerations for care, 1:281–282
  nutrition, 1:279–280
  oral nutrition alternatives, 1:280–281
  statistics, 1:280
  United Nations Children's Fund (UNICEF), 2:226
  See also Immune system
HMB (beta-hydroxy beta-methylbutyrate), 1:190
Hmongs, diet of, 1:50*t*
Homelessness, **1:282–287,** 1:*283*
  diet deficits, 1:285–286
  government programs, 1:284–285
  organizations, 1:285
  poverty and undernutrition, 1:283
  undernutrition among children, 1:283–284
  See also Food insecurity
Homeostasis, 2:245, 246
  defined, 2:144
Hong Kong, organic foods in, 2:115
Hookworm, defined, 1:40
Hoppin' John, 1:11, 12
Hormiga, 2:202, *202*
Hormone replacement therapy. *See* Estrogen replacement therapy (ERT)
Hormones
  and cravings, 1:137
  defined, 1:31
  production, 2:158
  regulatory functions, 1:37
Howard Johnson's restaurants, 2:15, *15*, 16
HRT (hormone replacement therapy). *See* Estrogen replacement therapy (ERT)
Human Genome Project, 2:75
Human growth hormone (HGH), 1:262–263
Human immunodeficiency virus. *See* HIV/AIDS
Human subjects, 2:75–76
Hungary, 1:118
Hunger, 1:44–45, **1:287**
  See also Appetite; Food insecurity
Hydration, defined, 1:72
Hydrochloric acid, 2:157
Hydrogen breath test, 2:22
Hydrolysis, 2:157
Hydrolyze, defined, 2:157
Hygiene, defined, 1:236
Hygienic Laboratory, 2:73
Hype, defined, 1:33
Hyperactivity, 1:29
Hypercalcemia, 1:84
Hypercarotenemia, 2:234
Hypercholesterolemia, defined, 1:117
Hyperglycemia, 1:146, 148, **1:287–288**
  defined, 1:143
  See also Diabetes mellitus; Insulin
Hyperinsulinemia, 1:145
Hyperlipidemia, defined, 1:164
Hyperosmolar hyperglycemia state (HHS), 1:146
Hypertension, **1:288–291,** 1:*289*
  African Americans, 1:14, 14*t*, 290, 2:167
  Asia, 1:56–57
  as cardiovascular disease, 1:99–100, *100*, 103
  causes, 1:289–290
  DASH eating plan, 1:290–291
  defined, 1:10
  described, 1:288
  and diet, 1:290
  and exercise, 1:199
  lifestyle treatment, 1:291, 2:76–77
  men, 2:53
  pharmacological treatment, 1:291
  and potassium, 2:167
  and pregnancy, 1:289, 2:223
  primary, 1:289
  and rice, 2:181
  secondary, 1:289, 291
  types, 1:289
  women, 2:261
  See also Cardiovascular disease (CVD)
Hypertrophy, defined, 1:190
Hypervitaminosis A, 2:233*t*, 234
Hypochromic anemia, 1:38, 39*t*
Hypoglycemia, 1:24, **1:292**
  defined, 1:24
  See also Diabetes mellitus
HYV (high-yield variety) seeds, 1:261–262

I

IBIDS (International Bibliographic Information on Dietary Supplements), 1:156
Ice cream, glycemic index, 1:251*t*

IFG (impaired fasting glucose), 1:145
IGT (impaired glucose tolerance), 1:145
Ileum, 1:170
Illnesses, food-borne, 1:236, *237*, **2:1–4**
causes, 2:1–3, *2*
historical outbreaks, 2:118–119
international dietary trends, 1:164–165
intoxication and infection, 2:1, 120*t*
magnitude, 2:118
and organic foods, 2:116
Pacific Islands, 2:132
prevention, 2:3, 121
Scandinavia, 2:187
South America, 2:203–204
symptoms, 2:3
treatment, 2:3–4
See also Food safety; Organisms, food-borne
The Immune Advantage (Mazo and Berndtson), 1:279–280
Immune system, 2:1, 3, **2:4,** 2:34, 232
defined, 1:26
See also Infection
Immunocomprised, defined, 2:117
Immunoglobulins, 1:37
Immunologic, defined, 1:75
Immunoproteins, 1:37
Impaired fasting glucose (IFG), 1:145
Impaired glucose tolerance (IGT), 1:145
Impotence, 2:53
Inborn errors of metabolism, **2:4–7,** 2:5
amino acid metabolism disorders, 2:5–6
carbohydrate metabolism disorders, 2:6–7
See also Phenylketonuria (PKU)
Incidence, defined, 1:41
Incisor, defined, 2:153
Incomplete proteins, 2:156
India, oral cancer in, 1:88
Indian corn, 1:134
Indians, American. *See* Native Americans
Indians, Asian, diet of, 1:50*t*, 55
Indigestion, defined, 1:256
Indirect additives, 1:1
See also Additives and preservatives
Indispensable amino acids, 1:36, 36*t*, 38, 2:155–156
Infant mortality rate, **2:7–8**
See also Maternal mortality rate
Infant nutrition, **2:8–12**
beikost (solid food), 1:62, 2:9, 10–11
breastfeeding, 2:8–9, 11
calcium, 1:84–85
formula feeding, 2:9–10
nutrient requirements, 2:8
protein, 2:159
self-feeding, 2:11
South, 2:258, *258*
vegetarianism, 2:230
vitamin D, 2:235
vitamin E, 2:237
WIC program, 2:255, 256, 257, *257*
See also Beikost; Breastfeeding
Infection, 2:*12*, **2:12**
and diarrhea, 1:149, 150
as food-borne illness, 2:1, 120*t*
and malnutrition, 2:34
mastitis, 2:41, *41*
See also Immune system
Infectious agents, and cancer, 1:89–90, 91
Infectious diseases
defined, 1:35
and vitamin A deficiency, 2:234
Informed consent, defined, 2:75
Insoluble, defined, 1:63
Insoluble fiber, 1:221
Institute of Food Technologists, 1:248
Institutional Review Board (IRB), 2:75
Insulin, **2:12–13**
defined, 1:37
and diabetes, 1:143, 144, *145*, 147
in digestion, 1:170
and genetic engineering, 1:65
regulating blood glucose levels, 1:37, *37*
See also Diabetes mellitus; Glycemic index
Insulin injections, 1:*145*, 147, 2:12–13
Insulin pens, 2:12–13
Insulin pumps, 1:*145*, 2:12–13
Integrative medicine, 1:30
See also Alternative medicines and therapies
International Bibliographic Information on Dietary Supplements (IBIDS), 1:156
International Children's Day of Broadcasting, 2:226
International Conference on Child Labour, 2:227
International Conference on Health Promotion (1986), 1:263
International Conference on Nutrition, 2:205
International dietary trends. *See* Dietary trends, international
International disaster relief organizations. *See* Disaster relief organizations
International nongovernmental organizations, 2:83
International Space Station, 2:210, 212, *213*, 214, 215
Internships, 1:105–106
defined, 1:105
Interstitial, defined, 2:246
Intestines, defined, 1:64
Intolerances. *See* Allergies and intolerances
Intoxication, as food-borne illness, 2:1, 120*t*
Intracellular fluids, 1:37, 2:246
Intrauterine growth retardation, 2:197–198
See also Low birth weight infant
Intravascular fluid compartment, 1:37
Intravenous, defined, 1:84
Intrinsic factor, 1:40, 2:243
Iodine
Asia, 1:56
deficiency, 1:56, 2:35, 63, 159–160
functions, 2:62
poisoning, 1:253
Iodism, 1:253
Iran
eating habits, 1:*186*
United Nations Children's Fund (UNICEF), 2:226
Iraq, disaster relief in, 1:*174*
IRB (Institutional Review Board), 2:75
Ireland, 2:86
Iron
adolescents, 1:5
Asia, 1:56
children, 1:39
deficiency, 1:38–40, 56, 2:24, 26, 62–63, 153
defined, 1:5
disease prevention and treatment, 2:62
fortification of food, 2:72
as functional food, 1:242*t*
functions, 2:62
infant nutrition, 1:242*t*, 2:9, 10
and lead poisoning, 2:24, 26
and menopause, 2:50
and pregnancy, 1:40, 2:145
preschoolers and toddlers, 2:152, 153

and space travel, 2:212, 215
sports nutrition, 2:217
supplements, 2:59
toxicity, 2:63
vegetarians, 2:230
women, 2:259
Iron-deficiency anemia, 1:38–40, 2:153
Irradiation, **2:13–14**
See also Biotechnology; Food safety
Irritability, defined, 1:249
Islam. *See* Muslims
Isoflavones, **2:14,** 2:207, 208
defined, 2:14
Isoleucine, 2:6, 156*t*
Italy
cuisine, 2:204, 205, 206
life expectancy, 2:28
organic foods, 2:115

J

Jamaica, 1:110
Japan
diet, 1:53–54
food-borne illness, 2:118
life expectancy, 2:28
organic foods, 2:115
postmenopausal symptoms, 2:208
stomach cancer, 1:88
Japanese Americans, diet of, 1:50
Jefferson, Thomas, 2:79
Jejunum, 1:170
Jerk meat, 1:108, 109
Jewish food practices, 1:259, 2:176, 177–178, 178*t*
Job sharing, defined, 1:77
Johnson, Howard, **2:14–16,** 2:*15*
Joint Centre for Bioethics, University of Toronto, 1:67, 68
Joint United Nations Programme on HIV/AIDS, 1:280
Judaism. *See* Jewish food practices
Juices, as functional food, 1:242*t*, 243
Junk food
defined, 2:191
in schools, 2:191, 192

K

Kashrut, 1:259, 2:177–178
Kava, 2:131
Kcalorie, 1:87, 216
See also Calories
Kellogg, John Harvey, 1:60, 61, 255, **2:16–18,** 2:*17*, 254
See also Battle Creek Sanitarium
Kellogg, Will Keith, 2:16, 17, *17*
Kempner, Walter, 2:181–182
Keto-acid, defined, 2:157
Ketoacidosis, defined, 1:146
Ketones, 1:210
defined, 1:146
Ketosis, 1:97, 2:56
defined, 1:97
Kidney
and diabetes, 1:146
and hypertension, 1:289, *289*
and mineral toxicity, 2:61
Kidney stones, defined, 1:84
Killer-cell, defined, 1:43
Kilocalorie, 1:87, 216
See also Calories
Kimchi, 1:50, 54
Kinetic, defined, 2:158
Kiwanis Worldwide Service Project, 2:227
Korean Americans, diet of, 1:50
Koreans, diet of, 1:54
Kosher, 1:259, 2:177
Krebs Cycle, 1:96–97, 2:55
defined, 1:96
Kroc, Ray, **2:18–20,** 2:*19*
See also Fast foods
Kwanzaa, 1:13
Kwashiorkor, 1:40, **2:20–21,** 2:35, 92, 160
defined, 1:40
See also Malnutrition; Protein

L

Lactase, 1:26, 28, 172, 2:21, 22
Lactation. *See* Breastfeeding
Lacteals, 1:216
Lactic acid, defined, 1:96
Lacto vegetarians, 2:229
Lacto-ovo vegetarians, 2:179, 229
Lactose, 1:93, 94, 94*t*, 2:6, 21
Lactose intolerance, 1:26, 28, **2:21–23**
and absorption, 1:172
Asia, 1:56
clinical diagnosis, 2:22
congenital, 2:22
defined, 1:18
nutrition for, 2:22–23
prevalence, 2:21–22, *22*
secondary, 2:22
structure and functions of lactose, 2:21
treatment, 1:29
types, 2:22
Lactose tolerance test, 2:22
Laotians, diet of, 1:50*t*
Lasix, 2:88*t*
Latin America, underweight in, 2:35
Latinos. *See* Hispanics and Latinos, diet of
Latvia, cardiovascular disease mortality in, 1:118
Laws
Biologics Control Act (1902), 2:73
Child Nutrition Act (1972), 2:255–256
Color Additives Amendment (1960), 1:2–3
Dietary Supplement Health and Education Act (DSHEA) (1994), 1:31–32, 33, 156, 157–158, 241–243, 2:74
Federal Food, Drug, and Cosmetic Act (1938), 1:241–243
Food Additives Amendment (1958), 1:2
Food and Drug Administration Modernization Act (FDAMA) (1997), 1:264–265
National Consumer Health Information and Health Promotion Act (1970), 1:269
National Health Survey Act (1956), 2:68–69
Nutrition Labeling and Education Act (NLEA) (1990), 1:232–233, 263–264, 266
Older Americans Act (1965), 2:42
Organic Foods Production Act (1990), 2:113–114
Pure Food and Drug Act (1906), 2:162, 171
Lay health advisor (LHA), **2:23**
LDL. *See* Low-density lipoprotein (LDL)
Lead poisoning, **2:23–27,** 2:72
definition, 2:24
educational interventions, 2:26
medical treatment, 2:26–27
nutritional interventions, 2:26
populations at risk, 2:24
prevalence, 2:26
sources of lead, 2:*25*, 25–26
symptoms, 2:24
Leading health indicator (LHI), 1:*270*
League of Red Cross and Red Crescent Societies (LICROSS), 1:175*t*
"Lean," as nutrient content claim, 1:265*t*
Learned behaviors, defined, 1:186
Leavening, defined, 1:2
Leeks, 2:85–86

Legumes, 1:109, *2:27*, **2:27–28**
defined, 1:5
See also Vegetarianism
Leptin, 2:77
"Less," as nutrient content claim, 1:265*t*
Letrozol, 2:75
Letter on Corpulence (Banting), 1:205
Leucine, 2:6, 156*t*
Leukemia, 1:88
LHA (lay health advisor), 2:23
LHI (leading health indicator), 1:*270*
Licensing, of nutritionists, 1:106, 2:104
LICROSS (League of Red Cross and Red Crescent Societies), 1:175*t*
Life expectancy, 1:120*t*, **2:28**
See also Infant mortality rate
Lifestyle, defined, 1:24
"Light"
as marketing strategy, 2:39
as nutrient content claim, 1:265*t*
"Light in sodium," as nutrient content claim, 1:265*t*
Light therapy, 2:149, *149*
Lignin, 1:95
Lind, James, 2:197, *220*, 244
Linoleic acids. *See* Omega-3 and omega-6 fatty acids
Linolenic acids. *See* Omega-3 and omega-6 fatty acids
Lipase, 1:170, 172, 2:29
Lipid
defined, 1:36
See also Fats
Lipid profile, **2:28–31,** 2:29*t*, 30*t*
blood lipids and lipid transport, 2:29
and exercise, 1:199–200
treating abnormal blood lipids, 2:30
See also Cardiovascular disease (CVD)
Lipitor, 2:88*t*
Lipogenesis, 2:57
Lipolysis, 2:56
Lipoprotein, 1:37
defined, 1:103
Listeria monocytogenes, 2:2, 116, 119, 120*t*
Listeriosis, defined, 2:118
Lithuania
obesity, 2:105
vitamin C deficiency, 1:120
Liver
and alcohol, 1:24, *25*
in digestion, 1:170, 171
Lobsters, 1:*187*
Long-term care facilities, defined, 1:105
"Low," as nutrient content claim, 1:265*t*
Low birth weight infant, **2:31,** 2:197
See also Pregnancy
Low-carb diet, 1:97
Low-density lipoprotein (LDL)
and cardiovascular disease, 1:103
and carotenoids, 1:112
drug treatment, 2:30
HDL/LDL ratio values, 2:30*t*
in lipid profile, 2:29
and Mediterranean diet, 1:259, 260
optimal, borderline, and high levels, 2:29*t*
and soy, 2:207
Lower-quality proteins, 2:156
Low-fat products, 1:219
Luau, 2:131
Lunch Program, National School, 1:284, 2:96–97, 190–191, 194
Lung cancer, 2:234
Lutefisk, 2:189–190
Lutein, 1:113, 2:234
Lutheran World Federation (LWF), 1:175*t*
Lycopene, 1:91, 113, 2:53, 234
Lymph node, defined, 1:90
Lymph system, defined, 1:88
Lymphatic system, defined, 1:88
Lymphoma, 1:88
Lysine, 1:134, 2:156*t*

M

Macaroni and cheese, glycemic index, 1:251*t*
Macrobiotic, defined, 1:31
Macrobiotic diet, **2:31–33,** 2:*32*
Macrocytic anemia, 1:38, 39*t*, 2:243
Macrominerals, 2:95
Macronutrient, defined, 1:113
Macrophage, 2:29
Macrovascular disease. *See* Atherosclerosis
Macular degeneration, 2:234
defined, 1:112
Mad cow disease, 2:118–119, *119*, 187
Magnesium
deficiency, 2:61
disease prevention and treatment, 2:61
functions, 2:60
premenstrual syndrome, 2:148
toxicity, 2:61
Maize
Central America and Mexico, 1:113, 114–115
varieties, 1:133–134
Maize-based diets. *See* Corn- or maize-based diets
Major minerals, 2:60–61
Malabsorption
defined, 2:101
in HIV/AIDS patients, 1:280
Malaria, defined, 1:40
Malaysians, diet of, 1:55
Males. *See* Men's nutritional issues
Malignant, defined, 1:88
Malignant tumors, 1:88, 90
Malnourished, defined, 1:39
Malnutrition, **2:33–36,** 2:*36*
and alcohol, 1:24–25
Caribbean Islands, 1:110
defined, 1:22
and diarrhea, 1:150
and growth, 2:35–36
and infection, 2:34
necessary nutrients, 2:35
people at risk, 2:33–35, *34*
and popular culture, 2:140–141
Maltose, 1:94, 94*t*
Manganese toxicity, 2:63
Mangoes, 1:108
Maple sugar, 2:80
Maple syrup urine disease (MSUD), 2:6
Marasmus, **2:36–37**
defined, 1:40
malnutrition, 2:35, 92
vitamin deficiencies, 1:40
March of Dimes, 2:143
Marijuana, 2:176
Marine Hospital Service (MHS), 1:253, 2:73
Marker genes, 1:246
Marketing strategies, **2:37–41**
impact and influence, 2:37–38, *38*
inappropriate advertisements, 2:38–40, *39*
recommendations for responsible food marketing, 2:40
See also Health claims
Martinique, 1:110
Masa, 1:114–115
Mastitis, 2:*41*, **2:41–42**
See also Breastfeeding
Matambre, 2:203
Maté;, 2:201
Maternal Child Health Program Title V, 2:98
Maternal mortality rate, 2:36, **2:42**

See also Infant mortality rate
Maturity onset diabetes of the young (MODY), 1:145
Mazo, Ellen, 1:279–280
McDonald, Maurice (Mac), 2:18–19
McDonald, Richard, 2:18–19
McDonald's restaurants, 2:18–19, *19*, 20, *38*
McGwire, Mark, 1:*191*
Meals On Wheels, 1:*23*, 129, **2:42**
See also Nutrition programs in the community
Measurements, anthropometric. *See* Anthropometric measurements
Meat
Africa, 1:16, 18
Central America and Mexico, 1:115
Mediterranean diet, 1:257
Scandinavia, 2:188–189
Meat analogs, **2:42–43**
See also Vegetarianism
Medical nutrition therapists, 1:104–105, 168
Medical nutrition therapy (MNT), **2:43–46**
assessment components, 2:43–44
for diabetes, 1:147
insurance coverage, 2:45–46
therapy provision, 2:44–45
See also Nutritional assessment
Medicare, medical nutrition therapy coverage, 2:45
Meditation, defined, 1:30
Mediterranean diet. *See* Greeks and Middle Easterners, diet of
Mediterranean Pyramid, 1:226–227
Megaloblastic anemia, 1:40
Melatonin, and premenstrual syndrome, 2:*149*
Mellanby, Edward, **2:46–47,** 2:*47*
See also Rickets
Melo Palheta, Francisco de, 2:201
Menaquinones, 2:236
Menopausal, defined, 2:47
Menopause, **2:47–50,** 2:260
defined, 1:10
dietary and lifestyle changes, 2:50
physiological changes, 2:47–48
and soy, 2:48–49, 208, 260
stages, 2:47
treatments and remedies, 2:48–49, *49*
See also Women's nutritional issues
Men's nutritional issues, **2:51–54**
body image, 1:69, 70, 71
cancer, 2:51, *52*
college students, 1:124
cravings, 1:137–138, *138*
diabetes mellitus, 2:51
eating disorders, 1:177, 178, 184
heart disease, 2:51–53, *52*
hypertension, 2:53
impotence, 2:53
life expectancy in Europe, 1:120*t*
prostate health, 1:91, 2:53, 208, 234
Menstrual cycles, defined, 2:47
Metabolic, defined, 1:46
Metabolic disorders. *See* Inborn errors of metabolism
Metabolism, **2:54–58,** 2:57
carbohydrates, 2:6–7, 54–55
cholesterol, 2:57–58, 77
defined, 1:42
fats, 1:216, 2:56–57
during menopause, 2:260
protein, 2:55–56, 157
Metabolism, inborn errors of. *See* Inborn errors of metabolism
Metabolite, defined, 1:31
Metabolize, defined, 1:24
Metastasis, 1:88
Methionine, 2:156*t*
Metropolitan Life Insurance Company height and weight tables, 2:99, 100*t*
Mexican Americans
children, 2:168
diabetes, 1:277
diet, 1:276–277, 278*t*
See also Hispanics and Latinos, diet of
Mexicans. *See* Central Americans and Mexicans, diets of
Mexico
fruits and vegetables, 1:114
traditional dietary habits, 1:113
MHS (Marine Hospital Service), 1:253, 2:73
Micelles, 1:216
Microbial fermentation, 1:65
Microcytic anemia, 1:38, 39*t*
Microflora, defined, 2:154
Microminerals, 2:95
Micronutrients
deficiency in Asia, 1:55–56
defined, 1:19
Microorganisms, defined, 1:2
Middle Easterners. *See* Greeks and Middle Easterners, diet of
Midsummer's Day, 2:190
Mid-upper arm circumference (MUAC), 1:74
Midwest cooking, 2:167
Milk
and bovine somatotropin, 1:262
evaporated, 2:10
as functional food, 1:242*t*
glycemic index, 1:251*t*
health claims, 2:37–38
and infants, 2:9, *197*
pasteurization, 2:133
and scurvy, 2:*197*
with vitamin D, 1:242*t*, 2:122, 235
Milk sugar. *See* Lactose
Mind-body interventions, 1:31, 31*t*
Minerals, **2:58–64**
bioavailability, 2:59
deficiency, 2:61, 62–63
defined, 1:2
disease prevention and treatment, 2:60–61, 62
functions, 2:60, 62
major, 2:60–61
as nutrient, 2:94–95
pregnancy requirements, 2:145, *145*
sports nutrition, 2:217
supplementation, 2:59–60, *60*
toxicity, 2:61, 63
trace, 2:61–63
See also Dietary supplements; Vitamins, fat-soluble; Vitamins, water-soluble
Miscarriage, defined, 1:82
Mitochondria, defined, 2:55
MNT. *See* Medical nutrition therapy (MNT)
Models, fashion, 1:69
MODY (maturity onset diabetes of the young), 1:145
Molar, defined, 2:153
Mold, and food poisoning, 2:3
Molecule, defined, 1:36
Monaco, life expectancy in, 2:28
Monckeberg's arteriosclerosis, 1:45
Monocultural, defined, 1:140
Monoglycerides, 1:216
defined, 1:170
Mononucleosis, 2:*12*
Monosaccharides, 1:93, 94*t*, 2:54
Monosodium glutamate (MSG), 1:2, 4, 28
Monounsaturated fat, 1:102, 215, 217, 260
Montserrat, 1:110
Mood-food relationships, **2:64–67,** 2:66*t*
circadian rhythms, 2:65–66
meal size, 2:65
neurotransmitter effects, 2:64–65, 66*t*
positive moods and stress reduction, 2:*65*, 66–67

Mood-food relationships *(continued)*
See also Cravings
Moore, Mary Tyler, 2:*76*
Morbidity, defined, 1:73
"More," as nutrient content claim, 1:265*t*
Mormon food practices, 2:176, 178, 178*t*
Motor proteins, 1:37
MSG (monosodium glutamate), 1:2, 4, 28
MSUD (maple syrup urine disease), 2:6
MUAC (mid-upper arm circumference), 1:74
Mucilages, 1:96
Mucosa, defined, 1:159
Multiple cropping, 1:261–*262*
Muscle wasting
defined, 1:202
during space travel, 2:211–212
Muscular endurance and strength, 1:200, 2:216
Muslims
alcohol, 1:259
food practices, 1:16–17, 259, 2:177, 178*t*
Halal foods, 1:258, 259*t*, 2:177
southern Europe, 2:204
Mycotoxins, 2:120–121
defined, 2:3
Myocardial infarction, 1:272, *273*, 2:75
Myoglobin, defined, 2:62
Myristicin intolerance, 1:28

N

Nandrolone, defined, 1:191
National Academy of Sciences (NAS), **2:67**
diet, 1:97
food additives, 1:4
health claims, 1:264–265
Recommended Dietary Allowances, 2:164
See also Dietary Reference Intakes (DRIs); Recommended Dietary Allowances (RDAs)
National Center for Complementary and Alternative Medicine, 1:30–31, 31*t*, 2:*161*
National Center for Health Statistics (NCHS), 2:68
National Cholesterol Education Program, 2:29–30
National Consumer Health Information and Health Promotion Act (1970), 1:269
National Diabetes Education Program, 1:147
National Food Processors Association, 1:238
National Health and Nutrition Examination Survey (NHANES), 1:72, 73, **2:68–73**
caloric intake, 1:161
childhood obesity, 1:121, 122
data collection procedures, 2:71
future, 2:72
and Healthy Eating Index, 1:268–269
history, 2:68–70, *70*
procedures, 2:70–71
results, 2:71–72
sampling, 2:70
National Health Examination Survey (NHES), 1:121, 2:68–69
National Health Interview Survey (NHIS), 2:72
National Health Survey Act (1956), 2:68–69
National Immunization Days, 2:227
National Institute of Mental Health, 1:184
National Institute on Alcohol Abuse and Alcoholism, 1:24
National Institutes of Health (NIH), **2:73–78**
accomplishments, 2:75
Atkins Diet, 1:97
childhood obesity, 1:*122*
diarrhea, 1:149
funding, 2:76, *76*, *77*
history, 2:73–74
human subjects, 2:75–76
impotence, 2:53
institutes and centers, 2:74–75
mission, 2:74
Office of Dietary Supplements, 1:156, 2:74
Office of Legislative Policy and Analysis, 2:74
Office of Science Policy, 2:75–76
research and biomedical advances, 2:76–78
Trans-NIH Bioethics Committee, 2:76
National nongovernmental organizations, 2:83
National Nutrition Surveillance System, 2:69
National Osteoporosis Foundation, 2:123, 124
National Research Council, 1:154
National School Lunch Program (NSLP), 1:284, 2:96–97, 190–191, 194
Native Americans, diet of, **2:78–82**
alcohol use, 1:25
childhood obesity, 1:122
before colonial period, 2:79–80
current food practices, 2:80, *81*
diet-related health issues, 2:79*t*, 81
Food Distribution Program on Indian Reservations, 1:128
homelessness, 1:*283*
overweight and obesity, 2:79*t*, 81
sacred and ceremonial foods, 2:80
settlement hardships, 2:78–79
See also Corn- or maize-based diets
Nausea
defined, 1:27
during pregnancy, 2:146
NBI (nitrogen balance index), 2:159–160
NCHS (National Center for Health Statistics), 2:68
Needs assessment, defined, 1:173
Needy Family Program, 1:127
Negative nitrogen balance, 2:160
Neoplasm, 1:88, 90
Neotame, 1:46–47
Nervous system, defined, 1:38
Neural, defined, 1:40
Neural tube defects (NTDs), 2:142–143, 243
Neurological, defined, 1:184
Neuropathy, defined, 2:181
Neurotransmitters
defined, 1:137
mood-food relationships, 2:64–65, 66*t*
Nevis, 1:110
New England cooking, 2:167
NGOs (nongovernmental organizations), 2:82–83
NHANES. *See* National Health and Nutrition Examination Survey (NHANES)
NHES (National Health Examination Survey), 1:121, 2:68–69
NHIS (National Health Interview Survey), 2:72
Niacin (vitamin B_3), 2:239–241, 240*t*
in corn- or maize-based diets, 1:134–136, *135*
deficiency, 2:103
defined, 1:2
and pellagra, 2:135
Nicotinamide, 2:239
Nicotine. *See* Smoking
Nicotinic acid, 1:244, 254, 2:239
Night blindness, 2:234

NIH. *See* National Institutes of Health (NIH)
Nitrite, defined, 1:4
Nitrogen
  defined, 1:134
  and inborn errors of metabolism, 2:7
Nitrogen balance index (NBI), 2:159–160
Nitrosamines, and cancer, 1:4
Nixtamalizacion, 2:79
NLEA (Nutrition Labeling and Education Act) (1990), 1:232–233, 263–264, 266
NLM (U.S. National Library of Medicine), 2:74
Nonessential amino acids, 1:36, 36*t*, 2:155–156
Nongovernmental organizations (NGOs), **2:82–83**
  See also Disaster relief organizations
Nonpathogenic, defined, 2:154
Nonpolar, defined, 2:155
Noodles, glycemic index, 1:251*t*
Norepinephrine, effect on mood, 2:64, 66*t*
Normochronic anemia, 1:38, 39*t*
North Africans, diet of, 1:16–17, *17*
Northern Europeans, diet of, **2:83–87**
  eating habits and meal patterns, 2:84
  England, 2:84, *85*
  France, 2:86–87
  Ireland, 2:86
  nutritional status, 2:84
  Scotland, 2:84–85
  Wales, 2:85–86
  See also Central Europeans and Russians, diets of; Southern Europeans, diet of
Norvasc, 2:88*t*
Norwalk-type viruses, 2:119, 120*t*
NOSB (U.S. National Organic Standards Board), 2:113–114
NSLP. *See* National School Lunch Program (NSLP)
NTDs (neural tube defects), 2:142–143, 243
Nursing bottle mouth syndrome. *See* Baby bottle tooth decay
NutraSweet, 1:46
Nutrient additives, 1:2
  See also Additives and preservatives
Nutrient content claims, 1:156, 232
Nutrient density, **2:87**
Nutrient-drug interactions, **2:88–90,** 2:88*t*, *89*
  adverse effects, 2:88–89
  avoiding, 2:90
  drug functions, 2:88
  elderly, 2:89
  impact, 2:89
Nutrients, **2:90–95,** *2:93*
  carbohydrates, 2:91–92
  defined, 1:2
  functions, 2:91*t*
  lipids, 2:92–94
  minerals, 2:94–95
  proteins, 2:92
  vitamins, 2:94
  water, 2:95
  See also specific nutrients by name
Nutrition, **2:95**
  defined, 1:7
Nutrition education, **2:96**
Nutrition Educators, 1:105
Nutrition Facts statement, 1:233, *234*
Nutrition Labeling and Education Act (NLEA) (1990), 1:232–233, 263–264, 266
Nutrition managers, 1:104–105, 168
Nutrition Program for Older Americans, 2:98
Nutrition programs in the community, **2:96–99**
  Food and Nutrition Service programs, 2:96–98, *98*
  Health and Human Services Department programs, 2:98
  See also Meals On Wheels
Nutrition Screening Initiative, 1:20–21
Nutritional assessment, **2:99–102**
  anthropometrics, 2:99–101, 100*t*
  biochemical data, 2:101
  clinical data, 2:101
  dietary data, 2:101–102
  elements, 2:99–102
  evaluation, 2:102
  See also Dietary assessment
Nutritional deficiency, **2:102–104,** 2:*103*
  defined, 1:38
Nutritional requirements, defined, 1:7
Nutritional transition
  Asia, 1:56–57
  Central America and Mexico, 1:116
  Hispanics and Latinos, 1:276–278, 2:169
  Pacific Islander Americans, 2:128
  Pacific Islanders, 2:131–132
Nutritionist, 1:106, 2:44, *104*, **2:104–105**
  See also Careers in dietetics; Dietitian
Nutrition-support-team dietitians, 1:168
Nuts, 1:53, 242*t*, 2:108

O

Oats, as functional food, 1:242*t*
Obese, defined, 1:64
Obesity, **2:105–108**
  adolescents, 1:6, 2:192–193
  adults, 1:8
  African Americans, 1:14, 14*t*
  Asia, 1:56, 57, *163*
  body mass index, 2:105, 125, 140
  causes, 2:106
  costs, 2:106
  defined, 1:6
  and disease, 1:217
  as health risk, 2:105–106
  international dietary trends, 1:164
  and leptin, 2:77
  Native Americans, 2:79*t*, 81
  and oral health, 2:111–112
  versus overweight, 2:125
  Pacific Islander Americans, 2:126
  Pacific Islanders, 2:129, 131
  and popular culture, 2:140
  and portion sizes, 1:160
  prevalence, 1:203, 2:105
  treatment, 2:106–107, *107*
  water in body, 2:245–246
  See also Body mass index; Childhood obesity; Overweight
Observationes Medicae (Tulp), 2:224
Ohsawa, George, 2:31
Okra, 1:11, *11*, 12, 13
Older adults. *See* Aging and nutrition
Older Americans Act (1965), 2:42
Olestra, 1:*211*, 212, 213, 218–219
Oligosaccharides, 1:93
Olive oil, 1:256, 258, 259, 260
Olives, 2:204
Omega-3 and omega-6 fatty acids, **2:108–110,** 2:*109*
  benefits, 2:108–109
  and cardiovascular disease, 1:102–103
  in eggs, 1:*241*, 242*t*
  Mediterranean diet, 1:260
  types, 2:108
  See also Heart disease
Oncogenes, and cancer, 1:91
Oneworld Alliance for UNICEF, 2:227
Opacity, defined, 2:264
Operational nongovernmental organizations, 2:83

Opportunistic infections, defined, 1:279
Opsin, 2:232
Oral contraceptives, 2:88*t*
Oral health, **2:110–112**
factors affecting, 2:110
and fluoride, 2:112
and overnutrition, 2:111–112, *112*
and undernutrition, 2:111
See also Baby bottle tooth decay
Oral rehydration therapy (ORT), 1:151, **2:113,** 2:226, 247
See also Dehydration; Diarrhea
Oral-pharyngeal, defined, 1:280
Orange juice
calcium-fortified, 1:242*t*, 243
glycemic index, 1:251*t*
Organic foods, **2:113–117**
advantages and disadvantages, 2:114, *115*
certification and labeling, 1:237, 2:114
market, 2:115, *116*
nutrition quackery, 2:162
safety and nutritional value, 2:116–117
sustainable food systems, 2:222
See also Food safety
Organic Foods Production Act (1990), 2:113–114
Organisms, food-borne, **2:117–122**
mad cow and Creutzfeldt-Jakob, 2:118–119, *119*
magnitude of food-borne illness, 2:118
outbreaks, 2:118–119
prevention of food-borne illness, 2:121
types, 2:119–121, 120*t*
See also Food safety; Illnesses, food-borne
ORT. *See* Oral rehydration therapy (ORT)
Osteoarthritis, defined, 1:217
Osteoblast, defined, 2:123
Osteomalacia, 1:84, **2:122,** 2:183, 235
defined, 1:84
See also Rickets
Osteopathic, defined, 1:30
Osteopenia, **2:122–123**
Osteoporosis, **2:123–125,** 2:*124*
and calcium, 1:85, *85*, 2:61, 124
defined, 1:5
in female athlete triad, 1:219, 2:219
and nutritional deficiency, 2:103
prevalence, 2:124–125
risk factors, 2:123–124
and soy, 2:208
and spaceflight bone loss, 2:211
and vitamin D deficiency, 2:235
women, 1:10, 219, 2:123, *124*, 125, 219, 260
See also Calcium; Women's nutritional issues
Outcrossing, 1:248
Overnutrition, and oral health, 2:111–112, *112*
Over-the-counter, defined, 1:31
Overweight, **2:125–126**
body mass index, 2:125, 140
children, 2:153, 192–193
defined, 1:64
international dietary trends, 1:164
Native Americans, 2:79*t*, 81
versus obesity, 2:125
prevalence, 1:203, 2:105
southern Europe, 2:206
See also Obesity
OXFAM International, 1:175*t*
Oxidative, defined, 2:56
Oxygen, defined, 1:2
Oxytocin, 1:76

P

Pabellón caraqueño, 2:203
Pacific Islander Americans, diet of, **2:126–128,** 2:127*t*
eating habits and meal patterns, 2:127
nutrition and health status, 2:126–127
nutritional transition, 2:128
Pacific Islanders, diet of, **2:128–132**
childhood obesity, 1:122
eating habits and meal patterns, 2:129–130
nutritional status, 2:129
nutritional transition, 2:131–132
traditional cooking methods and food habits, 2:*130*, 130–131
See also Asians, diet of
Pacific Northwest cooking, 2:167
Pacifier caries, 2:111
Paella, 2:*205*, 206
Pain, and endorphins, 2:66
Paint, lead-based, 2:24, 25, 26
Palestinian refugees, 2:*165*
Pancreas, 1:170, 171
Pantothenic acid (vitamin B_5), 2:240*t*, 241
Papain, 1:65
Papayas, 1:108
Paraguay, 2:201, 203
Paralysis
and bone loss, 2:211
defined, 1:236
Parasites
defined, 1:41
and food-borne illness, 2:120
Parasitic, defined, 1:40
Parathyroid hormone (PTH), 1:83–84
Parenteral nutrition, 1:280
Parkinson's disease, 2:75
Pasta, glycemic index, 1:251*t*
Pasteur, Louis, **2:132–133,** 2:*133*
Pasteurization, **2:133**
defined, 1:65
electronic, 2:13–14
invention of, 2:132–133
See also Food safety
Patent medicines, 2:161, 162
Pathogen, defined, 1:235
A Pattern for Daily Food Choices, 1:225
Pauling, Linus, **2:133–134,** 2:*134*
PCM (protein-calorie malnutrition), 2:35, 159–160
PDD (premenstrual dysphoric disorder), 2:147
Peanut allergies, 1:29
Peas, glycemic index, 1:251*t*
Pectin, 1:96
Pediatric Nutrition Surveillance System, 2:153
Pellagra, 2:*135*, **2:135**
corn- or maize-based diets, 1:134–136, *135*
Funk, Casimir, 1:244
Goldberger, Joseph, 1:*253*, 253–254, 2:73
and nutritional deficiency, 2:103, 240–241
PEM (protein-energy malnutrition), 2:35, 36, 141
Pemberton, John S., **2:135–136,** 2:*136*
Penicillin, 2:89
Pepsinogen, 2:157
Percent Daily Value, 1:233*t*, 234
Perimenopausal period, 2:47
Periodontitis, 2:*112*
Peristalsis, 1:169
Pernicious anemia, 1:40, 2:243
Persistent diarrhea, 1:149
Peru
food habits, 2:202, 203
food-borne illness, 2:118
Pesticides, **2:137**
food safety, 1:236–237, 2:116–117
genetically modified foods, 1:247

nutrition quackery, 2:162
organic foods, 2:116
sustainable food systems, 2:221
See also Food safety; Organic foods
Petechiae, 2:111
pH, 1:37
defined, 1:1
Phenylalanine, 1:46, 2:5–6, 137–138, 156*t*
Phenylethylamine, 2:66
Phenylketonuria (PKU), 1:46, 2:5–6, **2:137–138**
defined, 1:46
See also Amino acids
Phosphate toxicity, 2:61
Phospholipids, 1:215–216
defined, 2:29
Phosphorus
defined, 2:58
functions, 2:60
and osteomalacia, 2:122
and vitamin D, 2:235
PHS (U.S. Public Health Service), 1:238–239, 253, 2:73
Phylloquinone, 2:236
Physical activity. *See* Exercise
Physical education, 1:*131*, 131–132
Physical fitness, 1:200
Physicians Committee for Responsible Medicine, 2:37–38
Physiological, defined, 1:8
Physiology, defined, 1:168
Physiology of Taste, or Meditations on Transcendental Gastronomy (Brillat-Savarin), 1:78
Phytate, defined, 2:59
Phytochemicals, 1:91, **2:138,** 2:207
defined, 1:91
Phytoestrogens, 2:48–49
defined, 2:48
Pica, **2:138,** 2:146
See also Cravings
Pickling, as preservative, 1:1
Pick-your-own farms, 2:222
Pigs, in Pacific Islander diet, 2:130
PIH (pregnancy-induced hypertension), 1:289
Pipes, lead-soldered, 2:24, 25, 26
Pituitary gland, defined, 1:244
PKU. *See* Phenylketonuria (PKU)
Plant proteins, 2:156
Plantains, 1:18
Plant-based diets, **2:138–139**
See also Vegetarianism
Plaque, 1:59, 60
defined, 1:60
Plasma, defined, 1:120
PLP (pyridoxal phosphate), 2:242
Plumbism. *See* Lead poisoning
Pluralistic, defined, 1:140
PMS. *See* Premenstrual syndrome (PMS)
Pneumonia, defined, 1:146
Pod corn, 1:134
Poi, 2:127, 130
Poland, 1:118
Polar, defined, 2:155
Polydextrose, as fat substitute, 1:211–212
Polypeptides, 2:155
Polyphenols, and heart disease, 1:240
Polysaccharides, 1:94–96, *95*, 2:91
Polyunsaturated, defined, 1:101
Polyunsaturated fat, 1:102, 215, 217
Popcorn, 1:133
Popular culture, and food, **2:139–142**
adolescents, 2:192
convenience foods, 2:141
current trends, 2:139
dieting, 2:141
eating away from home, 2:139–140, *140*
ethnic foods, 2:142
functional foods, 2:141
obesity and malnutrition, 2:140–141
supplements, 2:141
Population, world, 1:230
Pork, folk beliefs about, 1:13
Porridge, 2:84–85, 189
Portion sizes, 1:123, 160, 234, 2:65, 106, 140
Portugal, cuisine of, 2:204, 205
Positive nitrogen balance, 2:160
Post, C. W., 2:17
Postmenopausal period, 2:47
Potable, defined, 1:173
Potassium
and cardiovascular disease, 1:103
deficiency, 2:61
disease prevention and treatment, 2:60–61
functions, 2:60
and hypertension, 1:290, 2:167
toxicity, 2:61
Potassium iodide, 2:62
Potatoes
genetically modified, 1:245, 246–247
glycemic index, 1:251*t*
Ireland, 2:86
Poverty
and WIC program, 2:255, 256
worldwide, 1:230
Prednisone, 2:88*t*
Preeclampsia, 1:289, 2:146, 223
See also Pregnancy
Preformed retinoids, 2:232, 234
See also Vitamin A
Pregnancy, **2:142–147**
alcohol use, 1:25
aspartame, 1:46
beta-carotene, 2:36
caffeine, 1:82
calcium, 1:85
cravings, 1:136, 2:146
folate, 1:40, 2:243
iron, 1:40
nutrition requirements, 2:144–145, 144*t*, *145*, 146, 259
pica, 2:138, 146
protein, 2:159
smoking, 2:198
teens, 1:7
vegetarians, 2:230
vitamin A, 2:36, 234
vitamin and mineral requirements, 2:145, *145*
weight gain, 2:143–144, 143*t*
WIC program, 2:146–147, 255, 256, 257
See also Breastfeeding; Low birth weight infant
Pregnancy-induced hypertension (PIH), 1:289
Premenstrual dysphoric disorder (PDD), 2:147
Premenstrual syndrome (PMS), **2:147–150,** 2:*148*, 259
symptoms, 2:148
treatments, 2:148–149, *149*
See also Women's nutritional issues
Pre-renal, defined, 2:45
Preschoolers and toddlers, diet of, **2:150–154**
energy and protein needs, 2:151–152, 152*t*
nutritional requirements, 2:150–153
potential feeding problems, 2:153–154
vitamin and mineral needs, 2:152–153
WIC program, 2:255, 256, 257–258
See also Baby bottle tooth decay
Preservatives. *See* Additives and preservatives
Pressure cuffs, 1:99, *100*
Prevalence, defined, 1:14
Preventive medicine, defined, 1:253
Primary hypertension, 1:289
Primary lactose intolerance, 2:22

Primary sampling unit (PSU), 2:70
Probiotics, 1:242*t*, **2:154–155**
See also Functional foods
Problem solving, and weight management, 2:253
Processed foods
Central America, 1:113
defined, 1:12
and food allergens, 1:27
Mexico, 1:113
and vitamin C, 2:197
versus whole foods, 2:255
Product Identity statement, 1:232
Proenzymes, 1:37
Progesterone, and premenstrual syndrome, 2:149
Prolactin, 1:76
Proline, 2:156*t*
Proscription, defined, 1:188
Prostaglandin, defined, 2:108
Prostate, defined, 1:88
Prostate cancer, 1:91, 2:208, 234
Prostate health, 2:53
Protein, **2:155–160**
absorption, 1:172, 2:157
adolescents, 1:5
amino acids, 2:155–156, 156*t*
animal, 2:156
blood, 2:158
cancer patients, 1:92
and cardiovascular disease, 1:103
Caribbean Islands, 1:108
corn- or maize-based diets, 1:134
cravings, 1:137–138
defined, 1:5
denaturation, 1:37
digestion, 2:157
effect on mood, 2:66, 66*t*
functions, 1:37, 2:158–159
high-quality, 2:156
infants, 2:8
and kwashiorkor, 2:20, 21
in legumes, 2:27–28
lower-quality proteins, 2:156
metabolism, 2:55–56, 157
motor, 1:37
as nutrient, 2:92
plant, 2:156
preschoolers and toddlers, 2:151–152, 152*t*
protein-calorie malnutrition, 2:35, 159–160
protein-energy malnutrition, 2:35, 36, 141
quality, 1:134, 2:156
requirement, 2:159
sources, 2:159, 159*t*
soy, 1:243, 2:207, 207*t*, 208
sports nutrition, 1:192, 2:216, 218
structural, 1:37
supplements, 1:192, 2:218
See also Amino acids
Protein Power, 1:203*t*, 204
Protein-based fat substitutes, 1:212, 212*t*, 218
Protein-calorie malnutrition (PCM), 2:35, 159–160
Protein-energy malnutrition (PEM), 2:35, 36, 141
Protestant food practices, 2:176, 178*t*
Psoriasis, defined, 2:108
PSU (primary sampling unit), 2:70
Psychological, defined, 1:1
Psyllium, defined, 1:240
PTH (parathyroid hormone), 1:83–84
Puberty
defined, 1:4
See also Adolescent nutrition
Public Health Nutritionists, 1:105
Pubs, 2:84, *85*, 86
Puerto Rican Americans. *See* Hispanics and Latinos, diet of
Pure Food and Drug Act (1906), 2:162, 171
Pyridoxal phosphate (PLP), 2:242
Pyruvate, 2:55
Pyruvic acid, 1:96

Q

QPM (quality protein maize), 1:134
Quackery, **2:160–164**
claims and promises, 2:161, *161*, *163*
nutrition quackery, 2:161–162
patent medicines, 2:161, 162
victims, 2:162–164
See also Fad diets
Quality protein maize (QPM), 1:134
Quinoa, 2:202
Quinones, 2:236

R

RACC (Reference Amounts Customarily Consumed Per Eating Occasion), 1:234
Radiation, and cancer, 1:89
Radio programming, for children, 2:226
Radura, 2:14
Ramadan, 2:175, 177
Rastafarian food practices, 2:175, 176, 178, 178*t*
Ravioli, glycemic index, 1:251*t*
RD. *See* Registered dietitian (RD)
Reactive hypoglycemia, 1:292
Reactivity, defined, 1:275
Recombinant bovine growth hormone, 1:246
Recombinant DNA technology. *See* Biotechnology
Recombinant human growth hormone, 1:262
Recommended Dietary Allowances (RDAs), **2:164**
during breastfeeding, 1:76
defined, 1:20
and Dietary Reference Intakes, 1:155, 2:164
dietary trends, 1:161
elderly, 1:20
National Academy of Sciences, 2:67
preschoolers and toddlers, 2:151, 152, 152*t*
school food service, 2:194, 196*t*
school-aged children, 2:190–191
See also Dietary Reference Intakes (DRIs)
Recommended Nutrient Intakes for Canadians, 1:155
Red blood cell, 1:38, 2:212
"Reduced," as nutrient content claim, 1:265*t*
Reduced-fat products, 1:219
Reeve, Christopher, 2:*76*
Reference Amounts Customarily Consumed Per Eating Occasion (RACC), 1:234
Refugee Nutrition Information System (RNIS), **2:164–166,** 2:*165*
See also Disaster relief organizations
Regional diet, American, **2:166–170**
African Americans, 1:12, 2:166–168
Hispanics, 2:168–169
regional cooking, 2:167
See also Dietary trends, American
Regional diet, South American, 2:*202*, 202–203
Registered dietetic technician. *See* Dietetic technician, registered (DTR)
Registered dietitian (RD)
careers in dietetics, 1:105, 106, *106*
as dietitian, 1:168, 169
as medical nutrition therapy provider, 2:44–45, *45*
as nutritionist, 2:104
Registration Examination, 1:105, 106

Regulations
additives and preservatives, 1:2–4
dietary supplements, 1:156–157
drugs and food additives, 1:158
food safety, 1:238–239, 238*t*
functional foods, 1:241–243
Regulatory agencies, **2:170–174**
United States, 2:170–172, *171*
worldwide, 2:172–173
See also Food safety; *specific agencies by name*
Relief organizations. *See* Disaster relief organizations
Religion and dietary practices, **2:174–179**
fasting, 2:174–175, 176, 177, 178–179
food customs, 2:174, *176*
food proscriptions, 2:176–179, *177*, 178*t*
health benefits and risks, 2:175–176
stimulants, 2:176, 177
See also Eating habits; Fasting; *specific religions by name*
Rembrandt, 2:224, *224*
Renal failure, defined, 2:21
Renaud, Serge, 1:240
Rennin, 2:248
Report on the Nutrition Situation of Refugees and Displaced Populations, 2:165
Respiratory system, defined, 1:27
Retinoids, 2:232, 234
Rewards, and weight management, 2:253
R-group, 2:155
Rheumatic heart disease, 1:272
Rhodopsin, 2:232
Riboflavin (vitamin B_2), 2:238, 240*t*
Rice
in African-American diet, 1:11, 13
genetically modified (golden rice), 1:*66*, 68, 245, 246–247, 2:182, 264
Rice porridge, 2:189
Rice-based diets, **2:179–183,** 2:*180*
Asia, 1:52, *53*
genetically modified rice, 1:*66*, 68, 245, 246–247, 2:182, 264
for medical therapy and prevention, 2:181–182
nutritional properties, 2:180–181, 181*t*
and thiamine deficiency, 2:181
See also Asians, diet of; Corn- or maize-based diets
Rickets, **2:183–186,** 2:*184*
defined, 1:84
Glisson, Francis, 1:249, *249*
Mellanby, Edward, 2:46, *47*
nutritional deficiency, 2:104
vitamin D deficiency, 1:84, 2:46, *47*, 104, 183, 184, *184*, 185, 235
See also Osteomalacia
Ritual, defined, 1:11
RNA, defined, 1:40
RNIS (Refugee Nutrition Information System), 2:164–166, *165*
Roadside stands, 2:222
Roman Catholic food practices, 2:176, *176*, 178–179, 178*t*
Romania, 1:118
Ronald McDonald (fictional character), 2:*38*
Rosenstein, Nils Rosén von, 2:*186*, **2:186**
Rotary International, 2:227
Roti, 2:203
Roughage. *See* Fiber
Rugby, 1:*199*
Runner's high, 2:66
Russia
cardiovascular disease mortality in, 1:118
vitamin C deficiency, 1:120
See also Central Europeans and Russians, diets of

S

Saccharin, 1:47
Saffron, 2:204, *205*
Salmonella
food-borne illness, 1:236, 2:2, 119, 120*t*
hand washing, 2:3
organic foods, 2:116
photographs, 1:*237*, 2:*2*
Scandinavia, 2:187
Salmonellosis, defined, 2:118
Salt. *See* Sodium
Salvation Army World Service Office (SAWSO), 1:175*t*
Sanitarium Food Company, 2:17
Sarcoma, 1:88
SARS (Severe Acute Respiratory Syndrome), 2:262
Satiety, **2:187**
See also Appetite; Weight management
Saturated fat
actual and recommended intake, 1:217, *218*
and cardiovascular disease, 1:101
chemical structure, 1:214–215
defined, 1:51
Healthy Eating Index, 1:268
Mediterranean diet, 1:260
as nutrient, 2:93
Saudi Arabia, fast food in, 1:*165*
SAWSO (Salvation Army World Service Office), 1:175*t*
Say Yes for Children program, 2:227
SBP (School Breakfast Program), 1:284, 2:97, 190–191, 194
Scandinavians, diet of, **2:187–190**
eating habits and dietary patterns, 2:187–189, *188*, *189*
nutrition and health status, 2:187
special meals, 2:189–190
See also Central Europeans and Russians, diets of; Northern Europeans, diet of
Scavenger cell, 2:29
School Breakfast Program (SBP), 1:284, 2:97, 190–191, 194
School dietitians, 1:168
School food service, **2:194–197,** 2:*195*, 196*t*
competitive foods, 2:195–197
plate waste, 2:195
School gardens, 2:222
School health services, 1:110, 131
School-aged children, diet of, **2:190–194**
dietary patterns, 2:191–192
junk food in schools, 2:191, 192
nutritional needs, 2:190–191
obesity, 2:192–193
snacking, 2:192
See also Adolescent nutrition; Preschoolers and toddlers, diet of
Schools/Child Nutrition Commodity Programs, 1:129
Scotland, 2:84–85
Scurvy, 2:*197*, **2:197**
defined, 1:156
Glisson, Francis, 1:249, *249*
Stark, William, 2:219–220, *220*
and vitamin C, 2:219–220, *220*
SDR (standardized death rate), 1:117
Seasickness, ginger for, 1:33
Secondary hypertension, 1:289, 291
Secondary lactose intolerance, 2:22
Second-hand smoke, 2:198
Secretin, 1:170
Sedentary, defined, 1:51
Selective serotonin reuptake inhibitor (SSRI), 1:180–181, 2:149
See also Serotonin

Selenium
as antioxidant, 1:43, 44*t*
deficiency, 2:63
disease prevention and treatment, 2:62
functions, 2:62
Self-monitoring, and weight management, 2:251
Self-starvation, 1:181, 2:140
See also Anorexia nervosa
Semi-vegetarians, 2:229
Sen, Amartya, 1:207–208
Serine, 2:156*t*
Serotonin
cravings, 1:137
defined, 1:137
depression, 2:75
eating disorders, 1:178
effect on mood, 2:64, *65*, 66–67, 66*t*
premenstrual syndrome, 2:*149*
selective serotonin reuptake inhibitor (SSRI), 1:180–181, 2:149
Serum, defined, 1:103
Service-systems paradox, 1:282
Seventh-day Adventist Church, 2:17, 175, 178*t*, 179
Severe Acute Respiratory Syndrome (SARS), 2:262
Shigella, 2:2, 119, 120*t*
Shock, defined, 1:149
Shuttle space program, 2:212, *213*, 214
Shuttle-Mir program, 2:213, 214
Sickle-cell anemia, 1:*39*
Sideroblastosis, defined, 1:38
Sierra Leone, life expectancy in, 2:28
Siesta, 2:201, 206
Simple sugars, 1:93–94, 94*t*, 2:91
Simplesse, 1:218
Singapore, 1:55, 2:115
Skinfold calipers, 2:101, 102, *253*
Skylab space program, 2:212, 214
Slavery
and African-American diet, 1:10–11
and Caribbean Islanders diet, 1:107, *108*
Sleep apnea, defined, 1:122
Small for gestational age, **2:197–198**
See also Low birth weight infant
Smog, defined, 2:183
Smoking, **2:198–200,** 2:*199*
and atherosclerosis, 1:59
and cancer, 1:89, *90*, 91, 2:51
and cardiovascular disease, 1:101
and free radicals, 1:*43*
and heart disease, 1:274
and hypertension, 1:290
and pregnancy, 2:198
religious proscriptions, 2:176
Smorgasbords, 2:188
Snacking
adolescents, 1:5–6
American dietary trends, 1:159
college students, 1:123
eating habits, 1:186
school-aged children, 2:192
See also Grazing
SNE (Society for Nutrition Education), 2:200
Social group, defined, 1:143
Social support, and weight management, 2:252–253
Society for Nutrition Education (SNE), **2:200**
Socioeconomic status
defined, 1:20
and diabetes, 2:167
Hispanics and Latinos, 2:168, 169
and maternal mortality rate, 2:42
Sodium
and cardiovascular disease, 1:103
deficiency, 2:61
disease prevention and treatment, 2:60, 61
as food additive, 1:1, 2
functions, 2:60
Healthy Eating Index, 1:268
and hypertension, 1:290, 2:53
nutrient content claims, 1:265*t*
and space travel, 2:211, 215
toxicity, 2:61
Sodium-sensitive individuals, 1:290, 2:53
Soft drinks
American dietary trends, 1:160, *160*
caffeine, 1:81, 81*t*
glycemic index, 1:251*t*
and oral health, 2:111–112
school-aged children, 2:192
Solder, lead, 2:24, 25, 26
Soluble fiber, 1:221
Somalia, 1:*224*
Soul food, 1:11–12
Soursop, 1:109
South Americans, diet of, **2:200–204**
eating habits and meal patterns, 2:201
nutritional status, 2:201
regional food habits, 2:*202*, 202–203
traditional cooking methods and food habits, 2:201–202
See also Central Americans and Mexicans, diets of
South Asians, diet of, 1:55
South Beach diet, 1:97
Southeast Asians, diet of, 1:54–55
Southern Africans, diet of, 1:18
Southern cooking, 1:11–12, 2:167
Southern Europeans, diet of, **2:204–207,** 2:*205*
dietary benefits, deficits, and changes, 2:205–206
influences on American diet, 2:206
traditional foods, 2:204–205
See also Central Europeans and Russians, diets of; Northern Europeans, diet of
Southwest cooking, 2:167
Soy, **2:207–210,** 2:*209*
and cancer, 2:208
as functional food, 1:242*t*
genetically modified, 1:245
and heart, 2:207–208
and menopause, 2:48–49, 208, 260
and osteoporosis, 2:208
protein, 1:243, 2:207, 207*t*, 208
sources, 2:207*t*
See also Legumes; Meat analogs
Space travel and nutrition, **2:210–215**
dietary intake during spaceflight, 2:214–215
space food systems, 2:212–214, *213*
space physiology, 2:210–212
Spaghetti, glycemic index, 1:251*t*
Spain, 2:204, 205, *205*, 206
Special Milk Program, 2:97
Special Supplemental Program for Women, Infants, and Children (WIC). *See* WIC program
Sphygmomanometers, 1:99, *100*
Spices, 1:108, 2:204, *205*
Splenda, 1:47
Spores, and food-borne illness, 2:119
Sports bars, as functional food, 1:242*t*
Sports drinks, 2:4, 217–218
Sports nutrition, **2:215–219**
caffeine, 1:83
calories, 2:216
carbohydrates, 2:216
eating disorders, 1:125
fat, 2:216
female athlete triad, 2:218–219
fluids, 2:*217*, 217–218, 218*t*
glycemic index, 1:251–252
human growth hormone, 1:262–263
nutritional needs, 1:7

protein, 2:216
sports supplements, 2:218
timing of meals, 2:218
vitamins and minerals, 2:217
water, 2:245, 246, 247, *247*
See also Ergogenic aids; Female athlete triad
Sri Lankans, diet of, 1:55, 2:*180*
SSRI (selective serotonin reuptake inhibitor), 1:180–181, 2:149
See also Serotonin
St. Vincent and the Grenadines, 1:110
Stabilizing agents, 1:2
Stacking, 1:190
Standardized death rate (SDR), 1:117
Stanol esters, 1:242*t*
Staphylococcus aureus, 2:3, 119, 120*t*
Staples, defined, 1:16
Starch, 1:94
Stark, William, **2:219–220,** 2:*220*
See also Scurvy
Starvation, self-imposed, 1:181, 2:140
See also Anorexia nervosa
Steam doctors, 2:135
Stem cell research, 2:74–75
Steroid hormones, 1:215
Steroids, defined, 1:190
Sterol, defined, 2:30
Stevioside, 1:48
Still birth, defined, 1:252
Stimulants, religion and dietary practices, 2:176, 177
Stimulus control, and weight management, 2:251
Stool acidity test, 2:22
Stress, defined, 1:44
Stress management
mood-food relationships, 2:*65*, 66–67
and weight management, 2:251–252
Stress response, 1:138
Stroke, 1:100, 147
defined, 1:24
See also Cardiovascular disease (CVD)
Structural proteins, 1:37
Structure and function claims
for dietary supplements, 1:33, 156
for functional foods, 1:241–243
Subcutaneous, defined, 2:37
Sucralose, 1:47
Sucrose, 1:93–94, 94*t*
defined, 1:46
Sudan refugees, 2:*165*
Sugar
Caribbean Islands, 1:107
comparison, 1:94*t*
maple, 2:80
and oral health, 2:110
and pregnancy, 2:144
simple, 1:93–94, 94*t*, 2:91
Sugar alcohols, 1:47, 242*t*
Sugar Busters!, 1:203*t*, 204
Sulfite intolerance, 1:28
Summer Food Service Program for Children, 1:284, 2:97
Sun exposure, and vitamin D, 2:183, *184*, 184–185, *235*, 235–236
Sunette, 1:46
Sunscreens, 2:235, *235*
Superweeds, 1:246
Supplements, dietary. *See* Dietary supplements
Surgeon General's Report on Nutrition and Health, 1:154
Suriname, 2:203
Sustainable food systems, **2:220–223,** 2:*222*
importance, 2:221
promoting, 2:221–222
See also Organic foods; Pesticides
Swallowing difficulties, 1:21, 2:110, 111
Swanson TV Dinner, 2:141
Sweden
life expectancy, 2:28
obesity, 2:105
vitamin C deficiency, 1:120
Sweet corn, 1:133–134
Sweeteners, artificial. *See* Artificial sweeteners
Sweet'n Low, 1:47
Switzerland
food-borne illness, 2:118
life expectancy, 2:28
Systolic pressure, 1:99, *100*, 288

T

Tacos, 1:115, 116, 2:*81*
Taiwan, organic foods in, 2:115
Tajines, 1:17, *17*
Tamales, 1:115
Tartrazine, 1:4
Tea
caffeine, 1:81, 81*t*
England, Wales, and Scotland, 2:84
Ireland, 2:86
South America, 2:201
Teenagers. *See* Adolescent nutrition
TEFAP (The Emergency Food Assistance Program), 1:128, 284–285
Television
African Americans, 2:167–168
body image, 2:131
International Children's Day of Broadcasting, 2:226
obesity, 2:106
TV Dinners, 2:141
Temperance, 1:254, 255, 2:254
Temperate zone, defined, 1:18
Ten Steps to Successful Breastfeeding program, 2:226
Testosterone, defined, 1:137
Tetracycline, 2:88*t*, 89
Tex-Mex cuisine, 1:116
Thailand, food insecurity, 1:*229*, 230
Thalassemia, defined, 1:38
Thermoregulate, defined, 2:225
Thiamine (vitamin B_1), 2:238, 240*t*
and beriberi, 1:62
Casimir, Funk, 1:244
deficiency, 1:62, 2:103, 181
and rice, 2:181
Thiazide, 2:88*t*
Thickening agents, 1:2
Thirst, 2:217, *217*, 247
Threonine, 2:156*t*
Thrifty Food Plan, 1:153
Thrifty gene, 1:145, 2:126
Title V Maternal Child Health Program, 2:98
Tobacco. *See* Smoking
Tocopherol. *See* Vitamin E
Toddlers. *See* Preschoolers and toddlers, diet of
Tofu, 2:207, *209*, 230, *231*
defined, 1:5
Tolerable Upper Intake Level, 1:155
Tolerance, defined, 1:24
Tomatoes
carotenoids, 1:113, 2:234
genetically modified, 1:65, 245–246
and prostate cancer, 1:91, 2:234
Tortillas, 1:113, *114*, 114–115, 116
Total vegetarians, 2:229, 243
Toxemia, 1:289, 2:146, **2:223**
See also Pregnancy
Toxicant, defined, 1:4
Toxicity
calcium, 1:84, 2:61
fluoride, 2:63
iron, 2:63
magnesium, 2:61
manganese, 2:63
minerals, 2:61, 63

Toxicity *(continued)*
phosphate, 2:61
potassium, 2:61
sodium, 2:61
vitamin A, 2:233*t*, 234
vitamin D, 2:233*t*, 236
vitamin E, 2:233*t*, 237
vitamin K, 2:233*t*, 236
Toxins
defined, 1:77
in genetically modified foods, 1:246
Trace, defined, 1:43
Trace minerals, 2:61–63
Traditional Healthy Mediterranean Diet Pyramid, 1:226–227
Trall, Russell, 2:17
Trans-fatty acids
defined, 1:100
on food labels, 1:*217*
Mediterranean diet, 1:260
Traveler's diarrhea, 1:149
A Treatise of the Rickets, 1:249, *249*
Treatise on Bread and Bread Making (Graham), 1:255
Trichinella spiralis, 2:3, 120*t*
Trick or Treat for UNICEF, 2:228
Triglycerides
as basic fat unit, 1:215, 216, 2:92–93
defined, 1:68
in fat metabolism, 2:56
optimal, borderline, and high levels, 2:29*t*
Trinidad and Tobago, 1:110
Tripeptides, 1:37
Tryptophan, 2:156*t*
in maize, 1:134
and niacin, 2:239, 240–241
and pellagra, 2:135, 240–241
as precursor of serotonin, 2:64
and pyridoxal phosphate, 2:242
Tuber, defined, 1:108
Tuberculosis
and breastfeeding, 2:146
defined, 1:51
Tularemia, defined, 2:187
Tulp, Nicolaas, **2:223–225,** 2:*224*
See also Beriberi
Tumor, 1:88, 90
Tumor suppressor gene, 1:91
TV. *See* Television
Type I diabetes, 1:144, *145*, 146
Type II diabetes, 1:144–145, 146, 147
defined, 1:14
and exercise, 1:288
Native Americans, 2:81
prevalence, 1:164
Typhoid, defined, 1:253
Typhus, defined, 1:253
Tyramine, 1:28, 2:89
Tyrosine, 2:66, 137, 156*t*
Tzotzil, 1:*114*

U

Ulcer, defined, 1:79
Ulcer, gastric, 1:79, 172
Ultraviolet radiation
and space travel, 2:211
and vitamin D, 2:183, *184*, 184–185, *235*, 235–236
UN. *See* United Nations
Uncharged, defined, 2:155
Undernutrition
defined, 1:113
developing countries, 2:111, 141
homelessness, 1:283–285
oral health, 2:111
prevalence, 2:33
Underweight, 2:35, **2:225**
See also Body mass index
UNHCR (United Nations High Commissioner for Refugees), 1:189
UNICEF. *See* United Nations Children's Fund (UNICEF)
United Kingdom
mad cow disease, 2:118
organic foods, 2:115
United Nations
Administration Committee on Coordination Sub Committee on Nutrition (ACC/SCN), 2:165
Economic and Social Council, 2:198
food insecurity, 1:228
Food Safety Agency, 1:246
homelessness, 1:282
nongovernmental organizations, 2:82–83
Office for the Coordination of Humanitarian Affairs (OCHA), 1:175*t*
Universal Declaration of Human Rights, 2:35–36
urban population, 2:221
world population, 1:230
See also Food and Agriculture Organization (FAO)
United Nations Children's Fund (UNICEF), 1:175*t*, **2:225–228,** 2:*228*
accomplishments, 2:226–227
administration, 2:226
in Bam (Iran), 2:226
mission, 2:226
oral rehydration therapy, 2:113, 226
programs and operations, 2:227–228
resources, 2:226
United Nations High Commissioner for Refugees (UNHCR), 1:189
Universal Declaration of Human Rights, 2:35–36
University of Toronto Joint Centre for Bioethics, 1:67, 68
Unsaturated fatty acids, 1:215, 2:93, 94
Urban growth, and sustainable food systems, 2:221
Urban Institute, 1:282
Urea cycle disorders, 2:7
Uric, defined, 2:6
Uruguay, 2:201, 203
U.S. Agency for Healthcare Research and Quality, 2:198
U.S. Agency for International Development (USAID), 1:175*t*
U.S. Census Bureau, 1:275, 284
U.S. Centers for Disease Control and Prevention (CDC)
bioterrorism, 1:237
body mass index, 1:121
fetal alcohol syndrome, 1:*220*
food-borne illnesses, 1:236, 2:4
Global Polio Eradication Initiative, 2:227
growth charts, 1:262
high school students, 2:191–192
hypertension, 2:53
National Immunization Days, 2:227
physical activity, 1:161
prostate cancer, 2:53
as regulatory agency, 2:172
U.S. Department of Agriculture (USDA)
Center for Nutrition and Public Policy, 1:269
commodity foods, 1:127–129, *129*, 284–285
Continuing Survey of Food Intakes by Individuals, 1:160
Dietary Guidelines, 1:153–154
Economic Research Service, 2:116
Emergency Food Assistance Program, 1:128, 284–285
Food and Nutrition Information Center, 2:171
Food and Nutrition Service (FNS), 1:127, 128, 2:96–98, *98*, 194, 255

Food Guide Pyramid for Young Children, 2:151
food insecurity, 1:228
food labels, 1:232, 233
food safety, 1:164
Food Safety and Inspection Service, 2:*171*
food-borne organisms, 2:118
genetically modified foods, 1:247–248
health claims, 1:263, 264, 266, 2:37–38
Healthy Eating Index, 1:267–269, *268*
junk food in schools, 2:191
mad cow disease, 2:*119*
organic foods, 2:114, 116, 162
as regulatory agency, 2:171, *171*
school food service, 2:194, 195
See also Food Guide Pyramid
U.S. Department of Health and Human Services (HHS)
community nutrition programs, 2:98
cultural competence, 1:141–142
Dietary Guidelines, 1:154
nutrition programs for elderly, 1:129
U.S. Department of Homeland Security (DHS), 2:172
U.S. Environmental Protection Agency (EPA), 2:172
U.S. Federal Trade Commission (FTC), 2:164
U.S. Food and Drug Administration (FDA)
additive definition, 1:1
additive regulation, 1:2–4, 158
approved artificial sweeteners, 1:46–47
artificial sweeteners pending approval, 1:48
bioterrorism, 1:238, 2:172
dietary supplements, 1:33, 156, 158, 2:59–60
drug regulation, 1:158
fat intake, 1:*217*
fat substitutes, 1:211–212, 213
food labels, 1:232–233, 234, 237, 241–243, 2:161
food safety, 1:164, 235–236, 238
functional foods, 1:241–243
Generally Recognized as Safe (GRAS), 1:245
genetic engineering, 1:66–67, *68*
Hazard Analysis Critical Control Point program, 1:236
health claims, 1:263, 264, 266
nutrition quackery, 2:161
organic food, 1:237
as regulatory agency, 2:171–172
soy, 2:207
U.S. Food and Nutrition Board, 2:59
U.S. Food and Nutrition Service (FNS)
commodity foods, 1:127, 128
community nutrition programs, 2:96–98, *98*
school food service, 2:194
WIC program, 2:255
U.S. Institute of Medicine
beta-carotene, 1:63
homelessness, 1:283
pregnancy weight gain, 2:143
U.S. National Center for Environmental Health, 2:26
U.S. National Library of Medicine (NLM), 2:74
U.S. National Organic Standards Board (NOSB), 2:113–114
U.S. Office of Minority Health, 1:141–142
U.S. Public Health Service (PHS), 1:238–239, 253, 2:73
U.S. Senate Select Committee on Nutrition and Human Needs, 1:153–154
U.S. Surgeon General
college binge drinking, 1:25
dental caries, 2:110
diabetes, 1:164
nutrition and health report, 1:154
USAID (U.S. Agency for International Development), 1:175*t*
USDA. *See* U.S. Department of Agriculture

V

Vaccine, defined, 1:91
Valine, 2:6, 156*t*
Vector-borne diseases, 1:176
Vegan, **2:229,** 2:243
defined, 1:7
See also Plant-based diets; Vegetarianism
Vegetable oils, 2:108
Vegetables
and cancer prevention, 1:91
Caribbean Islands, 1:108
Central America and Mexico, 1:114
as functional food, 1:242*t*
glycemic index, 1:251*t*
Mediterranean diet, 1:258
Vegetarian Food Guide Pyramid, 2:231
Vegetarianism, **2:229–232,** 2:*231*
Battle Creek Sanitarium, 1:60, *61*
benefits, 2:229–230
at different ages, 2:230–231
legumes, 2:27–28
nutritional adequacy, 1:7, 2:230
and osteomalacia, 2:122
and religion, 2:175–176, 176, *177*, 179
types, 2:229
and vitamin D, 2:236
See also Meat analogs
Vegetative bacteria, and food-borne illness, 2:119
Veins, 1:99
Venezuela, 2:202–203
"Very low," as nutrient content claim, 1:265*t*
Very low-density lipoprotein (VLDL), 2:29
Vietnamese, diet of, 1:50*t*, 54
Viral disease, defined, 2:262
Virus
defined, 1:37
and food-borne illness, 2:119–120
Vitamin A, 2:232, 233*t*, 234
Asia, 1:56
and beta-carotene, 1:62–63
from carotenoids, 1:112, 113
daily recommended intakes, 2:233*t*
deficiency, 1:56, 2:233*t*, 234, 264
functions, 2:232, 233*t*
and golden rice, 2:182
people at risk, 2:233*t*
sources, 2:233*t*
supplements during pregnancy, 2:36
toxicity, 2:233*t*, 234
and vitamin E, 2:232
and vitamin K, 2:236
and xerophthalmia, 2:264
Vitamin B_1. *See* Thiamine (vitamin B_1)
Vitamin B_2 (riboflavin), 2:238, 240*t*
Vitamin B_3. *See* Niacin (vitamin B_3)
Vitamin B_5 (pantothenic acid), 2:240*t*, 241
Vitamin B_6, 2:240*t*, 242
Vitamin B_8. *See* Biotin (vitamin B_8)
Vitamin B_9. *See* Folate
Vitamin B_{12}, 1:40, 2:230–231, 241*t*, 243
Vitamin C, 2:241*t*, 244
as antioxidant, 1:42, 44*t*
and cancer, 2:167
Central Europe and Russia, 1:119, 120

Vitamin C *(continued)*
deficiency, 1:119, 120, 2:219–220, *220*
and illness, 2:134
and oral health, 2:111
processed foods, 2:197
and scurvy, 2:197, 219–220, *220*
Vitamin D, 2:233*t*, 234–236
and calcium, 1:84, 86, 2:235
daily recommended intakes, 2:233*t*
defined, 1:2
functions, 2:233*t*, 235
infant nutrition, 2:8
in milk, as functional food, 1:242*t*
and osteomalacia, 2:122
and osteoporosis, 2:124
people at risk, 2:233*t*
and phosphorus, 2:235
preschoolers and toddlers, 2:152
sources, 2:233*t*
during space travel, 2:211
and sun exposure, 2:183, *184*, 184–185, *235*, 235–236
toxicity, 2:233*t*, 236
and vegetarianism, 2:230–231
Vitamin D deficiency, 2:235–236
and cod liver oil, 2:234–235
and osteomalacia, 1:84, 2:183, 235
and osteoporosis, 2:235
and rickets, 1:84, 2:46, *47*, 104, 183, 184, *184*, 185, 235
symptoms, 2:233*t*
Vitamin E, 2:233*t*, 236–237
as antioxidant, 1:43, 44*t*, 2:237
daily recommended intakes, 2:233*t*
deficiency, 2:233*t*, 237
functions, 2:233*t*
people at risk, 2:233*t*
sources, 2:233*t*
toxicity, 2:233*t*, 237
and vitamin A, 2:232
and vitamin K, 2:236, 237
Vitamin K, 2:233*t*, 236
daily recommended intakes, 2:233*t*
deficiency, 2:94, 233*t*, 236
functions, 2:233*t*, 236
people at risk, 2:233*t*
sources, 2:233*t*
toxicity, 2:233*t*, 236
and vitamin A, 2:236
and vitamin E, 2:236, 237
Vitamins
in corn- or maize-based diets, 1:134–136
defined, 1:2
discovery, 1:244, *244*
as nutrient, 2:94
pregnancy, 2:145
sports nutrition, 2:217
Vitamins, fat-soluble, 2:94, 153, **2:232–237,** 2:233*t*, *235*
See also Vitamin A; Vitamin D; Vitamin E; Vitamin K
Vitamins, water-soluble, 2:94, **2:230–244,** 2:*239*, 240–241*t*
See also Choline; Vitamin C; *specific B vitamins by name*
VLDL (very low-density lipoprotein), 2:29

W

Waist circumference, 1:73–74
Waist-to-hip ratio, 1:68–69, **2:245**
See also Anthropometric measurements
Wales, 2:85–86
Warfarin, 2:88*t*, 236, 237
Warm-up, in exercise, 1:201
Wasting
defined, 1:73
HIV/AIDS patients, 1:280
and malnutrition, 2:35
Water, **2:245–248,** 2:*246*
contaminated, 1:150, 173, 174–175, 2:*228*
functions, 2:245
in human body, 245–246
as nutrient, 2:95
older women and men, 2:50
pasteurization, 2:133
recommendations, 2:246
sports nutrition, 2:217
water balance, 2:246
water excretion regulation, 2:*247*, 247–248
water intake regulation, 2:247
water intoxication, 2:248
See also Dehydration; Oral rehydration therapy (ORT)
Waterhouse, Debra, 1:137
Water-soluble, defined, 1:42
Water-soluble vitamins. *See* Vitamins, water-soluble
Wean, defined, 1:76
Weight and height tables, 2:99–100, 100*t*
Weight cycling, 1:184–185, 2:250, 264–265
Weight gain
menopause, 2:50
pregnancy, 2:143–144, 143*t*
Weight loss
diarrhea, 1:149
HIV/AIDS patients, 1:280
Weight loss agents, as ergogenic aids, 1:192
Weight loss diets, 1:167, 2:106–107, **2:248–250,** 2:*249*
See also Dieting; Fad diets; Yo-yo dieting
Weight loss soap, 2:*163*
Weight management, **2:250–253,** 2:*252*, *253*
adults, 1:7–8
and caffeine, 1:83
methods, 2:106–107, *107*, 251–253
See also Eating habits; Exercise; Fad diets; Weight loss diets
Weight Watchers, 1:167
Wellness, **2:253**
defined, 1:7
See also Health
Wernicke-Korsakoff syndrome, 1:62, 2:238
West Africans, diet of, 1:17–18
West Indies, 1:11
West Nile Virus vaccine, 2:75
Western Health Reform Institute, 1:60, 2:254
See also Battle Creek Sanitarium
Westernization of dietary patterns, 1:163–164, *165*
See also Nutritional transition
WFP (World Food Programme). *See* Food Aid for Development and the World Food Programme
White, Ellen G., 1:60, 2:17, *254*, **2:254–255**
See also Battle Creek Sanitarium
White blood cell, defined, 2:4
Whites
childhood obesity, 1:121
diet-related disease, 1:14*t*
specific food consumption, 1:278*t*
WHO. *See* World Health Organization (WHO)
Whole foods diet, 1:242*t*, **2:255**
WIC program, 2:97, **2:255–258,** 2:256*t*, *257*
and Commodity Supplemental Food Program, 1:127
history, 2:255–256
and homelessness, 1:284
new directions, 2:258
outcomes and evaluation, 2:257–258
and pregnancy, 2:146–147, 255, 256, 257
rules, 2:256–257

See also Infant nutrition; Pregnancy; Preschoolers and toddlers, diet of
Wilson, Owen, 2:*258*, **2:258**
See also Infant nutrition
Wine, as functional food, 1:240, 242*t*
Women, Infants, and Children (WIC) program. *See* WIC program
Women's Health Initiative, 2:48, *49*
Women's nutritional issues, **2:259–261**
anemia, 2:259
body image, 1:69, *70*, 71
breast cancer, 2:260
calcium, 2:259, 260
chronic diseases, 2:260–261, *261*
college students, 1:124–125
cravings, 1:137, *138*
diabetes, 2:260
eating disorders, 1:177, 178, 184
folic acid, 2:259
heart attack symptoms, 2:75
heart disease, 2:260–261
hypertension, 2:261
iron, 2:259
life expectancy in Europe, 1:120*t*
menopause, 2:260
osteoporosis, 1:10, 2:123, *124*, 125, 260
pregnancy and breastfeeding, 2:259
premenstrual syndrome, 2:259
serotonin, 2:64
See also Menopause; Pregnancy; Premenstrual syndrome (PMS)
World Bank, 1:230
World Declaration and Plan of Action for Nutrition (1992), 1:250
World Food Programme (WFP). *See* Food Aid for Development and the World Food Programme
World Food Summit, 1:225, 230
World Health Organization (WHO), **2:262–264,** 2:*263*
Applied Nutrition Program, 2:262
artificial sweeteners, 1:48
biotechnology, 1:67, 68
breastfeeding, 1:75, 2:226, 263
Department of Nutrition for Health and Development, 2:35
diabetes, 1:143
diarrhea, 1:149, 151
dietary supplements, 1:156
food insecurity, 1:229
Food Safety Department, 2:172–173
Food Safety Program, 2:262–263
food-borne illness prevention, 2:121
Global Database on National Nutrition Policies and Programmes, 1:249–250
Global Outbreak Alert and Response Network, 2:262
Global Public Health Intelligence Network, 2:262
health definition, 1:263
Health for All Database, 1:117
history and mission, 2:262
HIV/AIDS, 1:280
hunger, 1:287
irradiation, 2:13
lead poisoning, 2:26
life expectancy, 2:28
malaria prevention, 2:227
malnutrition, 2:34, 35
marasmus, 2:36
nutritional deficiency, 2:*103*
obesity, 1:164
oral rehydration therapy, 2:113
osteoporosis, 2:122
programs, 2:262–264
Severe Acute Respiratory Syndrome (SARS), 2:262
smoking, 2:198
See also Food Aid for Development and the World Food Programme
World Health Organization (WHO) Joint Expert Committee on Food Additives, 1:4, 46, 47
Wurtman, Judith, 2:64

X

Xerophthalmia, 2:234, **2:264**
See also Beta-carotene; Vitamin A

Y

Yeast allergy, defined, 1:29
Yellow root, 1:13
Yerba maté;, 2:201
Yin and yang, in macrobiotic diet, 2:31
Yogurt, 2:22–23, 154
Yohimbe, as ergogenic aid, 1:190–191, 2:218
Yo-yo dieting, 1:184–185, 2:250, **2:264–265**
See also Dieting; Weight loss diets

Z

Zeaxanthin, 1:113, 2:234
Zein, in maize, 1:134
Zeisel, Steven H., 1:157–158
Zinc
deficiency, 2:63
defined, 1:41
disease prevention and treatment, 2:62
functions, 2:62
preschoolers and toddlers, 2:152
Zocor, 2:88*t*
The Zone (diet), 1:203*t*, 204