



# Programme and Book of Abstract



COM O ALTO PATROCÍNIO  
DE SUA EXCELENCIA

UNDER THE HIGH PATRONAGE OF THE  
PRESIDENT OF THE PORTUGUESE REPUBLIC



*O Presidente da República*



SNS SERVIÇO NACIONAL  
DE SAÚDE



Food and Agriculture  
Organization of the  
United Nations



Infarmed  
Autoridade Nacional do Medicamento  
e Produtos de Saúde, I.P.

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## Welcome message



Dear Colleagues,

It is my honour and pleasure to invite you to the 13th International Food Data Conference (IFDC), which will take place in Lisbon from October 15th to 18th, 2019. This year the theme of the conference will be “Challenges for food composition databases in the bioinformatics era”. As has been the case in previous years, this conference will discuss recent developments in the field of food composition databases from the production of analytical data to its application and interaction with users.

The International Food Data Conferences brings together the major figures in the field of food databases and about 150 participants to promote exchange on all topics concerning the generation and compilation of food composition data and their applications in the different areas such as nutrition, health, biodiversity, food technology, biotechnology, food policies, food nutrition education, and agriculture programmes and policies.

The 13th IFDC 2019 will be held in Lisbon, famous for its hospitality and the family-like way it welcomes visitors. It is nestled in colourful neighbourhoods full of personality, rich in monuments of unique architecture, viewpoints, typical neighbourhoods, riverside area, Fado houses, parks and gardens. Lisbon offers several possibilities to discover, visit and enjoy the vast natural, historical and cultural patrimony.

The conference web site: <https://www.ifdc2019.com/> will be periodically completed and updated until the opening of the Conference on October 15<sup>th</sup>, 2019. Please consult it regularly for the latest information! I hope that you join us for this conference and extend my best wishes for the great success of the conference.

Chairman of the Executive Board  
Instituto Nacional de Saúde Dr. Ricardo Jorge, IP  
Dr. Fernando de Almeida

## 13<sup>th</sup> IFDC Welcome address

It is a privilege to us to be the host of the 13<sup>th</sup> International Food Data Conference (IFDC). On behalf of the Organizing Institutions and the local Organizing Committee we are pleased to invite all you to the 13<sup>th</sup> IFDC in Lisbon, Portugal and enjoy the scientific topics around the selected theme “**Challenges for Food Databases in the Bioinformatics Era**”. This conference will be held in Lisbon, between the 14<sup>th</sup> and 18<sup>th</sup> of October 2019.

Our aim is to exchange experiences among specialists from around the world on themes such as the generation and compilation of food composition data and their applications in the different areas such as nutrition, health, biodiversity, food technology, biotechnology, food policies, food nutrition education, and agriculture programmes and policies.

The Conference Programme Committee, with the support of the INFOODS and International Scientific Committee is working to develop an outstanding program of scientific excellence divided into sessions covering a broad of topics, namely: 1) Analytical methods; 2) National and international activities; 3) Food composition in nutritional epidemiology; 4) New compositional data; 5) Food processing and recipe calculation; 6) Data quality and metrology; 7) Food authenticity; 8) Food composition in agriculture, trade and legislation; 9) Food data and bioinformatics; 10) Food data and environmental and sustainability; 11) Food composition and application of Novel foods and restricted diets; and 12) Others.

We welcome all of you at the 13<sup>th</sup> IFDC and are looking forward on working together on improving food composition data usage and availability from a multidisciplinary approach and welcoming professionals from nutrition, economy and agriculture.

This conference will allow us to exchange experiences and knowledge, create new partnerships and discuss aspects that may improve the food composition area and its usage. The shared experience of those countries already having a database could inspire others to apply those advances and new technology.

In addition, Lisbon is a historical city full of stories to tell with lots of sun and good temperature. Lisbon is a city full of authenticity where old customs and ancient history intermix with cultural entertainment and hi-tech innovation. Lisbon is ageless, but it loves company, as you'll find out if you meet someone and ask them to explain, with lots of gestures and repetition, where the best place is to listen to Fado. After all, Lisbon is famous for its hospitality and the family-like way it welcomes visitors.

Our wish is that you have a fruitful and successful 13<sup>th</sup> IFDC, enjoy your stay and leave Lisbon with unforgettable fond memories. With the collaboration and support of all attendants and with the spirit of partnership and working together we hope that achieving the goal of the IFDC.

**Isabel Castanheira**  
**Chair 13<sup>th</sup> IFDC Organizing Committee**

**Ruth Charrondiere**  
**INFOODS Coordinator**

## Scientific Committee

Anders Møller	Danish Food Informatics, Denmark
Angela Kimani	OptimAdept Consult Ltd, Kenya
Ayesha Salem Al Dhaheri	College of Food and Agriculture, United Arab Emirates
Basma Dashti	GULFOODS, Kuwait
Catherine Champagne	Pennington Biomedical Research Center, USA
David Haytowitz	NORAMFOODS, United States of America
Elizabet Wenzel Menezes	University of São Paulo, Brazil
Henrietta Ene-Obong	AFROFOODS, Nigeria
Hettie Schonfeldt	AFROFOODS, South Africa
Isabel Castanheira	National Institute of Health Doutor Ricardo Jorge, Portugal
Jayashree Arcot	UNSW Sydney, Australia
Jayne Ireland	Danish Food Informatics, Denmark
Johana Ortiz	LatinFoods, Cuenca-Ecuador
Kunchit Judprasong	ASEANFOODS, Thailand
Lilia Masson	LATINFOODS, Chile
Maria Antónia Calhau	Portugal
Maria Graça Dias	National Institute of Health Doutor Ricardo Jorge, Portugal
Maria João Gregório	General Direction of Health (DGS), Portugal
Norma Samman	LATINFOODS, Argentina
Pamela Pehrsson	U.S. Department of Agriculture (USDA), United States of America
Paul Hulshof	Wageningen University & Research, Netherlands
Paul M Finglas	EuroFIR Aisbl, United Kingdom
Pedro Graça	Faculty of Nutrition and Food Sciences University of Porto, Portugal
Pedro Moreira	Faculty of Nutrition and Food Sciences University of Porto, Portugal
Prapasri Puwastien	AESEANFOODS, Thailand
R. Ananthan	National Institute of Nutrition Jamai-Osmania (PO), India
Renee Sobolewski	Food Standards, Australia
Ruth Charrondière	INFOODS, Food and Agriculture (FAO), Rome
Siva Sivakumaran	OCENIAFOODS, New Zealand
Susanne Westenbrink	Netherlands National Institute for Public Health and the Environment (RIVM), Netherlands
Thingnganing Longvah	SAARFOOD, India

## Executive Committee



**Isabel Castanheira**

INSA



**Ruth Charrondière**

INFOODS, FAO

## Organizing Committee

Andreia Rego,  
Carla Maia,  
Carla Motta,  
Inês Coelho,  
Inês Delgado,  
Mariana Mendes Ribeiro,  
Marta Ventura,  
Roberto Brazão,  
Sandra Gueifão,  
Susana de Jesus,  
Tiago Moreira

National Institute of Health Doutor Ricardo Jorge, Portugal

# 13<sup>th</sup> INTERNATIONAL FOOD DATA CONFERENCE

*Challenges for Food Databases in the Bioinformatics Era*

## SCIENTIFIC PROGRAMME

**Venue**  
INFARMED- National Authority of  
Medicines and Health Products. I.P  
**Lisbon, Portugal**

October 16<sup>th</sup>, 2019

Venue: Auditorium INFARMED – Parque Saúde

8.30 - 09.00 **Registration**

### Opening Ceremony

Chairs: Maria Antónia Calhau

Welcome address – Fernando de Almeida and Isabel Castanheira (INSA) (5 min)

09.00-10.15

FAO/INFOODS – Ruth Charrondiere (5 min)

Prof. Dr. Nevin Scrimshaw Award - Paul Hulshof - (15 min)

Greenfield Southgate Award Lecture - Hettie Schönfeldt (15 min)

Keynote address: National food composition databases – essential for public health nutrition– Marga Ocké (30 min)

10.15-10.30

Coffee break

### Session 1. National and international activities

Chairs: Norma Samman and Isabel Castanheira

**FAO/INFOODS Compilation guidelines.** Ruth Charrondiere

**EuroFIR Default value documentation for aggregated/compiled nutritional values.** Susanne Westenbrink

**USDA FoodData Central (FDC): A Bridge to the Future of Food Composition.** Pamela Pehrsson

10.30-12.30

**Food Composition Tables of Japan, as archives WASHOKU food materials.** Tomoko Watanabe

**Update on New Zealand Food Composition database (NZFCDB) activities, 2016–18.** Subathira Sivakumaran

**African Network of Food Data Systems (AFROFOODS): new initiatives, collaborations, successes and future directions.** Henrietta Ene-Obong

12.30-13.30

Lunch and poster session

## Session 2. Data methodology and dissemination

Chairs: Hettie Schönfeldt and Ana Catarina Moreira

**Strategy and resources for updating the Portuguese Food Composition Database and the 2019 release.** Luísa Oliveira

**Semi-automatic generation process of a food composition table: the last update of the French Ciqual table.** Marine Oseredczuk

13.30-15.30 **Development of the new Australian Food Composition Data Management System.** Renee Sobolewski

**Development of a National Food Database in Argentina.** Norma Samman

**The new Danish Food Composition Database System: a reliable, transparent and flexible solution.** Tue Christensen

**Dissemination of new food composition tables and recipe book in Kenya.** Mwai Maina

15.30-16.00 Coffee break and poster session

## Session 3. New data base and approaches

Chairs: Kunchit Judprasong and José Camolas

**Updated and expanded Food Composition Table for Western Africa (WAFCT 2019).** Ruth Charrondiere

**Neglected no more: the importance of food composition data for the conservation and sustainable use of agricultural biodiversity.** Nurcan Güzelsoy

16.00-18.00 **Diversifying food production and diets with locally available food trees and crops.** Barbara Stadlmayr

**New initiatives on open access harmonised food composition data for developing and emerging Countries.** Mark Roe

**Inflammatory factor of foods: Incorporating biomarker-derived values into next generation food composition databases.** Paolo Colombani



**Session 4. New nutrient data**

Chairs: Jayashree Arcot and Beatriz Oliveira

**Brazilian food biodiversity: centralizing food composition data for the promotion of nutrient-rich foods in Brazil.**

Fernanda Grande

**Quantification of vitamin D2 (ergocalciferol) content in Indian foods.** R. Ananthan

08.30-10.30

**Effects of different cooking methods on vitamin D and true retention in selected fish.** Kunchit Judprasong

**New data for the vitamin D content of Australian foods.** Eleanor Dunlop

**Carotenoids content in Ibero-American and European Foods – contribution to creation of Databases.** M. Graça Dias

**Iodine in U.S. Food and Dietary Supplements.** Pamela Pehrsson

10.30-11.00

Coffee break and poster session

**Session 5. New compositional data on animal food**

Chairs: Marine Oseredczuk and Carla Gonçalves

**The necessity of nutrient data on processed meat in African diets.** Hettie Schönfeldt

**Implementation of the GS1 data in the Belgian food composition database.** Carine Seeuws

11.00-13.00

**Nutrient composition of fish species sampled off the coast of Ghana.** Astrid Hasselberg

**Nutrient composition in seafood products available for Norwegian consumers.** Synnøve Næss

**Production of a nutritional composition dataset for seafood consumed in Europe.** Mark Roe

**Retention and yield of beef and lamb retail cuts.** Beulah Pretorius

13.00-14.00

Lunch and poster session

## Session 6. New compositional data

Chairs: James Harnly and Pedro Moreira

**Challenges in completeness and accuracy of food branded data in the Netherlands.** Susanne Westenbrink

**New food composition data on raw foods in the Czech Food Composition Database NutriDatabaze.cz.** Marie Machackova

14.00-16.00

**Providing information on the chemical composition of the compound dishes consumed by the Brazilian population.** Kristy S. Coelho

**Added and free sugars: new dataset for latest New Zealand Food Composition Database products.** Elizabeth Fleming

**A Multi-Country Collaboration Leads to the Development and Establishment of a Country Specific Food Composition Database for Malawi.** Averalda Graan

16.00

Social Program

October 18<sup>th</sup>, 2019

Venue: Auditorium INFARMED – Parque Saúde

**Session 7. Analytical methods and compliance**

Chairs: Jayne Ireland and José da Silva

**Compliance of maize flour from commercial mills to fortification legislation levels for micronutrients in Kenya.**  
Anselimo Makokha

**Determination of Vitamin K2 in foods by High-performance Liquid chromatography with Fluorescence Detection.** Zhu Wang

08.30-10.30 **Six folate vitamers in food – an inter-comparison study on a method using a pure deconjugase of plant origin and quantification by LC-MS/MS.** Jette Jakobsen

**Iron levels in the fortified rice sold in Papua New Guinea.**  
Maria Chandra-Hioe

**Development and application of a primary method for speciation analysis of chromium in foodstuffs by HPLC coupled to ICP-MS using SSID.** Petru Jitaru

**Quantifying animal protein food intake in a developing country: The case of meat in South Africa.** Hettie Schönfeldt

**Comparative study of sodium content in common foods consumed in Argentina and Costa Rica.** Norma Samman

10.30-11.00 Coffee break and poster session

## Session 8. Food Data and Bioinformatics

Chairs: Anders Møller and Isabel Trancoso

**Handling missing values in food composition tables: the example of the nutrient dataset for the French national food consumption survey.** Laure du Chaffaut-Koulian

11.00-13.00 **FoodEx2 as a tool to facilitate the harmonization of food consumption and food composition data.** Rita de Sousa

**Ontologies for food description from farm to fork: A case study with FoodOn and the OBO Foundry vocabularies.** Damion Dooley

**Diet Assess & Plan nutritional software in EFSA's EU Menu project: platform for food data harmonization and regional collaboration in the Balkans.** Milica Zeković

**Nutrify India Now (NIN) mobile application: A public utility tool.** T Longvah

**Natural Language Processing applied to Food Data – A smart food description mapping system.** Sidney Tomé

13.00-14.00 Lunch and poster session

## Session 9. Nutritional epidemiology and recipe calculation

Chairs: Ana Rito and R. Ananthan

**Introducing INDDX24: A dietary assessment platform for scaling up availability, access, and use of global dietary data.** Jennifer Coates

14.00-16.00 **State of the Australian food supply: an approach to monitor annual change in the nutritional quality of packaged foods and beverages.** Maria Shahid

**Estimation of Nutrient Values from Label Data in Branded Foods.** Karl Presser

**A Web-application to reformulate recipe through optimization: proof of concept.** Romane Poinot

**Comprehensive EuroFIR recipe calculation guideline to produce food composition data.** Katja Sandfuchs

16.00-16.30 Coffee break and poster session

**Session 10. Round table: The origins of Food Composition Tables**

Chair: Helena Soares Costa

Facilitators: Luísa Oliveira (INSA)

Pamela Pehrsson (USDA)

16.30-17.30

Hannah Pinchen (Quadram Institute)

Paolo Colombani (Mymeleon AG)

Susanne Westenbrink (RIVM)

Ruth Charrondiere (FAO)

**17.30 – 18.00 Closing ceremony and Poster Award**

## Prof. Dr. Nevin Scrimshaw Award



Paul JM Hulshof is assistant professor in the chair group Nutritional Biology at the Division of Human Nutrition of Wageningen University. He was head of the chemical laboratory at the Division for about 20 years and his laboratory provided considerable data to the Dutch food composition database. His main interest are in the field of body composition methodology, energy expenditure methodology including the use of doubly labelled water, food composition, and biomarkers of dietary exposure. He participated in several EU funded projects related to biomarker validation of dietary exposure (EFCOVAL project), in the EuroFIR project, in the SMILING project related to sustainable micronutrient interventions to control deficiencies and improve nutritional status in Asia, and more recently in the Food Biomarker Alliance JPI (Foodball project). He (co)-authored more than 50 original research papers on diverse topics. Since 2005 he is course director of the International Post Graduate Course on the Production and use of Food Composition Data in Nutrition. He is amongst other member of the Dutch Academy of Nutritional Sciences, member of the Dutch Nutritional Assessment Platform, member of the editorial board of JFCA, consultant for the International Atomic Energy Agency for training on the use of stable isotopes in nutrition, and reviewer of manuscripts for several journals. Paul is married; has two children and two grandchildren, and loves photography, gardening, hiking and cooking.

## Prof. Dr. Nevin Scrimshaw Award Lecture

### **Training on food composition: relevance for the nutrition & health theme**

#### **Paul Hulshof**

Food is very complex causing metabolic responses which is linked to the nutrient composition of the food, the matrix, interactions and properties of the host such gut microbiome. We are what we eat and the compiler has the challenging task to capture the variation of factors that affect food composition and to use standardized approaches to document the composition appropriately and making the data accessible for users. This requires training on the subject matter. Training -as part of social development- is an indispensable pillar of capacity building. Every two years, since 1992, the Division of Human Nutrition of Wageningen University in collaboration with Graduate School VLAG offers training courses on food composition data. Since 1992, almost 400 participants from more than 100 countries have been trained in Wageningen and many contributions were made in other parts of the World. Shaping training courses requires inputs from stakeholders, from nutrition sciences, compiler experts, and should implement standardized approaches aligning with the progress made in the field. There are still many challenges ahead in the practice of compilation and in training which may also justify a broader focus on the food data domain.

## Greenfield Southgate Award



Professor Schönfeldt's research focuses on linking nutrient quantity and quality of foods to sustainable food systems for attaining nutrition and food security for all. She is an advocate for nutrition research, promoting excellence through the creation, translation and dissemination of science-based information into policies, programmes and training programmes both nationally, and internationally. She publishes evidence on why country specific food composition data is essential to make it possible to interpret the dietary outcomes of countries. She serves as scientific advisor to AFROFOODS, a network on the African continent, forming part of IUNS/UNU/FAO INFOODS Task Force. She is the director of the new African Research Universities Alliance Centre of Excellence in Food Security and holds a Department of Science and Technology /National Research Foundation Research Chairs Initiative in Nutrition and Food Security.



## Greenfield Southgate Award Lecture

### **Generating unique country-specific data for the African region**

Hettie Schönfeldt

University of Pretoria, Pretoria, South Africa

Hettie.schonfeldt@up.ac.za

Food composition and nutrient requirements guide human nutrition - from dietary advice and guidance to food labelling. Relevant, reliable and up-to-date food composition data are of fundamental importance in nutrition, dietetics and health, but also for other disciplines such as food science, biodiversity, plant breeding, food industry, trade, and food regulation.

Following my studies which all include a component of what we today recognise as nutrient analysis of different foods, I have continued to build capacity in Food Composition and Analysis in different ways. I have trained and continue to train numerous post-graduate students through formal MSc and PhD studies. Furthermore, by collaborating with various international organisations I have participated in various training courses since 1996 and hosted at least six.

By participating with INFOODS we have improved the evidence of the importance of Food Composition in Nutrition through the normative work freely available online. To this end I have served in the INFOODS Network first as ECSAFOODS coordinator, followed by AFROFOODS coordinator for ten years and currently scientific advisor to AFROFOODS.

Career highlights include: European Union reviewer under the 6th framework of EuroFIR activities; evaluation of FAO's Role and Work on Nutrition and chief rapporteur of FAO Expert Consultation on Dietary Protein Quality.

Looking forward it is my mission to continue building capacity using a food based approach and I endeavour to continue to improve the evidence that local foods are more nutritious and sustainable.

Keywords: Food based approach, Food composition, INFOODS, Nutrient analysis

## KeyNote Speaker



Marga Ocké

Marga studied Human Nutrition at Wageningen University, the Netherlands, where she also received her PhD degree. She works as a senior scientist at the National Institute for Public Health and the Environment (RIVM, Bilthoven), and is seconded at Wageningen University for one day a week.

Her drive is to support public health and a healthy environment by conducting research and providing advice in the areas of public health nutrition and nutritional epidemiology. As a senior scientist she coordinates projects focusing on the Dutch national food consumption surveys, dietary assessment methodology, nutrition and health, and integral evaluations of the diet. Marga has 20 years of experience as project leader and work package leader of various national and international projects.

Her scientific interests are: public health nutrition, healthy and sustainable diets, dietary assessment methodology, dietary monitoring, evaluation of dietary intake and dietary pattern analysis, and dietary validation studies. Marga is co-author of more than 40 policy advice reports, various book chapters and more than 160 papers in peer-reviewed international journals.

## KeyNote address

### **National food composition databases – essential for public health nutrition**

*Marga Ocké*

*National Institute for Public Health and the Environment. Bilthoven. The Netherlands. E-mail: marga.ocke@rivm.nl*

**Introduction:** Public health nutrition is the promotion and maintenance of nutrition-related health and wellbeing of populations through organized efforts and informed choices of society.

**Objective:** To show the essential role of national food composition databases for public health nutrition, and to point to gaps and needs for future improvements of these databases.

**Methodology:** The role of national food composition databases is illustrated through various activities of the Dutch National Institute for Public Health and the Environment in the triple A phases (Assessment, Analyses and Action) of public health nutrition.

**Main findings:** In the *assessment phase*, we use national food composition databases to identify for which nutrients intake is inadequate or excessive in the population as a whole or in specific population subgroups; to estimate the associations between nutrient intake and various chronic diseases; and to estimate the public health impact of changes in nutrient intake. In the *analyses phase*, we use food composition data to determine for example the main food sources of nutrients with excessive intake like salt and we look at socio-economic differences in nutrient intake. For the *action phase*, we use food composition data to develop e.g. food based dietary guidelines that fulfil nutrient requirements and we derive safe maximum levels of food fortification. Gaps and needs for food composition databases are related to the rapidly changing food markets which require that food composition databases remain up-to-date; recent interests in specific dietary components such as specific amino acids and in other aspects of food like the environmental footprint of foods; and foods especially consumed by e.g. immigrants or vegans with specific nutrient challenges. Moreover, ICT developments, bio-informatics and the availability of branded food databases provide new opportunities and challenges for integration with national food composition databases. Lastly, international harmonisation is important for conducting international studies.

**Conclusion:** National food composition databases are key infrastructure components for all phases in public health nutrition. A constant effort is needed to keep them up-to-date with correct values and new foods and to extent them with new components to make them suitable for the current and future issues in public health nutrition.

# 13<sup>th</sup> INTERNATIONAL FOOD DATA CONFERENCE

*Challenges for Food Databases in the Bioinformatics Era*

## ORAL PRESENTATIONS

**Venue**  
INFARMED- National Authority of  
Medicines and Health Products. I.P  
**Lisbon, Portugal**

(O1.1) FAO/INFOODS Compilation guidelines

U. Ruth Charrondière<sup>1</sup>, Barbara Stadlmayr<sup>1,2</sup>, Rajendran Ananthan<sup>3</sup>, Avonti Basak<sup>4</sup>, Joelaine Chetty<sup>5</sup>, Judy Cunningham<sup>6</sup>, Henrietta Ene-Obong<sup>7</sup>, Fernanda Grande<sup>1,8</sup>, David Haytowitz<sup>9</sup>, Kunchit Judprasong<sup>10</sup>, T Longvah<sup>11</sup>, Emily Mbelenga<sup>12</sup>, Marine Oseredczuk<sup>13</sup>, Karl Presser<sup>14</sup>, Prapasri Puwastien<sup>10</sup>, Mark Roe<sup>15</sup>, Siva Sivakumaran<sup>16</sup>, Subathira Sivakumaran<sup>16</sup>, Renee Sobolewski<sup>17</sup>, Anna Vincent<sup>1</sup>, Susanne Westenbrink<sup>18</sup>

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<sup>8</sup>Post Graduate Program in Applied Human Nutrition. FCF/FEA/FSP. University of São Paulo (USP). Food Research Center (FoRC/CEPID/FAPESP). São Paulo. SP. Brazil, <sup>9</sup>Independent consultant. formerly USDA,

<sup>10</sup>Institute of Nutrition. Mahidol University (Salaya Campus). Thailand, <sup>11</sup>Food Chemistry Division. National Institute of Nutrition. Hyderabad. India

<sup>12</sup>Nutrition Consultant. Le Laboratoire Nutrition Evaluation Consultants, <sup>13</sup>French Agency for Food. Environmental and Occupational Health & Safety. Maisons-Alfort. France, <sup>14</sup>Premotec GmbH. Winterthur. Switzerland, <sup>15</sup>EuroFIR AISBL. Brussels. Belgium, <sup>16</sup>Food Innovation. New Zealand Institute for Plant & Food Research Limited. Palmerston North. New Zealand, <sup>17</sup>Senior Scientist. Food Standards Australia New Zealand, <sup>18</sup>National Institute for Public Health and the Environment RIVM). Bilthoven. Netherlands.

Introduction: Food composition compilers rely on international recommendations when compiling a food composition table or database (FCT/FCDB). Information on how to compile a FCT/FCDB, however, is scattered and incomplete, leaving especially inexperienced compilers with many questions.

Objective: To elaborate a global harmonized approach for data compilation that assists particularly new compilers by providing, in addition to theoretical aspects, practical examples of collecting, compiling and aggregating data.

Methodology: FAO/INFOODS contacted experts on food composition to participate in the development of the Compilation guidelines of which 20 accepted the invitation. Participants were assigned to working groups based on their expertise. The working groups were given a theme, reading material, and an outline with the task to write one chapter. Results of an online survey on understanding main challenges of compilers, conducted by FAO/INFOODS, assisted in framing the chapters and targeting specific issues. Chapters were reviewed and harmonized and are currently being revised.

**Main findings:** The Compilation guidelines are a rich source of information, based on compilers experience and written in a simple language. Altogether nine chapters are included: introduction; selecting data (foods, components, literature sources); data compilation: from collecting to aggregating data; estimating data; evaluating and documenting data; presenting food composition data; fatty acids, amino acids and practical tips. Focus was given on practical guidance by providing examples of different datasets and at different stages in the compilation process.

**Conclusion:** The Compilation guidelines will assist overall new compilers to find solutions to technical issues during the development of a FCT/FCDB, thereby increasing the quality of the FCT/FCDB. The guidelines will need regular consultations and updates to include new approaches and to become more comprehensive.

**Key words:** food composition, compilation, data harmonization, international activiti

## (O1.2) EuroFIR Default value documentation for aggregated/compiled nutritional values

Susanne Westenbrink<sup>1</sup>, Karl Presser<sup>2</sup>, Mark Roe<sup>3</sup>, Jayne Ireland<sup>4</sup>

<sup>1</sup>National Institute for Public Health and the Environment. MA Bilthoven. Netherlands,

<sup>2</sup>Premotec GmbH. Winterthur. Switzerland, <sup>3</sup>EuroFIR. Brussels. Belgium, <sup>4</sup>Danish Food Informatics. Roskilde. Denmark.

EuroFIR documentation working group

**Introduction:** Food composition data is one of the pillars of food and health research. Documentation of meta data of nutrient values is essential in food composition data management, to understand how values were determined or changed during compilation. It enables evaluation of the quality of data and indicates if updates may be needed. Moreover, it allows users to better understand the data and enables comparison and use of data from other food composition databases.

**Objective:** EuroFIR has developed a Standard to document food composition data and Thesauri (controlled vocabulary) to harmonize this approach. Until now, the EuroFIR Thesauri have been mainly used to document original values. The present goal was to harmonize documentation of aggregated/compiled values and enable automated data documentation during these processes.

**Methodology:** Typical approaches on how to aggregate/compile nutrient values were investigated, such as weighted mean, recipe calculations or use of formulae. For each approach, default documentation of value properties (value type, method type, method indicator, acquisition type, reference) was discussed by the EuroFIR documentation group.

**Main findings:** Thirteen approaches of data aggregation/compilation were identified, and default value documentation properties for each of these approaches were agreed upon. These rules of default value documentation were then implemented in the FoodCASE software, which is increasingly used for food composition data management.

**Conclusions:** Guidelines for default value documentation of aggregated/compiled data were developed and can be applied in database management systems for automated documentation or used manually. Use of default value documentation makes the aggregation/compilation process simpler and more consistent for compilers. Results will become available with upcoming releases of European food composition datasets and will allow for increased standardization and better comparison between datasets.

**Key words:** Default value documentation, EuroFIR, Food composition database, Standardization of value documentation

## (O1.3) USDA FoodData Central (FDC): A Bridge to the Future of Food Composition

Pamela Pehrsson, Naomi Fukagawa, James Harnly, Alanna Moshfegh, John Finley

USDA ARS. Beltsville. MD. USA.

USDA's food composition data have evolved to meet the needs of diverse users, including researchers, policy makers, nutrition professionals, and food manufacturers. The dynamic US food supply and the need for transparent, easily accessible information on food components and products and related data on production and variability, necessitated new directions. USDA's FoodData Central (FDC) is a centralized, integrated system with five types of data, each with a unique purpose: 1) Foundation Foods that includes nutrient values and extensive underlying metadata on commercially available foods e.g., number of samples, sampling location, harvest dates, analytical approaches, and related agricultural information (e.g., genotype, production practices); 2) SR Legacy (2018), the final release of Standard Reference (SR), the primary food composition data type in the US for decades; 3) The Food and Nutrient Database for Dietary Studies (FNDDS) which provides nutrient values for foods and beverages reported in What We Eat in America, National Health and Nutrition Examination Survey (NHANES); 4) USDA Global Branded Food Products Database, industry-provided label data for over 250,000 foods from a public-private partnership (USDA, ILSI International, JIFSAN-UMD, GS1, Label Insight), with the goal of sharing label data from branded and private label foods; and 5) Experimental Foods that will include information from multiple sources about foods produced under experimental conditions but not commercially available. Agricultural data allow users to investigate many factors, including geography and agricultural practices that affect the nutritional profiles of foods and dietary intake estimates. These data, expected to grow over time, provide valuable research insights on factors that influence variability of classic nutrients and emerging bioactive compounds. With a single stop (<https://fdc.nal.usda.gov/>), researchers and consumers can access and download the data they need.

**Key words:** Agriculture practices, Database, Food composition, Nutrients



## (O1.4) Food Composition Tables of Japan, as archives WASHOKU food materials

Tomoko Watanabe, Masato Matsumoto, Shinji Matsumoto

Ministry of Education, Culture, Sports, Science and Technology. Tokyo. Japan.

**Introduction:** Archiving food information is an essential effort to keep traditional dietary cultures alive. National committee for food composition in Japan continuously assembles food compositions and cooking methods related to the Washoku cultures. **Objectives:**To point out certain foods, cooking methods and their recording procedures intent to keep Washoku cultures alive, from the Food Composition Tables in Japan (FCTJ).

**Methodology:** Reviewing past and present compiling process of FCTJ, foods and cooking methods combined tightly to Washoku cultures were determined, and their features keeping Washoku alive were clarified.

**Main findings:** In 2013, "Washoku; Traditional Dietary Cultures of the Japanese" received official recognition as an Intangible Cultural Heritage of UNESCO. Washoku is a social practice which revolves around the Japanese values of "respect for nature." Some examples of this include: Using various fresh foods to bring out natural tastes, Well-balanced and healthy diets, Emphasis of the beauty of nature in table setting, Integration in traditional events. FCTJ presents the nutritional features of over 800 species for vegetables and fishes, including seasonal produces and fresh seafoods. FCTJ also indicates traditional cooking methods including soaking, boiling, grilling, which are suitable for Washoku dishes. Japanese nutritionists learn much from FCTJ, about how to cook Washoku by using various fresh food materials around Japanese daily lives.

**Conclusion:**To keep Washoku cultures alive among Japanese food specialists and home cooking, the committee for FCTJ focuses on, Collecting composition data of edible wild plants, including recently cultivated crops, and also mushrooms, Investigating differences between more or less fatty fillet portions from the same fish kinds, Recording cooked foods utilized in Washoku culture, such as grated daikon radish, broth from kelp, mackerel sashimi pickled in vinegar.

**Key words:** Cooking methods, Food Composition Tables in Japan (FCTJ), Washoku (Japanese food)

## (O1.5) Update on New Zealand Food Composition database (NZFCD) activities, 2016–18

Subathira Sivakumaran<sup>1</sup>, Sivalingam Sivakumaran<sup>1</sup>, Kris Tham<sup>1</sup>, Carolyn Lister<sup>2</sup>

<sup>1</sup>Food Innovation. The New Zealand Institute for Plant and Food Research Limited. Palmerston North. New Zealand,

<sup>2</sup>Food Innovation. The New Zealand Institute for Plant and Food Research Limited. Christchurch. New Zealand.

**Introduction:** A regular update of information on foods and beverages is important for food composition databases, to provide up-to-date data to a range of users. This is especially important because there are constant changes in the food supply, improvements in methods of analysis, and emerging food-related health issues, along with increased consumer awareness of non-communicable diseases and healthy eating.

**Objective:** To update approximately 100 commonly consumed foods and beverages per annum for the New Zealand Food Composition Database (NZFCD) analytical programme.

**Methodology:** The foods were prioritised based on one or more criteria for NZFCD. The sampling protocol varied depending on the nature of foods. Food component data were obtained in a single and/or multiple composite sample by direct analysis, or derived from such analytical data, or presumed zero. For recipe foods, the data were calculated using a 'mixed method' by the NZFCD system, with yield factors applied at the recipe level, and retention factors applied at the ingredient level. All data were validated according to the FAO/INFOODS guidelines.

**Main finding:** A total of 203 new or reanalysed food and beverage records, with full datasets for 86 components, were updated in NZFCD during 2016–18. Foods were updated in 16 different food groups. The main focus was placed on New Zealand products, specifically vegetables, followed by non-alcoholic beverages, fruits, bakery products and dairy. For the first time, we included free and added sugar data with the standard components such as proximates, minerals, vitamins and fatty acids.

**Conclusion:** Updated data for 203 foods and beverages are now available in the NZFCD products (FOODfiles™ 2018, Concise Tables 13th Edition 2018 and an online search tool) on our website: [www.foodcomposition.co.nz](http://www.foodcomposition.co.nz). This resource of up-to-date compositional data are essential for nutritional-related studies and accurate estimation of nutrient intake for New Zealanders.

**Key words:** Concise Tables, Food components, FOODfiles™, New Zealand, NZFCDB

## (O1.6) African Network of Food Data Systems (AFROFOODS): new initiatives, collaborations, successes and future directions

Henrietta Ene-Obong<sup>1</sup>, Angela Kimani<sup>2</sup>, Ella Compaore<sup>3</sup>, Rosemary Mwaisaka<sup>4</sup>, Jalila El Ati<sup>5</sup>  
Christiant Kouebou<sup>6</sup>, Hettie C Schönfeldt<sup>7</sup>, Anna Vincent<sup>8</sup>, Karl Presser<sup>9</sup>, Paul Finglas<sup>10</sup>, U. Ruth  
Charrondiere<sup>11</sup>

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**Introduction:** Several calls have been made to governments, organizations and funding agencies to collaborate with AFROFOODS to provide the evidence base for delivering effective and well-targeted policies and programmes to reduce the unacceptable high rates of all forms of malnutrition in Africa.

**Objective:** To report on new initiatives and collaborative activities in the recent past and the successes recorded.

**Methodology:** Plans of action were developed by AFROFOODS network and other Stakeholders at various meetings, workshops/conferences; roles were assigned and followed up. Collaborative activities were undertaken with relevant Stakeholders while new ones are being initiated. Opportunities were utilized to sensitize and advocate for the development of Food Composition Tables (FCTs) and main streaming food composition into national/ regional plans of action.

**Results:** FAO/INFOODS has carried out numerous capacity building activities on food composition in Africa. INFOODS in collaboration with AFROFOODS updated the 2012 West African FCT, released in 2019. Substantial interest has been generated and more countries are now in the process of developing or updating their country-specific/regional food composition databases (Ethiopia, Ghana, Bukina Faso, Tunisia, Morocco, Nigeria, ECSA, NAFOODS, etc.). More country focal persons are being identified. Collaboration with WHO EMRO and EuroFIR AISBL yielded specific results such as capacity building in food composition, strengthening AFROFOODS network and development of AFROFOODS website for improved visibility and networking. A newsletter is also in place. Collaboration has been initiated between AFROFOODS and African nutrition societies (ANS & FANUS), while new ones with other Stakeholders are being initiated.

**Conclusion:** These gains must be sustained, future direction pursued vigorously to raise the status of food composition data in Africa for the solution of the nutrition and food security challenges of Africa.

**Key words:** AFROFOODS, Collaborations, Food composition, Future direction, New initiatives, Successe

(O2.1) Strategy and resources for updating the Portuguese Food Composition Database and the 2019 release

Luísa Oliveira, Maria da Graça Dias

Monitoring and Surveillance Unit. Food and Nutrition Department. National Institute of Health  
Doutor Ricardo Jorge. IP (INSA). Lisbon. Portugal.

Introduction: INSA is the compiler of the Portuguese Food Composition Data Base (FCDB). The first Food Composition Table (FCT) was published in 1961 and several editions were published at irregular intervals and in various formats. Inspired by the participation in EuroFIR Network project (2005-2010), INSA has been steadily building networking and infrastructures for the regular updating and sustainability of the Portuguese FCDB.

Objectives: To present the resources for updating the Portuguese FCDB, the 2018-2021 strategy and the contents of the 2019 release.

Methods: INSA created the Portuguese Food Information Resource networking (PortFIR), uses FoodCASE as its Food Information Management System, has a quality management system (QMS) and an analytical updating commission (AUC) in place to compile the Portuguese FCT and produce data according to EuroFIR's technical requirements. The dissemination is made through PortFIR website.

Results: PortFIR networks have 140 members from 90 entities representing almost all data users and producers. The Food Composition network supports INSA in revising the FCT, finding Portuguese sources of data and accessing users' needs. The 2019 FCT update includes 400-500 new foods compiled in close cooperation with the Food Consumption Survey team. Up to 2021 all EuroFIR's priority 1 components are foreseen to be included. DAN is 17025 accredited and has a compilation QMS in place according to EuroFIR's flowchart and SOPs. The AUC defines INSA's FCT analytical annual plan and coordinates the analytical work currently focused in the vegetarian population. PortFIR website, connected to FoodCASE, provides free access to the FCT, allowing search, comparison of foods and calculations of recipes and nutritional value of food plans, as well as the download of the FCT file in Excel format.

Conclusions: Close cooperation and a clear vision are crucial for the sustainable update of the Portuguese FCDB to meet the requests of different uses.

**Key words:** Food composition databases (FCDB), Food composition tables (FCT), FoodCASE, Networking, PortFIR, Updating strategy

## (O2.2) Semi-automatic generation process of a food composition table: the last update of the French Ciqual table

Marine Oseredczuk, Laure du Chaffaut, Céline Ménard

Anses (French Agency for Food, Environmental and Occupational Health & Safety). Maisons-Alfort. France.

The Ciqual database aims at providing the composition of generic French foods for 61 nutrients. Published data are produced by aggregation of initial data from various sources (own analysis, labelling data, scientific literature). To ensure completeness of a food nutrient profile, multiple data sources are generally combined.

Objective: To guarantee the reliability of Ciqual published table and its representativeness of French consumption, a traceable and sound process is needed for critical steps: relevant selection of initial data, aggregation and adjustment of aggregated data for consistency of food nutrient profiles.

Methodology: Algorithms were coded using SAS® according to compilers expertise. Inconsistencies in food nutrient profiles were automatically detected. Minor ones were automatically adjusted; major ones were scrutinized by compilers who archived faulty initial data. Several iterations of the whole process were performed until no major inconsistency was detected.

Main findings: Algorithm for initial data selection favored representative initial data sources. If no representative data were available, all recent data (< 10 years) were selected. For foods with high variability, no time limit was applied to enhance stability of aggregated data over versions of the Ciqual published data.

Algorithm for aggregation first defined a mean for each selected initial data source and then averaged these means. It also derived values for some nutrients.

Food nutrient profile consistency algorithms used a top down cascade approach for lipids and carbohydrates compounds: amounts of major components were fixed and sum of contributing compounds was adapted to this constraint value either automatically or by selection of new initial data.

Conclusion: A semi-automatic process to update the Ciqual food composition table was developed, considering some specificities of foods and relations between nutrients. This robust and efficient process is applicable to other databases.

**Key words:** Aggregation, Consistency, Data selection, Food composition table, Nutrient profile

## (O2.3) Development of the new Australian Food Composition Data Management System

Danielle Ballantyne, Shari Tompsett, Renee Sobolewski

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**Introduction:** Food Standards Australia New Zealand (FSANZ) has used a custom built data management system called the Australian Nutrient Data Bank (ANDB), since the 1990's to facilitate the upload, storage, compilation and reporting of food composition data. A review of the system undertaken in 2009 identified the need for a new system to be developed that fully integrated with FSANZs IT infrastructure and that did not require a high level of specialist programming skills to maintain.

**Objective:** To describe the development of FSANZs new Australian food composition data management system, now called Silo, and to identify future development plans.

**Methodology:** Several strategies were used to develop an integrated data management system that would meet FSANZs existing and future food composition and broader agency needs. An external IT company was contracted to undertake the development work. A product backlog was developed itemising key functionality requirements to form the basis of the development work. Development activities were then prioritised and developed using an agile project management approach. A prioritised list of additional enhancements was also developed to inform future phases of Silo development.

**Main findings:** The new database was developed as a web-based application. It provides a more stable and secure storage facility for our food composition data. The user experience has been improved with streamlined data load and compilation processes and easier interrogation and reporting of data. Functionality has also been enhanced to improve calculation times and allows changes in nutrient profile to be more easily tracked over time.

**Conclusion:** The initial Silo database development was completed in 2018. Further development will focus on expanding Silo's capacity to become the central repository for all FSANZ scientific data and to link with our in-house custom build dietary exposure assessment system, Harvest.

**Key words:** Australia, Data management system, Food composition, Nutrient data,

## (O2.4) Development of a National Food Database in Argentina

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The nutritional status of a population directly and indirectly impacts the productive capacity of a nation and the development of populations. The development of Food Composition Tables has several challenges, which is why it is necessary to form interdisciplinary teams that work articulately.

The objective was to develop a National Food Composition Table that is up-to-date and methodologically adequate to respond to health needs in the nutritional aspects, formulation of new healthy foods and others.

An electronic search of literature published from 2010 to the present was conducted with COVIDENCE software in several steps (screening titles and abstract; complete article evaluation and selection). An annotated search for non-indexed 'gray literature', laboratories informs and thesis was also completed. Quality of data was assessed in terms of sampling and analytical criteria.

Results: A total of 1548 potentially eligible references were identified, out of which 241 articles and reports met inclusion criteria. These studies provided information mainly about energy value and macronutrients and also of vitamins and minerals for 182 individual food items and multi-ingredient foods. Cereals, legumes and derivatives, milk and dairy products, meat, fish and derivatives were the most frequently reported food groups. Non-representative sampling and poor description of the analytical quality control, reports on dry base without including moisture value were the most frequent issues found to reject the sources of data. This information will be soon included in the National Food Data Base. To accomplish this, software has been developed, and work is continuing on the compilation and generation of analytical food composition data.

Conclusions: These results will contribute to the continuous and systematic updating of food composition database, which are of paramount importance for public health. Collaboration among data generators, compilers, and users is essential.

**Key words:** Argentinean FCT, Compilation, Convidence system

(O2.5) The new Danish Food Composition Database System: a reliable, transparent and flexible solution.

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In October 2018 the new Danish Food Composition Database (Danish FCDB) system was launched. The old system (AskSam DOS) was replaced with a modern frontend (Angular 7) on a SQL Server. The main purpose of the new Danish FCDB aims towards a more automated and transparent process when it comes to storing, maintaining, assembling, calculating and publishing food data.

The Danish FCDB is developed as a Minimum Viable Product (MVP), with emphasis on a quick launch and ready to be used, but with minimum sets of functionalities. After release, new user requirements are prioritized for further development. This current method has resulted in a short development period of 12 months before release of the Danish FCDB 1.0 in Oct 2018, which then has been followed by further releases.

The new system consists of three parts: frontend (Angular 7), backend (ASP.Net Core 2.0 application Service oriented architecture using Web-API. Entity Framework (EF) Core as database object-relational mapper (O/RM)), and database (SQL Server 2012). The database is built in four levels according to H. Greenfield and D.A.T. Southgate, 2003 and has an assembly-, calculation-, and presentation computer engine, which makes the database consistent and reliable when working with food data. Moreover, it has an import module, which accommodates specific data requirements and compares the imported data to the current raw data. Various users types are taken into account, thus mutual types of users can assess and export the database. One of the latest modules gives an overview of which particular parameters are missing for each of the food items. Furthermore, to ensure full transparency versioning was implemented in all levels of the database.

The new Danish FCDB and its modules frees data manager workload due to more structured data management which allows more focus on high quality data management and documentation instead of continuous operational tasks.

**Key words:** Food composition database, Database system, Data compilation



## (O2.6) Dissemination of new food composition tables and recipe book in Kenya

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**Introduction:** Food composition data provides food and nutrition sector, with the important guidelines in food labelling, nutrient intake assessment, diet formulation, and breeding. It is also used to establish food-based dietary guidelines and relationships between disease outcome and nutrient intakes which provides the evidence base for nutrition and health policies. The first edition of food composition tables in Kenya was published in 1993. Due to lack of wide dissemination, its use was limited. There is need for wide dissemination of Food Composition Tables 2018 to facilitate better use and encourage further generation of more data.

**Objective:** To build capacity of users, compilers and analysts on proper use of Food Composition Tables.

**Methodology:** Four classroom sensitization workshops including practical sessions on application of food composition data were conducted. Two at sub-national, one at national level targeting research and training institutions, health, nutrition and agriculture sectors. The fourth was specific to a faculty in one of the universities.

**Main findings:**

At sub-national level, nutrition and home economics coordinators from health and agriculture departments were sensitized. At national level, nutrition program coordinators from government and non-governmental organizations were reached. Instructors from training institutions in the field of food and nutrition sciences were also sensitized. Participants appreciated the work and noted that the sensitization greatly improved their knowledge on use of FCT and recipe book. The necessity to contextualize the FCTs targeting specific users was raised. This include Kenya Bureau of Standards as they develop food standards and stakeholders in the food industry for food labeling.

**Conclusion:** Improved nutrient analysis and data sharing is expected following sensitization. There is need for wider sensitization of stakeholders to enhance use and increased funding in food composition data.

**Key words:** Capacity building, Dissemination, Food composition

### Session 3. New data base and approaches

#### (O3.1) Updated and expanded Food Composition Table for Western Africa (WAFCT 2019)

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Introduction: 2019 Food Composition Table for Western Africa (WAFCT 2019) is a collaborative effort between FAO and INFOODS members in Benin, Burkina Faso, Cameroon, Ghana, Mali, Nigeria and South Africa, as part of the INDDX project.

Objective: Improve the quality and usefulness of FCT for nutrition and agriculture in Africa.

Methodology: Each country collected and compiled analytical data for missing foods according to FAO/INFOODS standards, which were scrutinized and compiled at FAO. All borrowed international composition data, yield factors and retention factors were reviewed and updated. Field work in Burkina Faso collected recipes for mixed dishes including weight of raw ingredients and the final dish. The composition of the mixed dishes was calculated.

25 foods from Ghana were sampled and analysed for WAFCT 2019 and analytical data from the 2018 Kenya FCT were included.

The update took 72 person months over 4 years to complete.

Main findings: Foods in WAFCT 2012 were reviewed and updated and 556 foods were added, comprising 94 mixed dishes, 164 raw foods (of which 31 are fortified foods) and 298 cooked foods. WAFCT 2019 includes 1028 foods and 57 components, compared to 472 foods and 28 components for WAFCT 2012.

Significant data gaps in analytical data from Africa remain, especially for vitamins, minerals and dietary fibre but also for many traditional, processed and biodiverse foods and recipes.

The update increased food data availability and compilation capacity in partner countries.

Conclusion: WAFCT 2019 represents a significant expansion and revision of WAFCT 2012, and includes all the publicly available, good quality data from Western Africa. The addition of new foods and new nutrients to WAFCT 2019 makes it more useful for nutrition, health and agriculture programmes and policies. Value level documentation highlighting data gaps shows where decision makers, donors and researchers should focus future food composition activities.

**Key words:** Database, Food composition, Mixed dishes, Update, West Africa

## (O3.2) Neglected no more: the importance of food composition data for the conservation and sustainable use of agricultural biodiversity

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Recent exhortations for a radical global food system transformation, which puts greater emphasis on the incorporation of biodiversity and specifically plant-based foods into diets and agricultural production systems, can leave consumers and decision-makers at a loss when it comes to choosing what to grow and consume.

Many locally-important fruits, vegetables, nuts, roots and tubers, pulses, grains and food trees plant-based foods exist that can be used to complement mainstream agricultural commodities, but limited information is available on their nutritional value and their potential use to improve and diversify diets.

Brazil, Kenya, Sri Lanka and Turkey have started to fill this knowledge gap by generating evidence of the nutritional value of nationally-important domesticated, semi-domesticated, and wild species and varieties to support biodiversity. As part of the Biodiversity for Food and Nutrition initiative funded by the Global Environment Facility, the four countries used novel and ingenious approaches to prioritize a rich diversity of species for healthier diets and improved nutrition and food composition data is currently available for 185 prioritised species across the four countries. Proximates, mineral and vitamin composition were assayed using standard methods and reference materials and food composition data shows that, for some nutrients, wild edible species, neglected and underutilized species are nutritionally equivalent or superior to their cultivated counterparts. Ethnobotanical information was also collected from the custodian farmers that maintain these crops on farm and included in national databases or documented in recipe books. Information generated is feeding into national policy discussions around reorienting food systems towards greater diversity and sustainability and used to mainstream these plant species into production and consumption systems, including in school meals and public food procurement, dietary guidelines and gastronomy.

**Key words:** Ethnobotanical information, Food biodiversity, Food composition data

### (O3.3) Diversifying food production and diets with locally available food trees and crops

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**Introduction:** Knowing the nutritional content of foods is key for assessing and improving diet quality, and is also important for selecting nutritious species for agricultural domestication and breeding programs.

**Objective:** To address seasonal and location specific food harvest and nutrient gaps in local food systems.

**Methodology:** World Agroforestry has developed the “Food Tree and Crop Portfolio” method, that selects socio-ecologically suitable and nutritionally important food-tree species along with complementary vegetable, pulse and staple crops to diversify production and diets in smallholder farming communities. Species are identified with on-farm food production diversity, seasonal harvest calendars, months of food insecurity and dietary data. In order to address not only food harvest gaps, but also nutrient gaps in a site, species are mapped with food composition data, following international standards. Thereafter, scores for whether the species are a high source, source, or low source of selected micronutrients are calculated to simplify the nutrient content information. Moreover, food composition data are used to test associations between farm production diversity and dietary diversity by applying the nutritional function diversity metrics, which allows comparing the nutritional diversity provided by farm and per agro-ecological zone.

**Main findings:** More than 90 food tree and crop species have been identified across 13 sites in Ethiopia, Kenya and Uganda as important food sources from local food systems. Information on the actual nutrient content of the species is available in a database, which is linked to additional information on ecological suitability, geographic distribution and agronomic characteristics of the species.

**Conclusion:** The portfolios and the database are important tools to support decision-making for diversified production and consumption and research activities on food system and agroforestry for better nutrition and health.

**Key words:** Diversity, Food composition, Food trees, Micronutrients, Smallholder farming communities, Sub-Saharan Africa

## (O3.4) New initiatives on open access harmonised food composition data for developing and emerging Countries

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**Introduction:** FoodEXplorer is a unique EuroFIR tool that allows food composition data from many European countries to be searched simultaneously. In recent years, data from countries outside Europe has also been made available to both EuroFIR members and other users.

**Objective:** Between 2016-2019, EuroFIR has worked with Quadram Bioscience Institute (UK), WHO Eastern Mediterranean Regional Office (Egypt) and AFROFOODS with the aim to add new and updated datasets from African and Eastern Mediterranean countries, that are available on an open access basis.

**Methodology:** Funding from the UK Global Challenges Research Fund enabled a series of workshops and training activities that supported production of new data that better reflect foods that are currently consumed in these countries. Workshops identified the current status of food composition datasets in the region and provided training on: design of sampling and analytical protocols; analytical methods; data compilation tools and data management tools.

**Main findings:** New and updated datasets were produced and documented, according to EuroFIR thesauri, by Tunisia, Morocco, Iran, Iraq, Pakistan, Kuwait and South Africa. These datasets were checked against EuroFIR standards, errors corrected and were added to FoodEXplorer. The datasets are available to all users on an open access basis (<http://www.eurofir.org/FoodEXplorer/foodgroups.php?data=D2>). All FoodEXplorer datasets are available to individuals and students from countries that are eligible for Overseas Development Aid.

**Conclusions:** Updated and searchable datasets from Africa and Eastern Mediterranean Countries have been made freely available and will contribute to improved quality of data for use in research and public health monitoring. The collaborative projects and training workshops have led to improved cooperation between compilers from these countries and updated and new datasets can be further developed and extended within these countries.

**Key words:** Afrofoods, Eastern Mediterranean region, Food composition data, FoodEXplorer, Open access data

(O3.5) Inflammatory factor of foods: Incorporating biomarker-derived values into next generation food composition databases

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**Objective:** Classical food composition databases (FCDBs) contain mostly values of chemical components that were determined *ex vivo*. The metabolic impact of a food component, however, is not only defined by the component itself. Its interaction with other food components or the metabolic condition of the consumer also influence its metabolic effect. Today, foods and their dietary impact are often judged according to their chemical components, which were assessed by *ex-vivo* analysis. A more accurate dietary assessment would be possible if one was able to judge foods also according to their metabolic impact assessed *in vivo* (like with the retinol equivalents that consider biopotency). A first attempt to expand current FCDBs with such biomarker-derived values was the assignment of glycemic index values to foods [1]. Here we describe the assignment of an inflammatory factor (IF) to foods, based on analysis of inflammatory biomarkers, to judge the dietary risk for low-grade chronic inflammation.

**Methodology:** The IF was calculated as sum of validated inflammatory scores of the food components. Of the 36 existing food component scores [2], the following redundant five were excluded: energy, b-carotene, fat total, n-3 fatty acids, and n-6 fatty acids. For the proof of concept, the IF was attributed to the USDA National Nutrient Database for Standard Reference, Legacy (2018), considering the USDA's Expanded Flavonoid Database R1.1.

**Main findings:** The IF could be attributed to all foods of the USDA National Nutrient Database.

**Conclusion:** Expanding current FCDBs with biomarker-derived food information will increase the usability of FCDBs in such a meaningful way that one can consider them as next generation FCDBs. Knowing the IF of foods, for example, will help targeting low-grade chronic inflammation, which is now considered a common soil for many diseases.

**Key words:** Anti-inflammaging, Biomarker, Food composition database, Low-grade chronic inflammation

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2. Shivappa et al. *Public Health Nutr.* 17: 1689-96, 2014

(O4.1) Brazilian food biodiversity: centralizing food composition data for the promotion of nutrient-rich foods in Brazil

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Centralizing chemical composition data for biodiverse foods can be an important strategy to promote their consumption. The present work describes the elaboration of a dataset of foods from Brazilian biodiversity and gives examples to illustrate the differences in the nutrient content of selected foods. The dataset was elaborated using data previously compiled according to international guidelines for the Brazilian Food Composition Table (TBCA). The criteria for inclusion of foods in the dataset was based on the following indicators: (i) foods with description below species level; (ii) wild foods; and (iii) underutilized foods. The elaborated dataset contains analytical data compiled for 1,305 food entries. The dataset holds a total of 7,945 component values collected mainly on energy and proximate composition (40%), vitamins and pro-vitamins (34%), and minerals (25%), all expressed per 100 g of edible portion (EP). A wide range on the nutrient content was observed for foods identified below species level; while underutilized foods presented similar or higher content of selected nutrients comparing to traditional foods. For instance, depending on the cultivar of sweet potato (*Ipomoea batatas*), the vitamin A content ranged from negligible amount to high-content (0.33 µg to 3,637 µg RE per 100 g EP). Camu-camu (*Myrciaria dubia*), a fruit from Amazon, was identified as the richest source of vitamin C (2,300 mg of ascorbic acid per 100g EP), corresponding to 48 fold the content of orange. To increase the visibility, the dataset was incorporated into the Biodiversity and Regional Food Database of the TBCA version 6.0 ([www.fcf.usp.br/tbca](http://www.fcf.usp.br/tbca)). The dataset centralizes information which can support strategies to promote either the production of certain varieties/cultivars of commonly consumed foods or the consumption of underutilized foods. These strategies may be integrated into more effective programs and policies on nutrition and food security in Brazil.

**Key words:** Biodiversity, Cultivar, Data compilation, Food composition, Underutilized foods, Varieties



## (O4.2) Quantification of vitamin D<sub>2</sub> (ergocalciferol) content in Indian foods

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**Introduction:** We envisaged there must be contribution of vitamin D from plant foods as they are major source of the diet. But vitamin D<sub>2</sub> (Vit-D<sub>2</sub>) content have been reported only in mushrooms. Therefore, we embarked upon the task of developing, standardizing method to measure vitamin D<sub>2</sub> content in the plant foods.

**Objective:** To quantify the vitamin D<sub>2</sub> (ergocalciferol) content in commonly consumed Indian plant foods using LC-MS/MS technique.

**Materials and methods:** LC-MS/MS method was developed, standardized for different plant food matrices and duly validated. The commonly consumed plant foods were collected across the country and analysed for its ergocalciferol content.

**Main findings:** Spices namely Pippali had the highest D<sub>2</sub> content (118 µg) among all the foods analysed followed by curry leaves (117 µg) , Oyster mushroom (109 µg) and gingelly seeds (76 µg). Among the different food groups, roots and tubers had very less D<sub>2</sub> content (0.04-1.64 µg) while condiment and spices had relatively high content (1.31-118 µg). Among cereals and millets, Amaranth seeds was the richest source of Vit-D<sub>2</sub>, while it was absent in Barley, Quinoa, Rice flakes, Rice puffed, Rice and Varagu. In the grain legumes, Soya showed highest value (69.81 µg). Among the green leafy vegetables, amaranth leaves contain around 15 µg of D<sub>2</sub> content followed by drumstic (14.33 µg) and basella (9.18 µg). Pomegranate showed highest vitamin D<sub>2</sub> among the fruits analysed. D<sub>2</sub> content in nuts and oil seeds ranged from 0.55-76.51 µg with highest in gingelly seeds. About 0.40 µg of vitamin D<sub>2</sub> was found in Sugarcane juice and cane sugar.

**Conclusion:** Good amount of vitamin D<sub>2</sub> was seen in food groups such as condiments and spices, mushrooms, nuts and oilseeds, grain legumes, cereals and millets and certain fruits while it was seen in lower concentrations in green leafy vegetables, roots and tubers, fresh condiments and spices and sugars.

**Key words:** Ergocalciferol, Food Composition, Method Development, Plant Foods, Vitamin D<sub>2</sub>

### (O4.3) Effects of different cooking methods on vitamin D and true retention in selected fish

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Vitamin D was investigated in five freshwater and five marine fish species which are commonly consumed in Thailand. The fish were sampled from three wholesalers which are representative sources. They were washed with tap water several times to remove adhering blood and slime, then prepared by common household practices, i.e., eviscerating, descaling (without removing skin) and beheading, and washed again twice with deionized water. Fish from each source was divided into four groups with equal size and number. They were used as raw and applied three cooking methods: boiling, frying with palm oil, and roasting. Edible portion of raw and cooked fish were homogenized, put in screwed-cap plastic bottles and kept at -20°C until moisture and vitamin D analyses. This study aims to investigate the effect of different cooking methods on vitamin D retention. Vitamin D<sub>2</sub> and D<sub>3</sub> were determined using HPLC method (AOAC, 2016, method no. 995.05) which was well-validated. An intercollaborative study of vitamin D analysis in selected samples was conducted at the National Institute of Measurement (NIM), Australia, showed no significant different ( $p = 0.139$ ). This study showed that vitamin D<sub>3</sub> is the major component (82-100%) of the vitamin D in the studied fish. Common silver barb, Red Nile tilapia and Nile tilapia contain high level of vitamin D<sub>3</sub> (48.5±26.5, 31.0±7.7 and 19.8±0.5 mcg/100 g edible portion of fresh weight (FW), respectively) whereas lower than 10 mcg/100 g FW was found in other species. Higher vitamin D<sub>3</sub> retention were observed in boiled fish whereas lower level was found in fried and roasted fish. The true retention of vitamin D<sub>3</sub> in boiled, fried, and roasted fish of all species ranged from 66-100%, 22-97%, and 47-100%, respectively. The vitamin D database and its retention factor derived from this study could increase the quality of the current Thai FCDB and improve reliability of recipe calculation.

**Key words:** vitamin D, true retention, fish, cooking methods

## (O4.4) New data for the vitamin D content of Australian foods

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**Introduction:** Nearly one in four Australian adults are vitamin D deficient (serum 25-hydroxyvitamin D (25(OH)D) <50 nmol/L). Dietary vitamin D is an important contributor; however, usual vitamin D intakes are unknown, as Australia has limited accurate vitamin D food composition data.

**Objective:** We aimed to measure vitamin D<sub>3</sub>, 25(OH)D<sub>3</sub>, vitamin D<sub>2</sub> and 25(OH)D<sub>2</sub> in 94 selected foods sampled from retail outlets in Melbourne and/or Sydney.

**Methodology:** Foods were sampled based on their frequency of consumption in the 2011-2013 Australian Health Survey, likelihood of containing vitamin D and production location (central/regional). Of the 94 selected foods, 23 were purchased in both Melbourne and Sydney, 63 were purchased only in Melbourne, and 8 were purchased only in Sydney. For each food, 6 samples were purchased per city, totaling 702 samples. Where applicable, foods were cooked by common household methods. Vitamin D<sub>3</sub>, 25(OH)D<sub>3</sub>, vitamin D<sub>2</sub> and 25(OH)D<sub>2</sub> were quantified in duplicate by liquid chromatography-triple quadrupole mass spectrometry.

**Main findings:** Depending on food matrix, limits of detection ranged between 0.01-0.15 µg/100 g for all vitamins. Recoveries from spiked samples were 76-96% (vitamin D<sub>3</sub>), 80-94% (25(OH)D<sub>3</sub>), 92-117% (vitamin D<sub>2</sub>), and 79-96% (25(OH)D<sub>2</sub>). The highest concentrations (µg/100 g) of vitamin D<sub>3</sub> were in canned salmon (22.7) and Milo (vitamin D-fortified chocolate/malt powder) (19.5). The foods highest in 25(OH)D<sub>3</sub> included eggs (1.0) and chicken leg meat (0.4). Vitamin D<sub>2</sub> content was greatest in vitamin D-fortified foods: margarine spread (6.1) and soy/pea-based milk alternatives (1.7). Lamb liver (0.1) and beef mince (0.1) contained the most 25(OH)D<sub>2</sub>.

**Conclusion:** Another 31 foods are currently being sampled in Perth. These vitamin D composition data, applied to nationally-representative Australian Health Survey food consumption data, will allow us to estimate, for the first time, usual vitamin D intakes in the Australian population.

**Key words:** 25-hydroxyvitamin D, Australia, Food composition, Vitamin D

## (O4.5) Carotenoids content in Ibero-American and European Foods – contribution to creation of Databases

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**Introduction:** Carotenoids rich diets are frequently linked to a lower risk of developing certain diseases, whereby researchers have extensively study its levels and distribution in different food matrices, namely in fruits and vegetables. Based on the results published, food and pharmaceutical industries devoted growing budgets for carotenoids namely in matters related to human health. Food Composition Tables, in general do not contain values for carotenoids, since only  $\beta$ -carotene has established as nutrient.

**Objectives:** To gather accurate quantitative data on carotenoids in fruits and vegetables from the peer-reviewed literature, evaluating data quality, in order to create a comprehensive database valuable for studies relating consumption of food containing carotenoids to human health.

**Material and Methods:** In the scope of IBERCAROT network, carotenoids analytical data obtained by HPLC as well as data quality regarding sampling and analytical method were collected from peer-reviewed scientific literature; foods considered were produced in Ibero-American countries. Later, integrated COST Action EUROCAROTEN, the same methodology was used to gather data from food items produced in European countries and using EuroFIR guidelines to evaluate data quality.

**Results:** Carotenoids content of 660 different food items, fruits and vegetables, classified through the FoodEX2 system, produced in Ibero-American countries, corresponding to 191 species, 42 carotenoids and 2800 data points were published. Concerning the results of EUROCAROTEN the database produced is under curation before publication and a quality score will be attributed to each data.

**Conclusions:** The food carotenoids HPLC data collected from peer-review literature is/will be a valuable tool namely for studies relating these components with health, in the establishment of carotenoids recommended intakes in order to support fruits and vegetables rich diets and consumers' information.

**Key words:** Data quality, Food carotenoids databases, Fruits, HPLC, Vegetables

## (O4.6) Iodine in U.S. Food and Dietary Supplements

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**Objective:** Data on the iodine content of foods and dietary supplements are needed to develop general population intake estimates and identify major contributors to intake. However, USDA food composition databases lack iodine values, but some data are available through the U.S. Food and Drug Administration (FDA) Total Diet Study (TDS).

**Methods:** To develop a more comprehensive database on dietary iodine sources in the U.S., samples such as seafood, dairy products, eggs, baked products, salt, water and select commercial foods were assayed for iodine content using inductively coupled plasma mass spectrometry with rigorous quality control measures and SRMs. The data are being merged with FDA TDS data and mapped to foods reported consumed in the 2014 U.S. National Health and Nutrition Examination Survey (NHANES); mapping for subsequent NHANES is planned.

**Results:** Among finfish, saltwater species (haddock, cod) had considerably higher iodine values ( $151\pm 90$  mcg/100g, n=7) than fresh water fishes ( $<10$  mcg/100g, n=4). Dairy and egg products were concentrated sources of iodine; 2% milk contained  $39\pm 6$  mcg/100g (n=32), cheese contained  $62\pm 20$  mcg /100g (n=30), and iodine in eggs ranged widely (55-300 mcg/100g). Commercial cheeseburgers had highly variable iodine contents ( $<10$  to nearly 400 mcg/100g, n=6), likely due to bun dough conditioners. Commercial entrées such as lasagna and cheese ravioli contained 25 mcg/100g (n=6), due to the cheese. Iodine data for dietary supplements will be drawn from the ODS-USDA Dietary Supplement Ingredient Database and the ODS Dietary Supplement Label Database.

**Conclusion:** This information will be a valuable resource in generating updated U.S. iodine intake estimates and in clarifying the primary contributors to total iodine intake. An important potential application will be the development of dietary guidance, especially for those at risk for deficiency (i.e., women of reproductive age and young children).

**Key words:** Composition database, FDA, Food Data Central (FDC), Iodine, Total Diet Study (TDS), USDA

(O5.1) The necessity of nutrient data on processed meat in African diets

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Dietary protein is important in the diet of children and adolescents for growth and development and in the adult diet to help the body repair and regenerate cells particularly so in the elderly. Economic constraints and cultural preferences contribute to differences in food choices observed among socioeconomic groups in developing countries. Ready-to-eat processed meat products forms a significant part of the diet of Africans particularly true for vulnerable groups. It can be attributed to their low cost, versatility, extended shelf-life and availability on the market. Value-added processed meat consumption has increased significantly since 1994.

To evaluate the nutrient composition of processed meats compared to the nutrient content reported in food composition tables.

Current data on the nutrient composition of processed meat in food composition tables in Africa were reviewed. Additionally, seven commonly consumed processed meat products were analysed for nutrient content and compared to label values and values as stated in food composition tables (FCT).

Of all the food items found in the FCT for South Africa, West Africa and Nigeria only thirteen, two and one processed meat items are listed in the respective tables. All the data is borrowed from the American FCT. None of the data for processed meat products is of African origin, although these products differ substantially from those from American origin, e.g. the polony value is derived from bologna. There are significant differences in the nutritional value of different processed meats; protein values ranged from 8.6g–17.8g/100g, from 0.34g–2.81g/100g for iron and from 0.54g–1.62g/100g for zinc respectively.

Processed meat is not a homogeneous food group and the composition of these products varies widely. It is important to study dietary quality for distinct meat categories and to inform the development of specific appropriate food-based dietary guidelines at country and regional level.

**Key words:** Food composition, Nutrient data, Processed meat

## (O5.2) Implementation of the GS1 data in the Belgian food composition database.

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**Introduction:** Nubel (Nutrients of Belgium) is a non-profit organization that manages nutrition related information in Belgium. Nubel consists of both private and governmental partners. Nubel has numerous additional members working in the area of nutrition and health and which are using the Nubel products as basic information for several target groups.

**Objective:** To update and improve the quality and the management of its scientific food composition database of nutrients, Nubel implemented the GS1 data in its national food composition database. The GS1 database brings together organizations such as supermarkets, drugstores and construction markets. It offers global standards for identification, as well as data capture and sharing to ensure that consumers can make informed choices both online and offline.

**Methodology:** The implementation of GS1 in the Belgian food composition database facilitate the updating of the data. Indeed, if there is a lack of data or an outdated one in our database, the product properties and composition can be found in the GS1 database. To make it easier to find a product and to limit errors, the products in the Belgian food composition database and the ones in the GS1 database are linked and searched using the EAN code (barcode). The updating of the data from the GS1 database into the Belgian food composition database is manually done and the main goal is to keep the most recent data.

**Findings:** Despite some challenges there are various benefits working with the GS1 database. The updating of the data is easier and faster, a lot of companies are available and putting their data into GS1 and the product information is vast and recent (ingredients, composition...).

**Conclusion:** With the implementation of GS1 in the Belgian food composition database, it is easier and faster to update data but the lack of information and the errors that may occur in the GS1 database implies that importing data still must be done manually and not automatically.

**Key words:** Belgium, Data, GS1, Nubel, Nutrition

### (O5.3) Nutrient composition of fish species sampled off the coast of Ghana

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**Introduction:** Fish plays a central role in food and nutrition security as it contributes with several essential nutrients that are vital for human growth and health. Nutrient composition of fish may vary within and between species, depending on tissue, habitat, region and season. Thus, high quality and available food composition data should be published on a country-specific basis. **Objective:** The aim of this study was to evaluate the nutrient content of selected fish species sampled on the research vessel (R/V) Dr. Fridtjof Nansen, off the coast of Ghana, between August to September 2017.

**Methodology:** Fish samples were analyzed for macro- and micronutrients (protein, total fat, fatty acids, vitamin D3, vitamin A, vitamin B12, iodine, selenium, zinc, iron, and calcium), using accredited methods at the Institute of Marine Research, Norway. The samples of small fish species: dwarf dory (*Zeion hololepis*), small driftfishes (*Cubiceps* spp), Cunene horse mackerel (*Trachurus trecae*), anchovy (*Engraulis encrasicolus*), Brazilian lizardfish (*Saurida brasiliensis*), bigeye grunt (*Brachydeuterus auritus*), red pandora (*Pagellus bellottii*), round sardinella (*Sardinella aurita*) and Atlantic chub mackerel (*Scomber colias*) were analyzed as composite samples (n=6) of whole fish or fillet, each consisting of 25 fish. Large fish species: African moonfish (*Selene dorsalis*, n=16) and African forktail snapper (*Apsilus fuscus*, n=25) were analyzed individually as fillet.

**Main findings:** This study confirms that fish species caught off the coast of Ghana are good sources of several key nutrients. Variations in nutrient content were observed both within and between species, and between samples of whole fish and fillet. Whole small fish had the highest contents of n-3 PUFAs, vitamin A, vitamin B12, iron, zinc, iodine and calcium.

**Conclusion:** These data contribute to current food composition databases in Ghana and give valuable insight into fish as a valuable source of essential micronutrients.

**Key words:** Fish, Food and nutrition security, Food composition data, Micronutrients, Nutrients, Seafood



## (O5.4) Nutrient composition in seafood products available for Norwegian consumers

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**Introduction:** Seafood products are an increasingly popular consumer choice in many European countries, including Norway. Thus, knowledge of nutrient content in seafood products are of great importance in order to estimate dietary intake and develop dietary guidelines.

**Objective:** The aim of the study was to describe the content of selected nutrients in commercially available and market representative seafood products in Norway.

**Methodology:** Seafood products purchased during 2015 (n=16), 2017 (n=35) and 2018 (n=35) were analyzed as composite samples for macro- and micronutrients (protein, total fat, fatty acids, vitamin D3, vitamin A, vitamin B12, iodine, selenium, zinc, iron, and sodium) using accredited methods at the Institute of Marine Research in Norway. The products include a selection of brands within the following main categories: fish cakes/ burgers; fish au gratian; fish fingers; saithe products; fish pudding; spread with salmon/trout; mackerel in tomato sauce and caviar.

**Main findings:** The amount of fish, and type of species, used in the seafood products varied between brands and products. The lean fish products in general combined several types of fish species while the fatty fish products generally consisted of one type of species (e.g. salmon, trout, mackerel). This study confirms that seafood products are good sources of several key nutrients such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), vitamin D3, vitamin B12, iodine and selenium. Variations in nutrients concentrations were seen both within and between the same product category from different years. The fatty fish products, such as spread with salmon, trout or mackerel had the highest content of EPA, DHA and vitamin D3, while the lean fish products were in general higher in iodine and calcium.

**Conclusion:** These data contribute to current food composition databases in Norway, and gives valuable insight into seafood products as a source of essential micronutrients.

**Key words:** Food composition data, Micronutrients, Nutrients, Seafood, Seafood products

## (O5.5) Production of a nutritional composition dataset for seafood consumed in Europe

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**Introduction:** The EU-funded SEAFOODTOMORROW project aims to validate and optimize commercial solutions for improving the socioeconomic and environmental sustainability of seafood production and processing. Effective communication, dissemination and knowledge transfer of results, including data on seafood composition, to enable exploitation of project outputs, are a key aim.

**Objective:** To support consumers in making informed decisions about seafood consumption, a communication tool is being further developed, enabling users to understand the nutritional benefits of regular seafood consumption and weigh these against potential risks related to contamination with, for example, heavy metals. The tool is building on the existing FishChoice ([www.fishchoice.eu](http://www.fishchoice.eu)) web-application, with significant modifications to improve functionality.

**Methodology:** EuroFIR is responsible for improving and extending the nutrient database underpinning FishChoice. Drawn from EuroFIR's FoodEXplorer, a dataset for 49 nutrients for 80 priority fish and seafood species (raw, cooked and processed) has been compiled, based on consumption patterns by country.

**Main findings:** The SEAFOODTOMORROW dataset includes average values for nutrients to ensure FishChoice is relevant for public health and consumer choice. Values represent fish and seafood, as consumed in Europe, and nutrient data and related information (e.g. species identification) were checked against scientific names and English translations. Product information was compiled to match EFSA FoodEX2 classifications for seafood.

**Conclusions:** Our approach will ensure the sustainability, compatibility and comparability of the SEAFOODTOMORROW nutrient dataset, facilitating access to and comparison of values across products, countries and regions. New and updated seafood data will help consumers choose a wider range of seafood in their diets and also support researchers and policy officers to monitor nutrient intake from seafood.

**Key words:** EuroFIR, Fish composition, FishChoice, Food composition database, Seafood composition, SEAFOODTOMORROW

## (O5.6) Retention and yield of beef and lamb retail cuts

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The nutritional analysis of cooked foods is costly and time consuming and cannot be performed in many instances. Calculation of the nutrient composition of the cooked dishes are still the method of choice by researchers studying food intake of population groups. Recipe calculations also contribute to a significant proportion of the nutrient information of combined dishes in food composition tables.

In this study the retention and yield factors for six beef and six lamb retail cuts were determined. Beef and lamb cuts were cooked to an internal temperature of 70°C (medium) using a dry heat cooking method. Each meat sample were dissected into edible and inedible fractions and weighed. The nutrient content of the edible fractions was determined.

The data showed the importance of reporting on what specific species' meat and cut is eaten. For example, "one piece of beef" can mean anything from a short rib with an average of 96g edible portion or a prime rib with a 223g edible portion. Furthermore, a "lamb chop" can be a "chump chop" or a "rib chop" with meat fractions ranging from 24.2g to 58.2g per cut and subcutaneous fat ranging from 10.2g to 26g.

Protein is retained in high percentages in meat after cooking. Retention factors for protein in beef ranged from 88% for short ribs to 103% in shin bones and in lamb from 96% in chump chops to 139% in riblets. The retention for fat in beef ranged from 50% for blade steak to 159% for short ribs and in lamb from 51% in riblets to 100% in neck chops. The mineral content is largely affected by the cooking process, ie. leaching into the water or from the bones into the meat.

It is evident that generalisation and lack of product specific consumption information can lead to possible over- or underestimation of nutrients consumed. The differences in retention and yield factors reported by other researchers and the factors found in this study prove the importance of determining country specific retention and yield factors.

**Key words:** Beef, Lamb, Retention Factors, Yield Factors

(O6.1) Challenges in completeness and accuracy of food branded data in the Netherlands

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Introduction: Food label data, from several data providers, including GS1 and main Dutch supermarket chains, is collected in the national branded food database using electronic data exchange facilities. Current and future applications are e.g. monitoring food reformulation, collecting food consumption data by barcode scanning and feeding apps to help consumers make healthy choices. Moreover branded data is used to complement nutritional values of generic foods in the Dutch food composition database (NEVO).

Objective: To investigate quality and usability of branded food label data. To evaluate if requirements for use in the food research and public health education area are met.

Methodology: Branded food label data are checked for completeness, consistency and correctness using automated procedures. Macronutrient content is checked using consistency checks, e.g. sum of macronutrients may not exceed 100 g. Micronutrient values are checked against ranges per food group derived from the NEVO database.

Main findings: Food identification frequently raises problems due to inconsistent documentation of names and additional information. Food label data generally only contains information for mandatory nutrients according to EU regulations, while data on micronutrient composition is often lacking. Label data does not unambiguously indicate if and how foods are fortified. Procedures to check label data and to identify fortified foods as well as findings concerning the amount and the nature of errors will be presented.

Conclusion The branded food database is a valuable resource of nutritional data for uses in food research and public health education; however current quality and completeness can be improved. Outliers and erroneous nutritional values do occur and need to be excluded. Micronutrient data needs to be complemented. Data providers need to be convinced of their crucial role in the improvement of the completeness and consistency of the data.

**Key words:** Barcode, Branded foods, Food composition database, Food data quality

## (O6.2) New food composition data on raw foods in the Czech Food Composition Database NutriDatabaze.cz

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**Objective:** In the Czech Republic, the NutriDatabaze.cz has been developed with the support of the Czech Ministry of Agriculture with the aim to provide reliable food composition data (FCD) applicable also in the field of nutrition declarations.

The objective of this study was to update the NutriDatabaze.cz with data obtained by chemical analysis of raw food materials used in the food industry for a set of nutrients (fat, fatty acids fractions, saccharides, sugars, fibre, proteins, salt, water, ash, energy) necessary for generation of mandatory nutrition declaration according Regulation EU 1169/2011 on provision of food information to consumers.

**Methodology:** Selection of raw foods was based on raw foods and ingredient profiles of foods available on the Czech market. Foods were sampled from three sources and analysed by accredited laboratories using standardized methods for each nutrient. Data were documented by the EuroFIR ([www.eurofir.org](http://www.eurofir.org)) harmonized procedure comprising full value documentation, traceability of data sources and indexing of foods by the LanguaLTM Thesaurus.

**Main Findings:** In the period 2012-2018, analytical data were obtained for 697 raw foods of the following groups: poultry, pork, beef, horse meat, game (e.g. mouflon, deer), fish (fresh water, sea), semi-products of milk processing, fruits and vegetables (raw, dried, lyophilized), cereals, seeds, oils, legumes and non-traditional foods (e.g. physalis berries). Documented data and photos of analysed foods (edible, inedible portions) have been continuously disseminated on NutriDatabaze.cz.

**Conclusion:** The Czech Food Composition Database NutriDatabaze.cz has been updated with analytical data of raw foods. Food businesses can use data for calculation of food composition values for mandatory nutrition declaration. The producers are advised to use the EuroFIR Guideline on calculation of nutrient content of foods as a procedure accepted by the Czech authorities for nutrition declaration.

**Key words:** Chemical analysis, Czech Food Composition Database, EuroFIR, Harmonised data documentation, New food composition data

(O6.3) Providing information on the chemical composition of the compound dishes consumed by the Brazilian population

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The number of preparations consumed by the population is infinite, which makes it impossible to obtain analytical data for all that the population consumes. It is also not always possible or necessary to break down each compound dish into its ingredients to calculate the population's nutrient intake. Therefore, it is important to calculate the chemical composition of composite dishes consumed by the population and make them available in the food composition tables. To compose the Brazilian Food Composition Table\_Nutrient Intake Evaluation Database (TBCA NIE-DB), the most cited recipes in food surveys were calculated. A standard recipe commonly used by the population was selected for each compound dish. Preferably, analytical data of ingredients prepared in Brazil (eg, cooked vegetables, grilled or roasted meats) were used proportionally to estimate 100 g of the final preparation - direct estimate. In the absence of these data, the appropriate yield factor (YF) and nutrient retention factor (NRF) was used, according to the preparation of each raw ingredient - indirect estimate. About 2,200 recipes were calculated. For direct estimation, the proportion of ingredients cooked in the recipe was estimated as this example: 100 g of Rice with broccoli - white rice cooked (70 g), cooked broccoli (24.5 g), onion and garlic sauteed with oil (5 g), salt (0.5 g). In indirect estimation, YF was used to obtain 100 g of the final preparation. For example: 100 g of Cake, wheat, homemade - wheat flour (32 g), sugar (30 g), eggs (27 g), milk (22 g), butter (20 g) and yeast; YF = 0.76. Then, NRF for wheat flour, eggs and milk were applied. Numerous foods are consumed in the form of compound dishes, and many nutritionists do not use the appropriate YF and NRF, both in the calculation of the recipe sheet and in the prescription of diets. To overcome this deficiency, the NIE-DB TBCA presents appropriately calculated data on more than 2,200 recipes consumed in Brazil.

**Key words:** Brazilian recipes, Food composition data, Nutrient intake evaluation database, Recipes calculation, TBCA

## (O6.4) Added and free sugars: new dataset for latest New Zealand Food Composition Database products

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Added or free sugar intake and their impacts on health are debated by researchers and policy makers. Evidence-based data are needed to inform policies (e.g. food reformulation), food labelling and for consumer guidance. No analytical methods exist to measure added or free sugars.

To estimate the added and free sugar content for foods in the New Zealand Food Composition Database (NZFCD) using Louie systematic calculation method developed for Australian Food Composition Database.

‘Added sugar’ is defined as all sugars added during food preparation and does not include intrinsic sugars (e.g. fruits and dairy). ‘Free sugars’ includes intrinsic sugars that are non-intact in foods and released during processes such as juicing. Added and free sugar contents were estimated from total sugar and individual sugar (mono- and disaccharides) values derived by chemical analyses. Added and free sugars were estimated as zero where natural sugars were intact (e.g. lactose in milk). Foods derived from recipes with multiple ingredients, added and free sugars values were estimated from the proportions of ingredients containing added and/or free sugars.

Of the 2767 foods in FOODfiles™ 2018: 1) 1879 (68%) were assigned as containing no added or free sugars, i.e. all sugars were intrinsic (e.g. fresh fruits) or absent (e.g. oils); 2) 706 foods contained equal amounts of added and free sugars; 3) in 84 foods including fruit juices, free sugar content was higher than added sugar content; 4) in 98 foods, all intrinsic sugars were free sugars, as they were non-intact in food because of processing.

Very few international food composition databases include the information on added and free sugars. For the first time, the NZFCD includes data for added and free sugars, based on a systematic method. These new datasets may assist development and implementation of science-based guidance on added and free sugars.

**Key words:** Added sugar, Food Composition Database, FOODfiles™ 2018, Free sugar, New Zealand

## (O6.5) A Multi-Country Collaboration Leads to the Development and Establishment of a Country Specific Food Composition Database for Malawi.

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**Introduction:** A country specific food composition database (FCDB) lends the opportunity for country specific nutrition practice, research and training. In the absence thereof, a multi-national collaboration was formed to establish a very first Food Composition Database for Malawi.

**Objective:** To develop and establish a Country Specific FCDB and Tables for Malawi.

**Methodology:** A multi-phased approach was employed as a development strategy, while a project framework guided the process. Phase1 comprised assessing the nutrition landscape focusing on health, nutrition, and food composition. Phase2 involved capacity building and collecting scientific FCD. Guided by a priority food list, collected data were extracted, evaluated, compiled and quality checked using standard methodology in Phase3. Phase4 comprised activities enhancing sustainability and preparing the FC Table.

**Main findings:** Phase1 led to a repository of relevant information on health, nutrition, agriculture, food composition, policy, food and donor sectors, informing a scoping exercise and report. Scoping included meetings with key stakeholders, with subsequent findings informing a detailed project work plan. Phase2 involved assessment of > 80 sourced scientific articles and dissertations using a data quality assessment tool. Phase3 comprised the compilation of 316 food items in 8 food groups. Malawian data comprised 63%; 125 food items emanated from analytical data, 73 from recipes, while 37% of items were borrowed. Phase4 involved stakeholder meetings to identify a custodian institution for the activity. The project culminated in the Malawian FC Tables and enabled sustainability through multi sectorial engagements and partnerships.

**Conclusion:** A multi-phase, multi-national collaboration led to the development of the first Malawian FCDB and Food Composition Table for Malawi. It moreover enabled multi-sectorial participation and engagement, leading to sustainable food composition activities in Malawi.

**Key words:** Collaboration, Database, Develop, Participation, Scoping, Stakeholder



(O7.1) Compliance of maize flour from commercial mills to fortification legislation levels for micronutrients in Kenya

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**Introduction:** Fortification of staple foods is a cost-effective strategy that has been used to reduce the prevalence of micronutrient deficiency in the population. National mandatory maize flour fortification legislation was introduced in Kenya in 2012 to help address micronutrient deficiencies among the vulnerable groups of the population.

**Objective:** This study aimed to determine the compliance of maize flour from commercial mills to the fortification legislation for vitamin B2, B3, Folate, vitamin A, zinc, and iron content.

**Methodology:** Maize flour brands from 27 commercial maize mills that had implemented flour fortification were sampled at retail points. Zinc and iron in the flour samples were determined using atomic absorption spectrophotometry while the vitamins (riboflavin, niacin, folate and B-carotene (Provitamin A)) were determined by HPLC. Overall, the level of compliance was low with only 11% of the samples complying with legislation levels in all the micronutrients while 18% of the samples did not comply in any micronutrient. The compliance levels for iron and zinc (minerals) were 77.8% and 59.3% respectively. For the vitamins, generally the compliance level for vitamins was low with retinol, riboflavin, niacin and folate complying at 24.3%, 30.0%, 33.3%, and 30% respectively

**Conclusion:** Generally, the compliance level with the national standards for commercial maize flour brands for specific micronutrients was low. This could partly be attributed to the instability of vitamins during storage. A concerted effort is needed to look for mechanisms of increasing compliance to fortification standards.

**Key words:** Compliance, Fortification, Maize flour, Micronutrient

## (O7.2) Determination of Vitamin K2 in foods by High-performance Liquid chromatography with Fluorescence Detection

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**Objects:** As a cofactor of carboxylase, vitamin K2 takes an important role on improvements of insulin sensitivity, inhibition of vascular calcification, regulation of bone metabolism, etc.. So, it is necessary to get vitamin K2 data in foods, and evaluated the relationship between vitamin K2 intake or physiological requirement and health.

**Methods:** Based on food consumption level, total 127 samples, including 37 livestock meat, 16 poultries, 7 eggs, 11 milk and products, 25 aquatic animals, 14 fungi and algae, and 14 fermented products were collected in Beijing markets. Each sample was a pretreated mixture of >3 batches. Samples were analyzed by a modified method. Briefly, extractions after hydrolyzed by lipase and protease were purified through aluminum oxide pre-column, then separated by HPLC Atlantis T3 column for vitamin K1, MK-4, MK-7 and MK-9. The fluorescence of effluent, derived by post zinc column, was detected at the max ex & em wavelength.

**Results:** The optimal condition of VKs determination was identified based on orthogonal experimental design. The linear range of vitamin K1, MK-4 and MK-7 were (0.01~0.4) µg/mL, and MK-9 (0.02~0.4) µg/mL. The LOD for each were 5 ng, 3 ng, 11ng, 30 ng per 100g respectively, and the spiked recoveries were 95%, 105%, 90% and 85% respectively.

Vitamin K1 were seldomly found, except in beef and poultry. MK-4 was abundant in most animal and some fermented soybean products, MK-7 was only high in natto, and the peak of Mk-9 was very low. By compiling datum of VK2 content into different food classification, it was found the distribution variety was very large(µg/100g): meat (Tr~ 40.1), poultry (19.5~202), eggs (Tr~5.88), milk and milk products(6.3 ~53.8), fish, shellfish and mollusk(Tr~79.0), fungi and algae(Tr~16.8) and fermented food (Tr~775). When multiply food content with food consumption data, the average intake of VK2 was somehow about 25 µg/d.

**Conclusion:** The method is suitable for determination of VKs or MKs in foods.

**Key words:** Vitamin K2, Food content, HPLC- fluorescence method

(O7.3) Six folate vitamers in food – an inter-comparison study on a method using a pure deconjugase of plant origin and quantification by LC-MS/MS

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For folates in foods, the non-specific, microbiological assay is currently the standard method. Comparative studies have shown a huge variation between laboratories using the microbiological method, and uncertainty about which combination of protease, amylase and deconjugase is optimal has not been solved. In the Nordic Committee for Standardization (NMKL) an inter-comparison study is carried out to standardize a specific, chemical method.

Methodology: The method under test is a recent single-laboratory validated method that combines the use of a pure plant deconjugase and LC-MS/MS in a rapid and sensitive assay to quantify the content of six major naturally occurring folates - 5-methyltetrahydrofolate, tetrahydrofolate, and the combined amount of 5,10-methenyltetrahydrofolate, 10-formylfolic acid, and 5-formyltetrahydrofolate, folic acid - in foods[1]. The method was previously compared in a round robin study to a microbiological assay and another LC-MS/MS method using animal deconjugase resulting in a constant bias of -17% and 25%, respectively[2].

The number of laboratories included in the inter-comparison study is eight. Each laboratory receives seven test materials, the required six folate vitamers and the four <sup>13</sup>C-labelled folate vitamers used as internal standard. In addition, the laboratory receives the required amount of the pure deconjugase of plant origin. The food products selected for the study are representatives for fruits, vegetables, legumes, dairy products, offal, fish and infant formula. Each laboratory receives three bags of each sample to be analysed on three different days.

For the evaluation all results will be checked for compliance and subjected to statistical analysis according to international standard recommendations for an inter-comparison study.

Main findings and conclusion: The laboratories must return the results by 22 July at the latest. Thus, the results, statistical evaluation and the conclusion will be presented at the conference

**Key words:** Deconjugase of plant origin, Folates, Foods, Inter-comparison study, LC-MS/MS

[1]Ložnjak P, García-Salinas C, Díaz de la Garza RI, Bysted A, Jakobsen J (2019): Journal of Chromatography A. 1594, 34-44.

[2]Ložnjak P, Striegel, L, Díaz de la Garza RI, Rychlik, M, Jakobsen, J (2019): Quantification of folate in food using deconjugase of plant origin combined with LC-MS/MS: A method comparison of a large and diverse sample set. Food Chemistry (Under review)

## (O7.4) Iron levels in the fortified rice sold in Papua New Guinea

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**Introduction:** In Papua New Guinea, the 2005 National Nutrition Survey reported that the prevalence of anemia in children is high and among women and men is moderate. For this reason, the mandatory rice fortification program has been implemented since 2007. This mandates the addition of 30 mg iron, 60 mg niacin and 5 mg thiamin per kg rice.

**Objective:** The study aimed to determine the iron levels in enriched white rice samples that are commercially available in PNG and their corresponding cooked samples.

**Methodology:** Selected rice samples (n=8) were purchased from supermarkets in Lae, PNG based on the most stocked-up rice on supermarket shelves. Rice samples were cooked using the absorption method (1:2 rice water ratio). Raw and cooked samples were subjected to open nitric acid digestion prior to ICP-OES analysis. The moisture content of samples was determined to calculate the retention of iron in cooked rice.

**Main findings:** Four out of 8 raw white rice samples met the mandatory requirement of 30 mg/kg iron, though above the required level. The iron levels in 4 remaining samples were <20 mg/kg. The range of iron in cooked rice samples was between 1.2-16.4 mg/kg. Most cooked rice samples retained 10% iron, thus the loss that occurred during cooking was 90%. One sample showed 35% loss (22.2 reduced to 14.3 mg/kg dry weight basis), while another sample (19 mg/kg dry weight basis) retained iron 100%.

**Conclusion:** The results suggest a wide variation iron levels between samples likely due to different methods used to fortify rice (spraying or dusting and mixing of iron onto rice). A formal monitoring and compliance should be introduced as part of the fortification program in PNG to improve the iron status of the population. The varying losses of iron in cooked rice could possibly be caused by the chemical stability of the type of iron fortificants added to rice.

**Key words:** Fortification, Iron, Papua New Guinea, Retention, Rice

(O7.5) Development and application of a primary method for speciation analysis of chromium in foodstuffs by HPLC coupled to ICP-MS using SSID

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Chromium speciation analysis at trace and ultra-trace levels in foodstuff has received great attention in the last years. Chromium is a peculiar element whose different species show opposite behaviour. Whereas Cr(VI) has been recognized for several decades as being carcinogen, Cr(III) was long time considered as having beneficial health effects. Nevertheless, the European Food Safety Authority (EFSA) stated relatively recently (2014) that there is no convincing evidence of beneficial effects of Cr(III) for healthy people. Therefore the interest in chromium speciation shifted relatively recently from focusing solely on Cr(VI) to the determination of both its species (Cr(III) and Cr(VI)). Chromium speciation analysis in food is very challenging mainly because of the high instability of Cr(III) and Cr(VI) species depending on the temperature and pH. In addition, in food samples both chromium species are present at ultra-trace levels hence requiring the use of both sensitive and highly selective analytical tools. Online coupling of HPLC with ICP-MS by using species specific isotope dilution (SSID) has become in the last years the state-of-the art method for accurate chromium speciation analysis. This work aims at the development of an accurate method for simultaneous speciation analysis of chromium (Cr(III) and Cr(VI)) in foodstuff by SSID in combination with HPLC-ICP-MS with purpose, simultaneous complexation of Cr(III) with EDTA and of Cr(VI) with DPC was performed. Species separation was carried out by using a Dionex ION PAC AG7 HPLC column and a mobile phase composed by 10mM HNO<sub>3</sub> + 2.5% Methanol + 32 mM EDTA. The method was validated by means of the accuracy profile approach using several food matrices. The method was applied for the study related to the impact of the cooking on the fate of Cr(III) and Cr(VI) species. For this purpose, milk, meat and bread were cooked using various approaches and both chromium species were quantified by the newly developed method.

**Key words:** Chromium speciation, Cooking process, Food, HPLC-ICP-MS, Species specific isotope dilution

## (O7.6) Quantifying animal protein food intake in a developing country: The case of meat in South Africa

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The consumption of animal protein foods has been subjected to increasing scrutiny due to sustainability concerns, as well as the association between excessive animal source food intake and the prevalence of obesity. Quantifying animal protein foods intake quantities is critical from nutritional and sustainability perspectives.

**Objectives:** To estimate the intake quantities of dominant animal protein foods (chicken, beef, pork, sheep meat) in South Africa (SA), and evaluate the results against the South African Food-based Dietary Guidelines (SAFBDG's).

**Methodology:** No recent nationally representative food consumption survey data exist for SA. The estimation of lean meat intake departed from national aggregate (post-abattoir carcass mass) figures on commodity quantities allocated to human consumption, reworked by applying carcass composition data for SA and cooking yield factors. Socio-economically disaggregated lean meat intake was estimated from official nationally representative household-level food expenditure data.

**Main findings:** From 2007 to 2017 the average daily per capita cooked lean meat intake was  $\pm 82$  grams, being below the SAFBDG (90g). The meat intake of at least 60% of the country population falls below the SAFBDG – limiting the intake of iron and zinc for these lower-income individuals. Meat intake is dominated by chicken ( $\pm 57\%$ ), followed by beef and pork – representing a very different intake pattern than other parts of the world such as pork-dominated Europe and Asia. The major impact of affordability on meat choices will be discussed.

**Conclusion:** In contrast to some developed nations, the below-recommended intake of meat in SA raises some controversy in terms of the contribution of animal protein foods to overweight / obesity - emphasising the importance of accurate country-specific food intake and compositional data. The importance of accurate conversion factors (i.e. accounting for skin, fat, bone, and cooking losses) should also be recognised.

**Key words:** Consumption, Developing country, Intake quantity, Meat, South Africa

## (O7.7) Comparative study of sodium content in common foods consumed in Argentina and Costa Rica

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<sup>3</sup>Project IDRC. N°108167.

High sodium intake is a risk factor and is related to cardiovascular diseases. PAHO proposed to reduce sodium intake to less <2 grams sodium/day in Latin America by 2020. Costa Rica and Argentina adhered to the proposal. The strategy proposes monitoring compliance with the goals established. In prepared foods, seasoned during cooking, the sodium content depends exclusively on the processor and can only be determined analytically.

Determine analytically and compare the sodium content in three types of foods consumed in Argentina and Costa Rica, to help reinforce public policies in salt reduction.

Pizzas, hamburgers and meat patties were selected for the study. Samples were purchased from street vendors and fast food stores in both countries, during July/December 2018, according to a specific sampling plan for each food. Moisture and sodium were determined by methods AOAC (2010). The analytical quality of laboratories was standardized through a Proficiency tests (PRIIDA N°86, canned meat product, 2018).

The average sodium content for Costa Rican foods were: pizzas 520±153, hamburgers 743±43 and meat patties 248±61 mg Na/100g and for Argentina: pizzas 726±162, hamburgers 816±119 and meat patties 314±44 mg Na/100g. In general, higher sodium content is observed in Argentina than in Costa Rica, which is probably due to the habits in the use of salt during the food preparation. Even so, the values are high if takes into account the high consumption of these foods.

The study contributes to the knowledge of sodium content in street and fast foods consumed in Argentina and Costa Rica and shows they also can be an important source of sodium in the diet of both populations. The results suggest the need to establish adjustments in public policies to achieve the goals set in the reduction of sodium intake. It is necessary for to establish new regulations and conduct follow-up actions regarding the sodium content of products sold on the street and fast food establishments.

**Key words:** Fast food, Intake, Regulations, Sodium content, Street food

(O8.1) Handling missing values in food composition tables: the example of the nutrient dataset for the French national food consumption survey

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**Objective:** Assessing the nutrient intake of a population implies to combine data on food consumption and food composition. To avoid underestimation of nutrient intakes, it's necessary to handle missing values in the food composition dataset. In France, the Anses-Ciquel food composition table was updated in 2016. Derived from it, a comprehensive nutrient dataset was needed for the third individual and national survey on food consumption.

**Methodology:** The process of estimating missing values was split into three phases following a descending approach: at first proximates were filled in, then non-proximates macronutrients and finally vitamins and minerals. For proximates, existing data were examined to assume zero values within a food group. Then, if possible, values were calculated from other compounds in the same food, otherwise they were borrowed from a similar food. Identification of similar food was automated by estimating nutrient content similarity. Automatic food matchings, based on nutrient content similarity, were scrutinized by compilers. For non proximates, vitamins and minerals, zero values were assumed using FAO/INFOODS guidelines. Remaining missing values were estimated by the median of the food group, after exclusion of enriched foods. The whole algorithm was coded using SAS®.

**Main findings:** The 2016 French food composition Anses-Ciquel table included 2642 foods and 61 components, with 30% missing values (but only 2.3% for proximates). The above semi-automatic process allowed to fill 97% of the missing values: 73% with the median of the food group, 12% from other compounds in the same food, 11% with a zero value and 0.5% from a similar food. Similar food allowed to fill 26% of missing values for proximates. Remaining missing values were imputed with zero.

**Conclusion:** An algorithm was generated to produce a comprehensive nutrient dataset from the Anses-Ciquel composition table. It turned out to be a systematic, documented, reproducible and powerful solution.

**Key words:** Assumed zero, Imputation, Missing values, Similar food



## (O8.2) FoodEx2 as a tool to facilitate the harmonization of food consumption and food composition data

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**Introduction:** FoodEx2 is a food classification and description system developed and maintained by the European Food Safety Authority (EFSA). It is currently used at global level with the support of the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO) to harmonize datasets in the FAO/WHO Global Individual Food consumption data Tool – FAO/WHO GIFT ([www.fao.org/gift-individual-food-consumption](http://www.fao.org/gift-individual-food-consumption)). This is an open access online platform hosted by FAO and supported by WHO, for collation and dissemination of individual quantitative food consumption data, especially from low- and middle-income countries.

**Objective:** To demonstrate FoodEx2's usefulness in global harmonization of food description in food consumption datasets and food composition tables (FCT), and its potential in facilitating food matching and nutrient intake assessments.

**Methodology:** Information was gathered from data owners of food consumption datasets or FCT who were trained to use FoodEx2, and on the number of food consumption datasets and FCT that have initiated or completed their data harmonization process, as a result of the FAO/WHO/EFSA collaboration.

**Main Findings:** Over 50 data owners of food consumption data and/or FCT have been trained in data re-categorization with FoodEx2. As a result, 2 FCT and 24 food consumption datasets (4 nationwide) from 17 countries were or are being coded with FoodEx2, and out of those, 12 datasets are or will soon be disseminated through FAO/WHO GIFT in the form of infographics and microdata.

**Conclusion:** Increased harmonization of food composition data with FoodEx2 would enhance the consistency and reliability of nutrient intake assessments. FAO/WHO GIFT advocates and actively supports the harmonization of individual quantitative food consumption data and FCT worldwide.

**Key words:** Data harmonization, Data sharing, Dietary assessment, Food classification, Food composition, Individual food consumption

### (O8.3) Ontologies for food description from farm to fork: A case study with FoodOn and the OBO Foundry vocabularies

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**Objective:** Ontologies - well defined, hierarchical vocabularies connected with logical relationships that are both human and machine readable - increasingly cover food production and consumption life-cycle data description domains. Ontologies facilitate standardized data exchange, thus enabling timely data collection in genomic epidemiology investigations of foodborne infectious disease outbreaks, enabling standards for biosample repository metadata, and improving agricultural sustainability and nutritional analysis data models that extend along food supply chains.

**Methodology:** The recently created FoodOn ontology (<https://foodon.org>), derived mainly from LanguaL, a mature and popular food indexing thesaurus, provides standard vocabulary to describe animal and plant food sources, food categories and products, and other facets. Joined with other OBOFoundry.org family of open source ontologies that cover biomedical and agricultural research studies, natural and built environments, taxonomy, anatomy, and chemistry, a vocabulary landscape is being assembled for solving data interoperability and analysis problems.

**Main Findings:** Partners such as Canada's open source Integrated Rapid Infectious Disease Analysis bioinformatics platform (IRIDA), the USDA Agricultural Research Service, and an International Standards Organization working group see that ontologies provide greater system interoperability, quality control, and software-driven intelligence. Ontologies are integrated into a food biosample metadata description standard, are being introduced into IRIDA's standardized infections outbreak case data sharing, and into the USDA Food Data Central website. Hsiao Lab also provides software for reusing ontology-driven data standards, and for matching food descriptions to ontology categories.

**Conclusion:** Ontologies provide a natural platform for tackling data harmonization problems that span food security, safety, production, distribution, and consumer health domains.

**Key words:** Crop research, Database design, Food description, Food products, Nutrition, Ontology,

## (O8.4) Diet Assess & Plan nutritional software in EFSA's EU Menu project: platform for food data harmonization and regional collaboration in the Balkans

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**Introduction:** In order to overcome evident lack of comparable and harmonized food composition and dietary intake data in the Balkan region, application of internationally accepted, validated indicators and standardized methods is warranted.

**Objective:** The aim of simultaneous implementation of Diet Assess & Plan (DAP) software in national dietary studies conducted under the umbrella of EU Menu project in Serbia, Montenegro, Bosnia and Herzegovina and Northern Macedonia is to enable synchronized and coordinated activities on food data compilation in the Balkan region.

**Main findings:** DAP is an advanced nutritional tool that allows extensive diet evaluation and planning based on dietary intake assessment and nutrient recommendations. The complex DAP structure comprises electronic versions of standard food consumption questionnaires, Food Composition Data Base Management (FCDM) web application, Serbian FCDB and Balkan food platform with Regional FCDB. Due to unique software architecture DAP is compatible with all national FCDBs hosted on EuroFIR platform. Furthermore, by integrating the EuroFIR thesaurus, LanguaL and EFSA FoodEX2 coding systems DAP platform enables flexibility in data utilization and facilitates food matching process, international data comparability and information exchange. Within the EU Menu project, data collection is performed according to EFSA's precisely defined methodological approach. National compiler organizations participating in the Balkan network of DAP users are working on country-specific files and regional FCDB while maintaining high level of standardization.

**Conclusion:** DAP software structure fulfills the criteria for standardized food consumption data collection within EFSA's pan-European dietary monitoring and risk assessment projects. Being core element of public health nutrition research infrastructure in the Balkans, DAP promotes regional collaboration and harmonization of compilation and dissemination of reliable food data.

**Key words:** Dietary software, EU Menu, Research infrastructure

## (O8.5) Nutrifly India Now (NIN) mobile application: A public utility tool

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The Indian Food Composition Tables containing totally analysed data for 528 foods samples collected through nationwide sampling plan and analysed using state of the art technology for more than 150 nutrients and bioactive substances was released in 2017. With growing public awareness of the role of food and nutrients in health there is a corresponding demand for information and assistance concerning diet and disease. At the same time high-quality food composition data are needed and should be made available to the public. While there are many nutrition App available today there is none that gives authentic food composition data as well as track energy consumption and expenditure. Therefore, the National Institute of Nutrition has developed a mobile application called Nutrifly India Now (NIN) to disseminate the IFCT 2017 data to the general public. The main content of the App are 1) My nutrient requirements, 2) Nutrients in my food, 3) My diet and activity, 4) Search foods by nutrients, 5) Food by language. The application provides comprehensive search information of nutrients on hundreds of raw Indian foods as well as cooked recipes not available in other mobile nutrition Apps. Another key feature of the NIN mobile App is the retention of information pertaining to foods consumed and energy expenditure of the user for last seven days. This application provides information in 17 regional languages of India including English and is available on all Android and IOS platforms. The NIN App can be used for tracking nutrient intake and energy expenditure as well as to obtain information on Nutrient data of foods anywhere, anytime.

**Key words:** Energy expenditure, Food & recipes, IFCT 2017, Mobile App, Nutrient search

## (O8.6) Natural Language Processing applied to Food Data – A smart food description mapping system

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**Introduction:** Data treatment operations that should be applied to a database that possesses information in the realm of food and feed, are operations that require constant input from technicians, i.e., people that are specialized and have the skill not only in this area. They also need to have some understanding of how the information is handled by the Information Management System. These technicians are a very limited type of resource, and over the years, we've noticed there is a point in whole treatment process which consumes the largest amount of time and effort: the manual mapping of food/feed description to a controlled terminology, whether it's a code or a list of established terminologies.

**Objective:** From previous projects, some possible solutions were implemented to bypass this problem, however when put into practice, these alternatives would only decrease the amount of effort and time consumed just by a small fraction. These solutions were also complex to implement and the result was very unsatisfactory.

**Methodology:** A new proposal is being made to solve this issue with the help of industrial level Natural Language Processing frameworks. Early versions of this approach had been implemented on our Information Management System, however, at the time the solutions and tools available publicly weren't as advanced as they are today. The Portuguese language wasn't supported in many frameworks, so we had to manually, from the ground up, build a very rudimentary parser for Portuguese text of food description.

**Main findings and Conclusion:** With the use of syntactic parser, tokenization, Part-of-Speech Tagging, and synonyms association we were able map natural text to a controlled terminology with the success of 60-70%. We now believe that with this new approach, utilizing more robust tools for syntactic parsing, as well as the help of data training models using our existing database as an input, we will be able to see results reaching the success rate near 90%.

**Key words:** Data Quality Control, Data Training, Natural Language Processing

## Session 9. Nutritional epidemiology and recipe calculation

### (O9.1) Introducing INDDX24: A dietary assessment platform for scaling up availability, access, and use of global dietary data

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**OBJECTIVE:** To introduce the INDDX24 platform and its development process.

**INTRODUCTION:** INDDX24 is a dietary assessment platform comprised of a mobile application (app) for dietary data collection that is linked to a web app for managing and sharing dietary data inputs (i.e. food composition data, recipes, food descriptors, and portion conversions). The platform's primary objective is to reduce the time and cost associated with generating dietary data, particularly among users in low and middle-income countries (LMICs).

**METHODS:** Priority technical specifications were drafted and reviewed by experts with dietary assessment experience in LMICs. Existing dietary assessment platforms were evaluated against the technical specifications via a structured literature review and key informant interviews. An initial version of INDDX24 was developed collaboratively with two technology firms and tested through feasibility studies in Vietnam and Burkina Faso and webinars with potential users of the platform. Additional development rounds implemented feedback from these studies. The platform's relative validity, time, and cost were then evaluated in Vietnam and Burkina Faso. A phased rollout of the platform will begin in the fall of 2019.

**MAIN FINDINGS:** The extensive consultative process and evidence driven design has produced a high quality platform that balances flexibility of adaptation to a range of contexts with quality control and standardization. INDDX24 allows users to search for and customize dietary data inputs to their research context, translate questionnaire text, add survey modules, conduct real time monitoring of data collection efforts, and match items reported during the survey to food composition data. To maximize the time and cost saving benefits of the platform, a concerted effort will be needed to populate the web app with dietary data inputs.

**CONCLUSION:** INDDX24 is an innovative contribution to global dietary assessment research infrastructure.

**Key words:** Dietary assessment, Food composition data, Innovative technology

(O9.2) State of the Australian food supply: an approach to monitor annual change in the nutritional quality of packaged foods and beverages

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**Introduction:** The growing availability of packaged foods increasingly exposes Australians to unhealthy processed and pre-prepared food choices.

**Objective:** To implement an approach to monitor annual change in the nutritional quality of the Australian packaged food supply using a food composition database.

**Methodology:** The George Institute's FoodSwitch database for 2017 and 2018 was used for food composition data, which is collected annually from four large supermarkets in Sydney, Australia. Key manufacturers were selected for assessment based on having a national retail sales value of  $\geq 1\%$  in 2018. Changes in nutritional quality were assessed for manufacturers and categories using rankings based on the average Australian Health Star Rating (HSR) (0.5/stars); proportion (%) of products classified as unhealthy (HSR below 3.5); Australian Dietary Guideline's classification of foods as discretionary (%); the NOVA classification of foods as ultra-processed (%); and nutrient composition including energy, saturated fat, sodium, and sugar.

**Main findings:** Food composition data were analysed for 32,157 packaged products. Overall, changes in nutritional quality across the year were minimal and showed no improvement. In 2018, 54% of products were classified as unhealthy (8% increase), 49% as discretionary (1% increase) and 73% as ultra-processed (1% increase). Mean HSR (2.9) showed no change overall. Changes in nutritional quality for manufacturers was influenced primarily by changes in product portfolios, where manufacturers sold or acquired less healthy brands. Significant variability in nutrient quality for most food categories was observed, highlighting the feasibility of producing healthier versions of similar products.

**Conclusion:** The use of annually updated food composition data to monitor changes in the nutritional quality of the Australian food supply will highlight key opportunities for government and business to improve the healthiness of packaged foods and beverages.

**Key words:** Food data, Food monitoring, Food supply, Health Star Rating, Nutrition, Packaged foods

### (O9.3) Estimation of Nutrient Values from Label Data in Branded Foods

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**Introduction:** Labels of commercial food products usually declare a few nutrient values according to national legislation and sometimes contain additional voluntary values. This rather small number of nutrient values limits information for consumers as well as investigations such as evaluations of consumption surveys.

**Objective:** The goal was to develop a tool to help compilers estimate missing nutrient values for branded foods. The tool takes an ingredient list, gets ingredient foods from a food composition database (FCDB), estimates ingredient amounts and performs recipe calculation. The outcomes are calculated macro- and micronutrients of the branded food with minimised deviations to macronutrients on the label. Importantly weight yield and nutrient retention factors are considered and the tool is user-friendly.

**Methodology:** Two algorithms based on linear programming were selected, investigated and improved before being implemented and compared. Investigations included identification of error sources and their impact. Improvements included a list of foods to select from and considering ingredient sub-lists where an ingredient has its own ingredient list. The tool was implemented in FoodCASE and further improved.

**Main findings:** The two algorithms delivered similar results but one was more stable. Both algorithms sometimes indicated that a change in the ingredient order would bring better results. While the improvement to handle ingredient sub-lists increases accuracy, other improvements had less impact. Presenting the outcome in FoodCASE with a spider diagram, in addition to a nutrient table, was shown to be effective and easy to interpret.

**Conclusion** Our results show that the tool delivers acceptable results and is user-friendly. The additional investigations and improvements helped increase accuracy and gain knowledge about the use of the algorithm. Nevertheless, nutrient estimation is challenging and more investigations would be helpful to further improve the tool.

**Key words:** Branded food, Food composition, Food labelling, FoodCASE, Nutrient estimation, Recipe calculation



(O9.4) A Web-application to reformulate recipe through optimization:  
proof of concept.

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Improving the nutritional quality of food through reformulation is a key approach to improve diet quality and to reduce the prevalence of non-communicable diseases. We created a flexible web application to estimate and also improve the nutritional composition of processed foods while taking into account the impact of processes on food nutrients content.

As a first step, user needs to enter ingredients, related quantities and processes. Nutritional composition of final product is then estimated using the mixed method (applying yield factor at recipe level and retention factors at ingredients level), as recommended in EuroFIR official guidelines. As a second step, the recipe can be improved depending on several requirements selected by the user. In just a few clicks, the application, based on linear programming, automatically corrects the amount of ingredients to meet the selected nutritional and ingredients constraints while staying as close as possible to the original recipe. Bramborak dish was used as a proof of concept. It is a deep fried pancake whose nutrient composition, retention factors and yield factor were taken from a previous study. Constraints were set in order to improve SFA, sodium, fiber and proteins contents simultaneously while keeping acceptable proportions in amounts of milk, flour and eggs. The nutritional quality of both initial and modelled recipes was assessed through the Nutri-Score, a labelling system rating nutritional quality of foods from A to E.

After optimization, increases in amounts of garlic, wheat flour, eggs, and decreases in amounts of potatoes lard and salt were obtained. The nutrient profile was improved from Nutri-Score category C to B.

Recent developments were done in order to allow substitutions of ingredients. Organoleptic qualities of the modelled recipe were not taken into account but adding more constraints fitted food industry needs could help to design a more acceptable recipe.

**Key words:** Linear programming, Nutritional quality, Nutri-Score, Recipe calculation, Recipe reformulation

(O9.5) Comprehensive EuroFIR recipe calculation guideline to produce food composition data.

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For food composition databases (FCDBs), due to resource limitations, it is accepted that nutrient composition values of composite dishes can be calculated from analysed compositions and amounts of ingredients. During cooking of dishes, there are complex effects of weight changes and nutrient losses and gains which should be considered in the calculation.

Objective: To create a comprehensive step-by-step recipe calculation guideline for compilers of a FCDB that considers the losses and gains during preparation of dishes to produce the best estimate of nutrient values.

Methodology: Publications related to recipe calculation, especially from EuroFIR, FAO/INFOODS and Max Rubner-Institute, were reviewed and combined into a single document. Inconsistencies, gaps and open questions were identified and solutions developed. Formulas for recipe calculation as well as examples were included. A draft version of the guideline was discussed with experienced compilers.

Main findings: The guideline describes in eight successive steps a standardised recipe calculation method. Weight changes during preparation of dishes are considered through weight yield factors which are applied at recipe level. Changes in nutrient content are considered through nutrient retention factors (NRFs) and additionally through fat and salt uptake factors. NRFs are applied for micro- and macronutrients at ingredient level. As no NRFs for the component water (moisture) exists, alternative calculation options together with their advantages and disadvantages are discussed. The calculation method has been implemented in the FoodCASE FCDB management software tool.

Conclusion: The revised recipe calculation guideline provides a comprehensive expert approved recipe calculation method, which is accepted as the EuroFIR method for recipe calculation. This standardised method ensures calculated nutrient composition values of composite dishes which are reproducible and comparable within and between European FCDBs.

**Key words:** food composition database, nutrient retention factor, recipe calculation, weight yield factor

# 13<sup>th</sup> INTERNATIONAL FOOD DATA CONFERENCE

*Challenges for Food Databases in the Bioinformatics Era*

## POSTERS PRESENTATIONS

**Venue**  
INFARMED- National Authority of  
Medicines and Health Products. I.P  
**Lisbon, Portugal**

(P1.01) Diffusion and management of the polyphenol database developed in Argentina: ARFenol-Foods

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In Argentina there was no systematic information about the polyphenol content of their food. A polyphenol database ARFenol-Foods was developed compiling information from peer-reviewed scientific publications and also reports of polyphenols data in several local foods generated analytically in laboratories in different regions of the country. The aim of this work is the diffusion, use and management of the ARFenol-Foods database. Its construction was made using data were critically analysed and evaluated before their compilation and inclusion in the database. The database is an open electronic tool through an easy-to-use web interface, which allows simple or complex queries. It is available online through a website of INSIBIO <http://insibio.org.ar/ar-fenoles-app/>. The content of total polyphenols and the subgroups reported in the bibliography were included. The program provides the entry through of the common food and this leads to another window where the different registers are with a brief description, if it contains the content of total phenols made by Folin-Ciocalteu assays and the origin of the data. The reports show how the sample was obtained, manipulated and/or processed. In the case of Andean potatoes, not only there is no information in international databases, but it is also important to determine the variability within the same group because the great biodiversity. The database contains information of 25 varieties and its possible obtained the range and mean value of them. Also, the software allows compare the data between different databases available. All results of queries can be exported as pdf files. The ARFenol-Foods database should be beneficial and useful to estimate the intake of total phenolic and their related contribution of foods in populations from the region. It would be useful for different users like food scientists, food manufacturers, dieticians or health-care professionals among others.

**Key words:** Argentina, Compounds, Database, Management, Phenolic, User

## (P1.02) Advances in 9th revision Korean Food Composition Table

Sang Hoon Lee, Yongmin Choi

Department of Agrofood Resources. National Institute of Agricultural Sciences. Rural Development Administration.

Korean Food Composition Table (KFCT) has been published since 1970 and updated every five years by Rural Development Administration. The objective of this study is to introduce the development strategies, features, and challenges of 9th revision KFCT. Due to the increasing demands of nutrient database users and generators, in 2013, RDA started new research project to improve data quality and quantity for 9th revision. Over 1,000 food items frequently consumed in Korea were selected as key foods using the results of the Korean National Health and Nutrition Examination Survey. About 200 raw materials and processed food items were collected and analyzed every year. Target nutrients which were analyzed by corporative labs were increased from 22 to 43 such as, sugars, vitamin K, D, folate, trans-fatty acid, etc. Analytical sample handling procedures and data quality evaluation system also were established in collaboration with 10 contracted labs. Data were evaluated for data quality according to FAO/INFOODS and AOAC guidelines. This revision contains data on 3,000 food items and also up to 43 and 140 food nutrients for the published book and database, respectively. New analytical data for 972 food items were added and data for 512 food items were collected from foreign nutrient database. The rest of data for 1,516 food items were maintained as 8th revision. All values are presented per 100 g edible portion on a fresh weight basis. All compositional data were standardized to this expression according to the FAO/INFOODS Guidelines. FAO/INFOODS component identifies, called tag-names, were used to describe the components. KFCT is the major source of nutrient data in Korea. It provides the basic infra-structure for food and nutrition policy, research, and dietary practice. The use of KFCT has increased exponentially in the past few years in both public and private sectors. In this regard, more effort should be paid to the preparation, improvement, and maintenance of KFCT.

**Key words:** Data quality analysis, Nutrients, Korean Food Composition Table

### (P1.03) Brazilian Food Composition Table (TBCA): development and functionalities of version 7.0 for web and app

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Celebrating the 20 years of the Brazilian Food Composition Table (TBCA) is being released the version 7.0, and a mobile application (APP) for android and IOS. TBCA website was development by the BRASILFOODS, University of São Paulo and Food Research Center and comprises two databases: (i) the Biodiversity and Regional Food Database (TBCA B-DB); (ii) the Nutrient Intake Evaluation Database (TBCA NIE-DB). TBCA NIE-DB presents mainly analytical data of food consumed in Brazil; in the absence of information, nutrient information from international tables with the same food description were aggregated, adjusted for moisture and lipids. A new classification by food type has been inserted to allow new filters. TBCA 7.0 is available online for free ([www.fcf.usp.br/tbca](http://www.fcf.usp.br/tbca)) presents new layout, with usability and friendly interface and can be consulted on computers and tablets. An APP specially designed for smartphones is being developed. The TBCA NIE-DB presents composition data for 34 components – proximate composition, fat fractions, 10 minerals and 10 vitamins, with 85% of national information for more than 3000 foods. In addition to the traditional search by name of food (in Portuguese, English or scientific), by food group or by component, the data can also be consulted by type of food (in natura; single-ingredient recipes, processed foods (ingredients), ready-to-eat food products, multi-ingredient recipes) depending on the new classification. The consult generates an online report, with information available depending on the database queried. These reports present nutrient data per 100 g and per household measures; also provide information on the type of data (analytical, calculated or borrowed) and the bibliographic references. TBCA 7.0 website can be used for nutrient intake evaluation of general population and to assist professionals in dietary prescription. The mobile APP facilitate the dissemination of information on food composition in food consumed in Brazil.

**Key words:** Brazilian foods, Brazilian recipes, Food composition data, Nutrient intake evaluation database, TBCA

## (P1.04) Research for Region Agricultural Product Database to Establish the National Standard Food Composition Database in Korea

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Korean Rural Development Administration (KRDA) has provided the national standard food composition databases (NSFCDB) and it has produced by national food analysis system (NFAS). NSFCDB is important source for polices, industries, education and dietary studies in South Korea. Due to the increasing demands of biodiversity database, in 2015, KRDA started new research project to collect nutrient data of regional agricultural products from nine local areas in South Korea. We organized local food analysis system (LFAS) with researchers from nine regional agricultural technology institutes. RDA collected various crop cultivars including apples, onions, peppers and peaches from nine areas. Analytical sample handling procedures and data quality system were established in collaboration with nine regional agricultural institutes. LFAS team has participated in selection and collection of samples and involved analysis of nutrients. This database has considered to identifying the range of cultivated crops in South Korea, local geographic conditions, cultivation environments and mainly cultivated species. It could be essential data for understanding the nutritional information of agro-food resources consumed in the country. In addition, it would be used for reference in farming agricultural products in each local area and used for secondary processing to food resources. Through this study, RDA aims to establish for enhanced food composition database and provide more accurate information to database users.

**Key words:** Cultivar, Database, Local food analysis system, Region agricultural product

## (P1.05) Redevelopment of Australia's Nutrient Reference Database

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Food Standards Australia New Zealand (FSANZ) has published Australia's reference nutrient database under the name NUTTAB since 1989. Data is publically available online through a searchable database and as downloadable files. New analytical data, user feedback and changes in FSANZ priorities and IT systems has resulted in a refreshed version of our reference database. To produce an updated nutrient reference database that meets user needs and aligns with FSANZ future requirements.

In addition to incorporating new analytical data, FSANZ reviewed user feedback and consulted with a small user group to determine their key areas of interest with regard to the database and potential areas for improvement. In-house IT requirements and future food composition needs were also considered.

Feedback suggested the name of the database was confusing and highlighted the need for consistent identification of foods and enhanced functionality of the online searchable version. Other changes included the introduction of a core set of nutrients for each food, the ability to view nutrient data by common measures, the removal of foods which were no longer relevant to the Australian market, and the incorporation of new analytical data for over 200 foods.

In January 2019, FSANZ published an updated reference database under a new name, the Australian Food Composition Database – Release 1 (AFCD-1). AFCD-1 contains data on 54 core nutrients for 1,534 foods. The online searchable database, downloadable files and additional information are available free of charge on FSANZ's website at [www.foodstandards.gov.au](http://www.foodstandards.gov.au). Further Releases of the AFCD will be published as new data is available.

**Key words:** Australia, Nutrient database, Reference database



## (P1.06) The 2018-19 Australian Key Foods Analysis Program

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The Food Composition Program at Food Standards Australia New Zealand (FSANZ) monitors nutrients in the Australian food supply to inform standards development work and compile nutrient databases, such as the Australian Food Composition Database. FSANZ commissions analytical programs as resources become available to update its food composition data holdings for these purposes. A systematic approach is needed to prioritise foods for analysis.

To apply a Key Foods approach to prioritise foods for analysis using updated National Nutrition Survey data.

Nutrients from the FSANZ survey database AUSNUT 2011-2013 were combined with food consumption data from day one of the 2011-12 National Nutrition and Physical Activity Survey (NNPAS) to determine food and nutrient intakes in the Australian population. Foods were allocated a score for each of 50 selected nutrients based on their percentage contribution to the reported intake of that nutrient. Foods were then ranked according to their total score and the top ranking foods selected for analysis. Individual and composite samples were analysed by an independent laboratory according to their key nutrient contribution and the results validated. Foods identified for analysis were similar to previous key food programs undertaken by FSANZ. Milk (full fat, reduced fat), breads (white, wholemeal, grain, toasted), white pasta, beef mince and tomato pasta sauce, cheddar cheese, chicken schnitzel, wheat breakfast biscuits and boiled potatoes were identified for analysis. Major findings from the analyses of these foods will be detailed, including how changes in the food supply are reflected in the data.

Using a key foods approach, 12 foods from the Australian food supply were identified and analysed. Compiled results will improve the quality of FSANZ data holdings, be included in future releases of FSANZ food composition databases and used to inform standards development.

**Key words:** Analysis, Food composition, Key Foods

(P1.07) The Salt Partnership initiative to reduce the salt intake. Analysis of sodium in Norwegian foods from 2014 to 2018.

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In 2014, the Norwegian Directorate of Health launched an action plan on salt for reducing the public's salt intake. The Salt Partnership has therefore established indicative targets for salt content in several food categories. Priority food categories were for instance bread, cereals, meat- and fish products, cheese, edible fats and ready meals such as pizza, portion dinner and lunch meals, soups, sauces, marinades and mayonnaise-based salads.

The aims were to assess the salt levels and the changes over time in various food categories, and to compare the results with the salt target.

All foods were purchased in Norwegian supermarkets from 2014 to 2018 and both bestselling products, several brands and low-price products were included. Three batches of each product were homogenized into one composite sample. Analyzed sodium concentrations were converted to salt by multiplying with 2.5.

Preliminary results indicate lower salt content in fresh bread and cereals products in 2018. For the 74 meat products, the salt level was reduced in cold cuts, liver pate and dry cured ham, and unchanged for sausages, meat balls and meat patties. A total of 33 fish products were analyzed and minor changes in the salt content were revealed. Similar minor changes were also revealed in the cheese. For the 49 ready meals, the salt content in soups, sauces and mayonnaise-based salads was slightly lower in 2018 and only minor changes were revealed in the other products in this category. The salt content in white cheese, breaded fish products and fish au gratin was in accordance with the salt target in 2014.

This study includes 539 analysis of salt in selected food categories considered important for lowering the dietary intake of salt. Although, the number of products varies in each food category, a higher proportion of food products are in accordance with the salt target in 2018 compared to 2014.

**Key words:** Analysis, Food composition data, Norway, Salt Partnership, Salt

## (P1.08) REFRESH Food Waste Compositional Database – FoodWasteEXplorer

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The EU has set a target to reduce food waste by 30% by 2025. However, by considering supply, quality and composition, it is possible for stakeholders to find value in food waste, and build a more sustainable and secure food system.

As part of the EU-funded project (REFRESH), 'FoodWasteEXplorer' was developed to help identify the edible and inedible food waste streams most appropriate for valorisation.

FoodWasteEXplorer, an online searchable database, provides the composition of food waste streams, so users can explore how food waste might be better managed and identify market opportunities, e.g. animal feeds, textile fibres, bioplastics or biofuels.

More than 25,000 datapoints on 1,264 main food side streams (e.g. orange peel), from a variety of sources, including published peer-reviewed scientific papers, have been added. The structure is based on CEN's standard for food data (EN 16104:2012) with easy to use search and reporting systems and is fully compatible with other information systems (e.g. FoodEXplorer, [www.eurofir.org/foodexplorer](http://www.eurofir.org/foodexplorer) and Quisper, [quisper.eu](http://quisper.eu)).

FoodWasteEXplorer is a valuable resource for food waste management, allowing identification of components and potential valorisation for important side streams. It enables use of side streams as new raw materials for a wide range of products, decreasing waste generation, and increasing value and sustainability. Access to FoodWasteEXplorer is free-of-charge at [www.foodwasteexplorer.eu](http://www.foodwasteexplorer.eu).

**Key words:** Bioactives, Food composition, Food Waste, Nutrients, Valorisation

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## (P1.09) Harmonization of Data Aggregation Procedures for Food Composition Databases within EuroFIR

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To determine the best estimate of a nutrient value of a food item several nutrient data points can be compiled and aggregated for Food Composition Databases (FCDBs). Currently, for calculation of the best estimate there is no harmonized data aggregation procedure available.

To develop a harmonized data aggregation procedure for FCDBs within EuroFIR.

A common definition of data aggregation in regard to FCDBs was developed. Based on this definition MRI and ANSES designed a questionnaire which was sent to all EuroFIR compilers to get an overview of their current data aggregation practices. Answers were collected from 13 FCDBs. To proceed on this topic, a EuroFIR working group Data Aggregation was built. At the EuroFIR Food Forum 2019, the working group conducted a workshop to specify the further work. The definition of data aggregation comprises three successive steps: 1. Selection of nutrient data from available data points based on criteria. These criteria were determined with regard to their impact on the quality of data points such as age of data. According to the results of the questionnaire, similarities in the use of selection criteria were identified such as ranking data sources with analytical data as first choice. 2. Calculation of the best estimate with statistical methods or selection of a single data point according to defined rules. Most compilers prefer the mean or weighted mean for calculation or choose one single data point as best estimate. 3. Consistency checks. The EuroFIR working group has obtained a consensus of priority topics for the further work: Application of common selection criteria and choice of appropriate statistical methods for calculation of the best estimate.

The overview of the data aggregation practices of the FCDBs is the basis for further work. The next step of the EuroFIR working group is to focus on the agreed priority topics.

**Key words:** Best estimate, Data aggregation, Harmonization, Selection criteria, Statistical methods

## (P1.10) Establishing priorities for Food Composition Table Update – Nutrients and Food

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Information on food composition is a basis for the characterization of nutritional unbalances, the elaboration of legislation and nutrition policies. Therefore, a continuous development of Portuguese Food Composition Table (PFCT) is crucial. Laboratory analytical data obtained for food consumed by the Portuguese population are a priority to produce high quality food composition data. As resources are limited there is need to establish priorities.

To define the priority foods/analites to be analysed/determined in order to contribute to high quality data for PFCT update.

Material and Methods: To prioritize foods, the results of the last National Food Consumption Survey (IAN-AF) were used. Priority one nutrients for Food Composition Tables established during the EuroFIR project was used to complete the current 42 nutrients present in PFCT.

Six nutrients, not present in the current version of PFCT, selenium, copper, omega-3 and omega-6 fatty acids, beta-carotene, and iodine were identified as priority according to EuroFIR rules. Also, lutein was included, due the last scientific advances relating it to human health. 69 foods were identified as the main sources of the prioritized nutrients. Among the PFCT development strategy for 2019-2021, food consumed by vegetarians was prioritized. Combining these needs and the items consumed by vegetarians accordingly to the IAN-AF, a list of 23 foods will be analysed as the first priority by our laboratory. From this list, eight food items, the majority from the seed group were the major source of the three nutrients selenium, copper and omega 3 fatty acids prioritized.

The prioritization rules for nutrients in Food Composition Tables established by EuroFIR, the IAN-AF, the lack of information of food consumed by vegetarians and the eventual nutritional unbalances of a vegetarian diet contribute to design a plan to update the PFCT with analytical values obtained by laboratories.

**Key words:** Food Composition Table Update, Nutrients, Portuguese Food Composition Table (PFCT), Vegetarian food

## (P1.12) IDRisk project – Improving data quality for risk assessment

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**Introduction:** The National Data Management System “PT•ON•DATA” was developed by INSA, in Portugal, under the implementation of the electronic transmission of contaminant data to EFSA, using the Standard Sample Description information format. The process has allowed the centralization and harmonization of data with a greater automation, contributing to the improvement on the final quality, integrity and consistency of data. **Objective:** Building technical and functional capacity on official controls data collection, management and transmission in order to produce data of robust quality to perform risk assessment activities through a consortium for knowledge exchange between Portugal (ASAE and INSA) and Croatia (HAPIH). **Methods:** The consortium prepared and submitted a project application to EFSA, under the Partnering Grants call GP/EFSA/ENCO/2018/03, entitled “IDRisk – SSD2 and FoodEx2 compliant real-time registration and classification of food sampling data – improving data quality for risk assessment (Pilot Project)”. **Results:** The project, approved by EFSA, financed by this entity and the partners involved, started its development in 2019 and will finish in 2021. It is planned to expand the existing system, which can be applied to other systems, in a manner that the data collection process starts right on the field. This will help gather and increase the reliability of information related to sampling data, also aiming to reduce the amount of data manipulation, which occurs before the treatment and reporting to EFSA. **Conclusions:** The improvement of data quality, integrity and consistency, for risk assessment studies and to support risk decisions, can be achieved by reducing the manual manipulation of data. The introduction of on-field devices and the automation of existing manual tasks will allow achieving the project goal.

**Key words:** Data collection, Data quality, Risk assessment, Sampling forms

(P1.13) Composition, texture and microstructure appraisal of paneer coagulated with sour fruit juices

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The health issues coupled with growing demand for food products fortified with nutritional additives and improved sensory properties have vastly attracted the consumers' attention in the recent past. The investigation studied the effect of sour fruit juices as coagulants on the physico-chemical properties, phytonutrients, sensory scores, texture profile analysis (TPA) and microstructure of paneer. Milk, acidulants and paneer were analyzed for total solids, fat, protein, ash and titratable acidity as per AOAC (2000) methods. The antioxidant activity of juices and paneer was determined by the method of Alma et al. (2003) using DPPH (2, 2-diphenyl-1-picryl-hydrazylhydrate). The total phenol content was determined by the Folin–Ciocalteu method by Cindric' et al. (2011). Mineral content was analysed using Inductivity Coupled Plasma Emission Spectrophotometer. The TPA was analysed using scanning electron microscopy (SEM). Milk was coagulated using citric acid solution (control), lemon or amla (Indian gooseberry) juice and its sensory qualities was evaluated. The total solids and protein recovery were higher using amla juice while fat recovery was more in control than with the other two coagulants. The mineral profile indicated that calcium content was higher in lemon and amla paneer than citric whereas sodium was highest in citric sample. Paneer collected using fruit juices exhibited higher quantity of functional components studied i.e. antioxidant activity, ascorbic acid, total phenols and tannins than control. Also, it scored high for sensory attributes of appearance/color, body and texture, mouthfeel, flavor and overall acceptability but exhibited disparate values for TPA (hardness, adhesiveness, gumminess and resilience) and discrete structures under SEM. Therefore, good quality paneer with high nutritional value and acceptability could be manufactured both from lemon and amla juice.

**Key words:** Fruit acidulants, Mineral profile, Nutritional additives, Paneer, Phytochemical, Sensory score

## (P1.14) Preliminary of Nutrient Composition of Raw and Cooked Freshwater and Marine Fish in Thailand

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Five freshwater and five marine fish species are selected for this study based on data of commonly consumed of Thai food consumption survey 2014-2015. Each fish was purchased from three shops and pooled as a composite sample in the wholesale market at Samutsakorn province, Thailand. Fish including skin was prepared by common household practices, and then cooked by three house-hold cooking methods (boiling, frying with palm oil, and roasting). Edible portion of raw and cooked fish were homogenized, put in screwed-cap plastic bottles, and kept at -20 oC until nutrients analyses. This study aims to investigate the nutrients composition of raw and cooked freshwater and marine fish in Thailand and to study their effect of cooking. Protein content varied between species and cooking methods ranging from 19 to 36 g/100 g edible portion fresh weight (FW). Raw studied fish contained fat content at the level of 5.2-13.0 g/100 g FW). Wide variations in fat content, between species and cooking methods (5-29 g/100 g FW in freshwater fish and 2-14 g/100 g FW in marine fish) were observed. Potassium and phosphorus are the major macro-mineral found in all studied fish (250-320 and 183-212 mg/100 g FW, respectively). Raw fish provided cholesterol (36-112 mg/100 g FW). High variation among species of true retention (TR) of vitamin A, E, B1, B2, niacin, B6, B12 and folate in all boiled, fried, and roasted fish of all species were observed at the level of 45-100%, 5-100%, and 15-100%, respectively. The nutrient composition and its retention factor derived from this study could increase the quality of the current Thai Food Composition Database and improve reliability of recipe calculation.

**Key words:** Cooking methods, Fish, Nutrient composition, True retention



(P1.15) The process and impact of legislation on fat class changes to a South African food database

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**Introduction:** In 2015, the South African Department of Agriculture, Fisheries and Forestry, promulgated regulations relating to the classification, packing and marking of dairy products and imitation dairy products sold in the country (R.260 of 2015). New standards of fat classes for milk products ranged from fat free (<0.5% fat), low (0.5-1.5%), medium (1.5-3.3%), full (3.3-4.5%) and high fat (>4.5%). Product types affected include milks, yoghurts, cream, cheeses (processed, cream, cottage), butter and dairy powders. Amendments to the user food composition table for R.260 category ranges, are in progress.

**Objective:** To implement new fat class ranges for products linked to regulation R.260 of 2015, and to identify the process of updating.

**Methodology:** A name search strategy for food items linked to regulation of the user database was identified and reviewed. Nutrient data checks for total lipids, both single ingredient and recipe foods affected by regulation applied. New fat classification checks only reviewed for South African food items, not borrowed data. Following total lipid nutrient checks, renaming occurred to food item descriptions. Major food item description changes based on fat class shifts reported.

**Main findings:** Data for 1667 food items reviewed. Food description name changes were applied to 13% (n=210) recipe items. Majority of changes occurred within milk food group (n=56;27%) but cut across 7 other groups (50% food groups affected). Major shifts for item types in fat classes from: low to high fat (cottage cheese; milk powder); low to medium fat (milk 2%; yoghurt); low to full fat (cottage cheese); and a previously termed "reduced fat" product has now migrated to a high fat (processed cheese).

**Conclusion:** The importance of updating a national food database when changing regulations result, is encouraged. An effective communication strategy to researchers and users of the national database following policy changes, is advised.

**Key words:** Fat classes, Food composition, Legislation, Milk food group, South africa, Total lipids

(P1.16) Prioritizing Strategy to meet National Regulatory Policy demands:  
Assessing the impact of Sodium Regulations on the SAFOODS database

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**Introduction:** The global nutrition agenda is constantly changing, inadvertently affecting the food composition environment. Multiple recent regulatory amendments have led SAFOODS to set priorities for focused update strategies.

**Objective:** To assess and guide a food composition database (DB) update strategy to address promulgated Sodium (Na) Regulations.

**Methodology:** Regulation 214 (Reduction of Total Sodium Content of Certain Foodstuffs) guided the updating process. A preliminary assessment involved the impact thereof on the DB informing the food group, food group size, category and Na percentage differences observed.

**Main findings:** The preliminary assessment showed 6% of the DB (4 food groups) affected by the Regulation; 18.7% food items affecting Cereals, while Sauces, Seasoning and Flavourings (SSF), constituted the largest affected group (26.3%). Evaluating grouped food items against the prescribed Na contents, showed mean Na values of 446, 505 and 783mg respectively in Breakfast Cereals, Bread and Crackers. The largest (95.7%) percentage difference (PD) was observed within the Crackers category. Food categories within the SSF group, had a mean Na content of 1562 mg: soups comprised both the largest category and PD at 18.4% and 49% respectively. Meat and Fats and Oil groups had respective mean Na values of 1198 and 674 mg. Processed meat encompassed 8 %, a mean Na of 1308 mg and PD of 101.2%. Fat spreads and butter comprised 20% of the Fat food group, showing a mean Na value of 674 mg and a 29.5% PD from the regulatory value. Since added salt is not reported in the database, recipes were excluded from the assessment.

**Conclusion:** A broad overview assessment guided an update strategy which showed a small number of food items affected. Differences were observed, however recently updated food items showed values within the regulation. The assessment informed a prioritized focused update, assisting in upholding a relevant DB in a changing policy environment.

**Key words:** Database, Food categories, Food groups, Policy, Regulation, Sodium

## (P1.17) Germination increases lutein and $\beta$ -carotene in Australian sweet lupin seeds

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**Introduction:** Consumption of Australian sweet lupin provides health benefits due to high contents of protein, fibre, vitamins and minerals. However, lupin is also known to contain anti-nutrients. Fermentation and germination have been reported to lower the anti-nutrients in lupin and to enhance the aroma, flavour and appearance.

**Objective:** The objective of the study was to compare the lutein and  $\beta$ -carotene contents in lupin after germination or fermentation.

**Methodology:** Lupin seeds were initially germinated, dried in an oven and ground, while the lupin flour was either naturally fermented or inoculated with yoghurt starter culture as reported in our previous study. The effect of drying temperature at either 50 or 80°C was also investigated. Samples were then compared with raw lupin as a control. Samples were dissolved in acetone and subjected to ultra-sound assisted extraction. The extracts were filtered and evaporated to dryness before HPLC analysis.

**Main findings:** Lutein and  $\beta$ -carotene levels raw flour were 93.2  $\mu\text{g}$  and 1.3 $\mu\text{g}$  per 100g, respectively. Germination increased the lutein level to 230 $\mu\text{g}/100\text{g}$  and there was no mean difference between the drying temperatures ( $p>0.05$ ). However, mean  $\beta$ -carotene of 15.1 $\mu\text{g}/100\text{g}$  after 50°C drying was significantly higher than after 80°C with 9.9 $\mu\text{g}/100\text{g}$ . Lutein levels in naturally fermented and raw flour samples were 91.6  $\mu\text{g}/100\text{g}$  and 93.2  $\mu\text{g}/100\text{g}$ , respectively, and did not differ significantly ( $p>0.05$ ). Lutein in inoculated samples was 82.8 $\mu\text{g}/100\text{g}$  and was not significantly lower than raw flour. Measured  $\beta$ -carotene was approximately 1.5 $\mu\text{g}/100\text{g}$  in both fermented and raw flour samples.

**Conclusion:** The results suggested that germination increased the levels of lutein and  $\beta$ -carotene in lupin, while fermentation had no effect. Drying temperature did not affect the levels of lutein in germinated seeds. However, drying temperature at 50°C seemed to be more protective of  $\beta$ -carotene than drying at 80°C.

**Key words:** Australian sweet lupin,  $\beta$ -carotene, Fermentation, Germination, Lutein

## (P1.18) Quality Information Service and Dietary advice for Personalised Nutrition in Europe

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on behalf of the Quisper® Consortium

**Introduction:** Consumers want to have healthier lifestyles and personalised advice has been shown to be more effective than generic public health advice in achieving and sustaining dietary changes. Online and app-based nutrition and health services are numerous, but rarely science-based, resulting in low trust and compliance, and focus on calorie counting rather than personalised dietary recommendations, based on individuals' needs and goals.

**Objectives:** Quisper® is a digital platform managed by a non-profit organisation in Belgium that aims to support personalised nutrition services through provision of scientifically validated data, knowledge, tools and services.

**Methodology:** Quisper® is underpinned by a dynamic digital structure, based on Amazon Gateway. In 2019, a series of use case studies will integrate resources (data, knowledge, tools and services) that can be tested amongst individuals (business-to-consumer) or providers (ICT SMEs, business-to-business). All resources linked to Quisper® will be reviewed by an independent scientific advisory board, ensuring rigorous oversight and transparency to promote trust amongst end-users, i.e. consumers.

**Main findings:** Linking fragmented diet, nutrition and health resources around Europe remains very challenging technically and scientifically. Harmonisation and standardisation are still serious issues, and oversight and transparency difficult to achieve. However, Quisper® is making progress with addition of dietary reference values and access to food composition data from EuroFIR. The successful integration of new digital services from ICT SMEs will enable Quisper® to attract new providers and funding and begin to demonstrate value for users.

**Conclusions:** Quisper® has potential added value for providers and users, supporting evidence-based personalised nutrition services, and translating scientifically validated resources to benefit for consumers and industry (food, ICT) as well as healthcare.

**Key words:** Advice, Diet, Health, Personalisation, Quisper®, Recommendations

## (P1.19) Consumer awareness and consumption of fortified foods in Kenya

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**Introduction:** The prevalence of anemia, vitamin A and zinc deficiency among Kenyan preschool children is 26.3, 9.2 and 83.3 percent respectively. The mean dietary diversity score of 3.63 in almost half of children is below the recommended cut-off for minimum dietary diversity of at least 4 of the 7 food groups, indicating inadequacy of their diets. In Kenya, among interventions addressing hidden hunger is mandatory fortification of wheat and maize flour. The level of compliance to standards is still low.

**Objective:** To determine consumer awareness levels and consumption of fortified foods.

**Methodology:** A nationwide survey that clustered Kenya into 9 regions using multistage cluster random sampling technique was used. One subcounty was randomly selected in each region. A sample size of 1435 respondents was determined using Large Country-Lot Quality Assurance Sampling method. Respondents were heads or other members of the households responsible for food purchase. A structured questionnaire was used to collect data on awareness levels and consumption patterns of fortified foods. STATA was used for descriptive summary and binary logistic regression to establish variable relationships, with significance levels set at 0.05%.

**RESULTS:** Majority (70%) of the respondents were not aware of food fortification with a few (17%) deliberately purchasing fortified foods the previous month. Only 17% purchased salt because it had added minerals whereas 10% purchased sugar because it is fortified. Most respondents purchased food, without considering its nutritive value. More than half (52.5%), consumed ugali daily from posho mills (35.9%) and packaged fortified maize flour (16.6%). Most of the respondents never use porridge flour from fortified maize flour.

**CONCLUSION:** There was limited awareness on food fortification, with just half the population consuming fortified products. Creation of awareness would increase the consumption levels

**Key words:** Consumer, Fortification, Minerals, Vitamins

## (P1.20) Decade of achievements in capacity development in food and nutrition in Central and Eastern Europe and Balkan Countries

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**Introduction:** Realising incoherent nutritional situation and lack of capacity for research in Central and Eastern Europe and Balkan countries (CEE/BC), the United Nations University Food & Nutrition Program and the UN Standing Committee on Nutrition, encouraged the formation of Network for Capacity Development in Nutrition in CEE (NCDNCEE) in 2005.

**Objective:** Major objective of NCDNCEE was to guide and support capacity development (CD) in food & nutrition research and training in CEE/BC based on country/region specific needs. CAPNUTRA, the follow-up network, was founded in 2012.

**Methodology:** CAPNUTRA identified regional challenges and needs in nutrition RI and CD in CEE/BC by reviewing different indicators e.g. existence of food composition databases (FCDB), nutritional education, dietary surveys, data base management, dietary assessment tools and standardized dietary intake data and shaped activities in context of continual CD in nutrition, accordingly.

**Main findings:** After identifying lack of RI in nutrition, CAPNUTRA activities focused on development of different elements for dietary assessments tools which comprise the Balkan Food Platform and on organisation of education and knowledge exchange for public health nutrition personnel. DIET ASSESS & PLAN (DAP), an advanced nutritional software-based tool for food consumption data collection, comprehensive dietary intake assessment and nutrition planning employs these RI elements and has its regional application through two EFSA EU Menu-supported dietary surveys in Balkan region (on children and adults) in which food consumption data are collected and analyzed in a harmonized way.

**Conclusion:** During the last decade, CAPNUTRA collaborated with FAO REU and other networks on EC funded and international research projects, enhanced nutritional training, exchange of information and knowledge and developed RI in CEE/BC that enables regional harmonized public health nutrition research.

**Key words:** Capacity development, Central & Eastern Europe/Balkan countries, Dietary assessment, Food & nutrition, International collaboration, Public health nutrition research

## (P1.21) Effect of chitosan-based edible coatings on strawberries' postharvest quality

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The quality of fresh fruits during the postharvest period is a constant concern of producers. On the other hand, the demand for fresh fruit throughout the year by consumers makes it necessary to guarantee the quality of the fruit during an extended period, inducing a minimum of changes in the fruit. The edible chitosan-based coatings have arisen as a technology capable to prolong the shelf-life of fruits, with appropriate characteristics of quality. Chitosan is a polysaccharide obtained by deacetylation of chitin, with promising preservation capacity, and previous experimental trials demonstrated positive results in fungal control and maintenance of nutritional and sensory quality during the postharvest period.

The present study was carried out to evaluate the effect of chitosan-based edible coatings, in two different concentrations, in strawberries during postharvest. For a period of cold storage of 12 days, the parameters weight loss, total soluble solids, texture and phenolic compounds were analysed for the three treatments under study: control strawberries, strawberries coated with 1% chitosan and strawberries coated with chitosan at 1.5%. Based on the obtained results, the effect of edible coatings on chitosan was evident. Strawberries belonging to control group exhibited a higher value of weight loss during storage. The evaluated textural parameters, namely external and internal firmness indicated better values for the coated strawberries than for the uncoated fruits. Regarding phenolic compounds, there was a positive effect of chitosan coatings on their increased content. A higher concentration of chitosan in the coating formulation showed better results in maintaining good strawberry quality during cold storage.

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**Key words:** Cold storage, Phenolic compounds, Postharvest, Sensory quality, Texture, Total soluble solids

(P1.22) Dietary intake and biomarkers of folate status among women of reproductive age in Serbia, country without mandatory folic acid food fortification

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**Introduction:** Folate, water-soluble B vitamin, essential for metabolic pathways involving cell division and growth, is recognized as nutrient of particular importance in adverse pregnancy outcomes prevention.

**Objective:** The aim of this study was to estimate dietary folate intake and biomarkers of folate status among women of reproductive age in Serbia, country without mandatory folic acid food fortification policy.

**Main findings:** In a cross sectional study, 503 non-pregnant, non-lactating women aged 18–49 years completed dietary questionnaires (three 24h recalls and validated food frequency questionnaire (FFQ)). Both dietary assessment methods provided similar estimates of mean daily folate intake (FFQ: 206.20 ±61.30 µg DFE vs. 24h recall: 211.0±81.06 µg DFE). Less than 7% of study participants reached folate Estimated Average Requirements (EAR; 320 µg/day) benchmark while more than 90% had folate intakes below Recommended Nutrient Intake (RNI; 400µg/day) for adults. Main food groups contributing folate intake were vegetables/ vegetable products, grains/ grain products and fruits/ fruit products with 37.35%, 23.39% and 11.52% of average daily intake, respectively. Regular consumption of folic acid alone or in the form of multicomponent supplements was reported by 4.77% of women. Representative subsample (n = 50) provided fasting blood samples for biomarker analyses. Mean folate serum level in the studied women was 12.29±6.59 nmol/L and red blood cell (RBC) folate concentration was 438.66±144.63 nmol/L. None of the women met or exceeded 906 nmol/L, the value of RBC folate associated with the lowest risk of having NTD-affected pregnancy.

**Conclusion:** Potential consequences resulting from suboptimal intake and inadequate folate status on pregnancy outcomes and overall health should be perceived by Serbian public health authorities. Findings of this study indicate the need for targeted initiatives and adequate nutritional interventions.

**Key words:** Dietary intake assessment, Folate, Women of reproductive age



## (P1.23) SaltQuanti – New Portable Device to Analyse Salt Content in Food – Validation of the Analytical Methodology

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**Introduction:** Excessive salt intake is a growing concern in society, impacting on a number of serious clinical conditions, such as the development of hypertension and increased mortality / morbidity from cardiovascular disease. The urgent need to introduce mechanisms of in-situ assessment of the salt content of processed foods led to the development of SALTQUANTI, a portable device developed and patented by a consortium promoted by the company EVOLEO Technologies and the University of Porto.

**Objectives:** The objective of this work was to validate the analytical methodology, through a portable device that combines sample preparation with the analytical detection by sodium selective electrode with potentiometric detection.

**Methodology:** The portable device consists of a processing and control unit that interconnects with sensors for the determination of sample weight, volume, sodium content and temperature. The device also controls the milling and stirring process of the sample. The user controls the device via a touch display that can also communicate with a central server via a WIFI connection. The methodology validation involved the establishment of the calibration curve, limits of detection, precision, accuracy and global uncertainty associated to the results. Processed samples from different sources were analyzed.

**Results:** Linearity was in the range from 0,06 to 6,00 g salt / 100 g food. Precision was on average 6% considering repeatability of results for different types of processed food and accuracy was 9% on average (evaluated by the recovery percentage). Interlaboratorial comparison by different analytical methods, including atomic absorption spectrophotometry, validated the results, with deviation of results less than 20% for the different types of samples.

**Conclusions:** The analytical procedure revealed simple and reliable, where automation (sample weigh, trituration, dilution and measurement) enabled the analysis in less than 5 minutes with an acceptable uncertainty.

**Key words:** Method validation, Portable device, Salt content

(P1.24) A classification system to assist compilers in the evaluation of digestion methods for the determination of mineral contents in pseudocereals

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Plant based diet pseudocereals, as quinoa, amaranth and buckwheat, are a rich source of minerals, with many health benefits.

A rigorous analytical determination is necessary to guarantee an estimation of dietary intake as close as possible of real mineral intake. Reliable food composition data is a crucial tool to avoid incorrect estimation of mineral deficiency.

Previously to analysis, a sample decomposition is required which can be undertaken by different digestion methods. The destruction of organic matter is a slow step of the overall analytical process mostly dependent on the content of significant components. Although, due to the lack of certified reference materials for pseudocereals analysis, little information is available to assist compilers and analysts in selecting or comparing the adequacy of digestion method for mineral determination.

This work aimed to identify the suitable digestion method for accurate determination of Cu, Mn, Fe, Zn, Mg, P, Ca, K and Na in pseudocereals assessing in terms of accuracy and precision framed by a quality system.

Analysis were carry out in accordance with ISO 17025. Mineral levels obtained, by ICP-OES, with the three procedures were compared. The adequacy of digestion methods to assist instrumental analysis on determination of mineral contents was score based on three categories of method performance: limit of detection, uncertainty and statistical comparability test. A classification system was rated based on method performance: the digestion method was rejected if results failed in two categories, classified as “use with caution” if results were not satisfactory in one category or accepted if the results passed in all the categories.

All methods were adequate for the determination of Mg and P. It was possible to obtain comparable results with caution, from all digestion methods. This classification system is a useful and pioneer effort to assist compilers and analysts to scrutinize pseudocerals mineral analysis.

**Key words:** Digestion methods, Dry-ashing, Graphite block acid digestion, Microwave, Mineral contents, Pseudocereals

## (P1.25) Vegetarian substitutes for meat in traditional recipes as sources of group B vitamins

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**Introduction:** The increasing number of vegetarians in Portugal in the last decade has led to a growing demand of ingredients that can replace meat in the traditional recipes that are part of Portuguese gastronomic culture. Even though those ingredients are mainly, selected for their protein content often, the similarity of their texture to meat is the primary choosing criterion.

**Objective:** Our purpose with this work was to evaluate some of these ingredients as sources of four group B vitamins: B1 (thiamin), B2 (riboflavin), B3 (niacin) and B6 (pyridoxine).

**Methodology:** Data for vitamin content of 10 ingredients: seitan, jackfruit, edamame, tempeh, tofu, coconut, eggplant, beetroot, cauliflower and mushrooms, was obtained from several of the food composition tables included in EuroFIR databases list. The mean value for each vitamin was calculated for each ingredient and compared with the Daily Reference Intake (DRI) for adults, in terms of percentage.

**Main findings:** Relevant contents of vitamins, equal or higher than 15% of the DRI (14), were reported for five of the ingredients: B6 in jackfruit, B1 and B2 in edamame, B2 and B6 in tempeh, B6 in beetroot and B2 and B3 in mushrooms.

With the exception of seitan, for which vitamin content is reported as null, and eggplant, 100 g of each of the other ingredients can contribute to the intake of 10% of the DRI of, at least, one of the vitamins in study.

**Conclusion:** Most of the meat substitutes evaluated are good choices in terms of group B vitamins content.

**Key words:** Meat substitutes, Vegetarians, Vitamins

## (P1.26) Gluten-free pastry products: Compliance with the Portuguese Integrated Strategy for the Promotion of Healthy Eating (EIPAS)

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**Introduction:** Over the last years, gluten-free foods market has expanded rapidly, because not only there is an increase in the number of people diagnosed with coeliac disease, but also due to the consumer's perception, since they consider that these foods are a healthier option.

**Objectives:** (i) To determine the total fat and salt content of gluten-free pastry products; and (ii) To analyse the compliance with the recommendations of the Portuguese Integrated Strategy for the Promotion of Healthy Eating (EIPAS).

**Methodology:** During 2019, 12 gluten-free pastry products were acquired from the major stores in Portugal. Then, total fat content (acid hydrolysis followed by Soxhlet extraction with petroleum ether) and salt content (Charpentier-Volhard titration method) were determined. Also, the contribution of these foods for the Daily Reference Intake (70 and 6 g/day for fat and salt, respectively) of these components was evaluated.

**Main findings:** Total fat content varied between 7.05 and 28.4 g/100 g. All the analysed gluten-free pastry products had a fat content higher than 15 g/100 g, except crackers (14.1 g/100 g) and ladyfingers (7.05 g/100 g). However, one of the samples with the lowest content of fat was the sample with the highest salt content (1.22 g/100 g). According to EIPAS, it is intended to achieve a salt content lower than 0.3 g/100 g. In this study, 83% of the selected gluten-free products have a salt content higher than 0.3 g/100 g.

**Conclusion:** Similarly to what happens to pastry products with gluten, gluten-free products have a high content of fat and salt. Therefore, the reformulation of these foods, which is a desired goal by the national and international organizations, to offer healthier options to consumers, should be targeted for gluten-free products.

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**Key words:** EIPAS, Fat, Gluten-free, Pastry, Salt

(P1.27) Cereal-based industrialized foods for children under 36 months in  
Natal/RN, Brazil

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**Introduction:** Inadequate feeding practices in children may increase the risk for noncommunicable diseases later in life.

**Objective:** To evaluate the nutritional profile of industrialized cereal-based foods for children from 0 to 36 months sold in the city of Natal/RN, Brazil according to Pan American Health Organization nutritional profile (PAHONP).

**Methodology:** An exploratory cross-sectional study, based on the protocol of the World Health Organization on the availability and nutritional composition of industrialized products for children from 0 to 36 months, was carried out in two socio-demographically distinct areas of Natal/Brazil in 2019, using a mobile application. Cereal-based food labels available at all stores selling baby foods namely supermarkets, convenience stores, bakeries and pharmacies were assessed. Information on the labels was evaluated, particularly nutritional data including macronutrients, sodium, and sweeteners.

**Main findings:** There were 32 stores that sold 25 different cereal foods; the mean (SD) characteristics by manufacturer serving size were: weight, 21.1 g (0.83); energy, 78 kcal (7.8); protein, 1.4 g (0.33), corresponding to 7.1 (1.62) TEV; total fat, 0.2g (0.40), corresponding to 1.9% (4.70) of the Total Energy Value (TEV); saturated fat, 0.0 g (0.02), corresponding 0.0% (0.02) TEV; total carbohydrates, 18g (1.5) corresponding to 90.6% of the TEV; sodium, 16.6 mg (18.6), equivalent to 0.21 mg/kcal (0.23). No products were identified with trans-fat or added sweeteners. The percentage of foods above PAHONP cut-offs were 0% for sodium, sweeteners, total fat, saturated, and trans-fat. Among the 25 analyzed products, 24 had added sugars, but there was no quantitative information on free sugars.

**Conclusion:** The sample of cereal-based industrialized foods meet the PAHONP regarding fats, sodium, and sweeteners. It was not possible to assess free sugars adequacy which is a critical aspect in cereal based industrialized foods.

**Key words:** Cereal-based industrialized foods, Composition nutritional profile, Labelling

## (P1.28) Cholesterol, Fatty Acids Profile and Atherogenic Index of raw lamb and mutton offal

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Offal is reported to be an affordable, alternative nutrient dense animal source food. It is known that offal has a high lipid content, but the fatty acid and cholesterol content is seldom reported on. This study reports the fatty acids profile and cholesterol content of lamb and mutton offal and relate this data to the associated health lipid indices.

No significant differences ( $p \geq 0.05$ ) were found for either the moisture or the fat content between lamb and mutton offal cuts. Cholesterol was highest in mutton tongue (1791 mg/100g) and lowest in lamb lung (11.67 mg/100g). The saturated fatty acid (%SFA) ranged from 1.45% in mutton lung to 17.08% in mutton stomach. The monounsaturated fatty acid (%MUFA) ranged from 0.79% in lamb lung to 22.51% in mutton lung with mutton offal samples generally showing a numerically higher MUFA content than lamb samples. The polyunsaturated fatty acid (%PUFA) varied from 0.107% in lamb lung to 1.93% in mutton tongue. The offal studied in the present work showed a P/S ratio of 0.04-0.05 for lamb and mutton stomach and intestines, while other offal cuts have a P/S ratio of 0.07-1.2. The n-6/n-3 ratio varied between 3.9 for mutton tongue to 12.5 for mutton liver. Offal products contribute consistently to the diet not only in terms of essential fatty acids such as linoleic acid (C18:2n-6) and arachidonic acid (C20:4 n-6), but also towards C20- and C22- polyunsaturated fatty acids and other beneficial unsaturated fatty acids (UFA), such as conjugated linoleic acids (CLA). Lamb offal has a higher atherogenic index (the relationship between SF and PUFA) than mutton with lamb stomach showing the highest value (1.833). The lowest atherogenic index was observed in lamb heart (0.029).

Food products from ruminants and oily fish are the only significant sources of preformed and C22 PUFA in the diet and a principal dietary source of CLA.

**Key words:** Atherogenic Index, Cholesterol, Fatty acids, Lamb, Mutton, Offal

## (P1.29) Building of Albanian food composition database

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**Introduction:** Food composition database due to its ability to provide detailed information on the nutritional composition of foods, may play a crucial role for studies, industries, policies and modelling diet and food, also it is essential for the food safety issues.

**Objective:** The aim of the work was to initiate building of Albanian food composition database.

**Methodology:** Building of the Albanian Food Composition Database started in June 2018 by the Faculty of Biotechnology and Food, at the Agricultural University of Tirana in the frame of the Official Development Support Program for Central and Eastern Europe in the food composition area, and financially supported by the Ministry of Agriculture and Rural Development of the Slovak Republic. In the frame of this cooperation two training sessions were held at National Agricultural and Food Center – Food Research Institute (NPPC-VÚP), in Bratislava in November 2017 and June 2018 focused on capacity building of three Albanian experts to be able to collect and document food composition data by using database management system Daris developed and licensed by NPPC-VÚP.

**Main findings:** In this paper is described the first collection of food composition data in Albania. For documentation of food composition data were used different sources as scientific papers, laboratory reports, food labels, PhD thesis. Agricultural University of Tirana implemented collection of 30 different foods: raw, dried, processed or fermented, of plant or animal origin produced in Albania. Data were documented in program Daris, which allow full value documentation by using the European Food Information Resource (EuroFIR) thesauri. After the compilation process the data were checked according the reference by Slovak compiler from NPPC-VÚP.

**Conclusions:** In the future the Albanian Food Composition Database will be enriched, maintained and up to date with other foods and traditional dishes from Albania.

**Key words:** Collected food data, Documented food data, Food composition databases, Software Daris

## (P1.30) Implications of sugar tax and sodium reduction regulation on South African Food Composition Database

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**Introduction:** As a means of addressing the growing concern of non-communicable diseases, the South African government has implemented tax on sugar-sweetened beverages in 2017 and a progressive sodium reduction regulation (SRR) in processed foods from 2016. The sugar tax and SRR has resulted in significant changes to the composition of affected foods due to product reformulations. This in turn affects the national food composition database as the new values will need to be updated to reflect what is currently consumed.

**Objective:** To assess to which extent the food composition database has been affected by the two legislations as the first step to update the database.

**Methodology:** The South African government gazette detailing the SRR and the policy paper on taxation of sugar-sweetened beverages were studied to identify the foods implicated. Foods implicated in both legislations were identified in the database, grouped and calculated.

**Main findings:** Sugar-sweetened drinks include soft drinks, sugar-sweetened fruit drinks, sports and energy drinks, vitamin water, sweetened iced teas and lemonades. Foods affected by the SRR include breads, breakfast cereals, fat spreads, savoury snacks, flavoured potato crisps, processed meats, gravy and soup powders, savoury powders and all forms of stock. From a total of 1667 food items currently in the database, 15% (n=251) of food items including recipes are affected by the SRR whilst the sugar tax affected only 1% (n=20) food items. The beverages group is mainly affected by the sugar tax with 75% (n=15), whilst the SRR affected mostly the cereals and cereal products group with 58% (n=145).

**Conclusion:** It is important that the national composition database reflect the legislative status of the country as it pertains to food consumed. This analysis has provided a bird-eyes view of affected food items and will be important in creating a comprehensive database updating strategy.

**Key words:** National Food Composition Database, Sodium reduction, Sugar-tax, Regulation, Non-communicable disease, South Africa



## (P1.31) Human Milk Composition Data Repository – Vision and Approaches

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Human milk is a very dynamic and variable biological fluid; its composition influenced by many maternal and environmental factors. Nutrient information on human milk in the USDA food composition databases (renamed as FoodData Central), that serve as the foundation for most nutrient databases used in food policy, research and nutrition assessment, is outdated. Many research studies on human milk are underway, but are limited in sample and nutrients/components explored. A Human Milk Composition Data Repository, as part of the FoodData Central, can provide a platform for researchers to submit human milk composition data (nutrients/components, microbiota, volume) that meets established protocols for sampling, collection, storage, analytical methods and quality control, etc. The repository could be extensive (a preliminary list includes over 450 potential measure, representing 34 categories of interest) and include supporting metadata on maternal, infant, sampling and environmental factors, using standardized vocabulary. For example, human milk sample metadata may include details such as collection, storage and handling methods, and lactation (weeks, fore or hind milk, etc.), among others. Furthermore, computational and statistical tools for analysis and visualization of data and a user interface for depositing, retrieving and analyzing data could potentially be made available, in addition to providing measures of central tendency and variability. The publicly-available Human Milk Composition Data Repository could facilitate understanding of the complexity of human milk composition, impact of maternal and environmental factors, and diet and health-disease-infant development outcome correlations. It could provide a central platform for researchers and public health officials for compiling, evaluating, comparing, tracking, and sharing human milk composition data.

**Key words:** Breast Milk Composition, Human Milk Composition, Variability

(P1.32) The range of variation in regional food composition data for nutrition research: Pilot results for Southeastern Africa

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**Motivation:** Variation in nutrient composition results from gene-environment interaction, modified by storage and processing. We introduce a method to identify the biologically plausible range of variation across a geographic region, combining food composition tables (FCT) with statistical tests to distinguish biologically plausible variation from non-classical measurement error. Our method is readily scalable to identify the plausible range of values, and is used here to combine a new FCT for Malawi with existing Tanzania data to construct a regional FCT.

**Method:** Our approach exploits naturally-occurring power laws, by which multiplicative interactions lead to lognormal distributions of underlying variables, using skewness and kurtosis tests to detect artifacts. To test across diverse nutrients we compare unit-free nutrient content ratios (NCRs) for each nutrient in each food to a common benchmark, which for maximum sample size is the SR28 dataset from USDA (2016), and then flag as implausible the smallest set of observations needed for the remaining data to be drawn from a lognormal distribution that is likely to reflect biological variability.

**Data:** Foods considered for this study include only standardized items for which market prices are collected by national statistical agencies, totaling 55 foods in Malawi and 71 in Tanzania. To obtain NCRs relative to the SR28 benchmark we could match 35 and 49 items respectively for a total of 58 unique items in the regional dataset, leading to a universe of 706 values for 31 nutrients in Malawi, and 851 densities for 30 nutrients in Tanzania.

**Results:** From the pooled set of 1,557 nutrient-food ratios, removal of 223 extreme values leaves a regional dataset for which lognormality cannot be rejected ( $p=0.052$ ). Values in this regional FCT range from 0.36 to 2.75 times their counterparts in SR28. Implausible observations are most common among minerals and least likely for macronutrients, which warrants further investigation.

**Key words:** Data quality, Food composition, Nutrient content

(P1.33) Salt Quanti – new portable device to analyse salt content in food – development of a database of products available on the Portuguese food market

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**Introduction:** Salt intake above WHO (5g/day) is associated with increased risk of cardiovascular diseases, the leading cause of death worldwide. To tackle this scourge, public health strategies are fundamental including nutrition labelling. However, there is not a public database compiling the information of all brands. The Salt Quanti was developed to be a portable and simple device for in-situ measurement of salt in meals. As complement, a database of food products was constructed.

**Objectives:** To create a database with information about labelled salt content of pre-packaged foods available in stores and in the websites of Portuguese food market.

**Methodology:** Products were collected in store and website of three main distributing food chains in Porto (North of Portugal) between March 30th and July 2nd of 2018. A database was constructed based on the following information: date of online and in-store collection, name of the website and store (source of information), product designation, food category and subcategories, brand name, labelled salt content (g per 100g of raw, cooked or drained product) collected in stores and in websites. Salt content was also categorized (Low, Medium and High) according to the traffic light methodology.

**Main findings:** Salt content was collected from 4083 products. Median salt/100g in food categories was: Rice 0.70g (n=27), Potato and potato-products 1.00g (n=196), Pasta 0.88g (n=108), Bread and bread products 1.10g (n=437), Vegetables and legumes 1.10g (n=375), Vegetarian 1.16g (n=182), Eggs 0.30g (n=31), Sauces 1.70g (n=479), Soups 0.70g (n=122), RTE meals 1.10g (n=508), Sausages and charcuterie 2.20g (n=848), Meat and meat products 1.30g (n=273), Fish and fish products 1.00g (n=406), Seafood and shellfish 1.20g (n=92).

**Conclusion:** This work highlights that salt content for each category was above the recommended range. There is a need to reduce salt content of products and simultaneously guarantee reliable information to the consumers.

**Key words:** Consumer, Food database, Nutrition labelling, Portable device, Salt content

(P1.34) Characterization of sugar consumption and adherence of the Mediterranean diet pattern in workers from the National Institute of Health

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**Introduction:** Inadequate eating habits, including excessive consumption of sugars, are related to the development of the diseases that affect most of the Portuguese population, such as obesity and dental caries. Mediterranean Diet is characterized with “occasional” or rarely consumption of sweets and foods with added sugars, however recent data shows that Portuguese are moving away from this healthy dietary pattern.

**Objective:** To characterize sugar consumption and to evaluate the adherence to the Mediterranean dietary pattern in the workers from the National Institute of Health.

**Methodology:** All the workers from the National Institute of Health were invited to participate, and 43 workers (33 female, mean age 38±12 years) agree to participate in the study. Quantification of daily sugar consumption and total energetic value was obtained by 24-hour dietary recall questionnaire which was applied twice, always counting weekdays. Adherence to the Mediterranean dietary pattern was based on the questionnaire PREDIMED. Statistical analysis was performed using the SPSS® program.

**Main findings:** The workers presented a mean Total Energy Intake (TEI) of 1487±458kcal/day, with a mean daily sugar consumption of 63±30g which represented 17.1% of the TEI. Only 4 of the workers presented an ingestion of sugar within the WHO recommended value (10% of TEI). The food groups that contributed most to the sugar intake were fruit, vegetables and legumes (42.96%); dairy products (19.40%) and sweets, cakes and biscuits (18.14%).

It was observed that 16 of the participants (37.2%) obtained a good adherence to the Mediterranean Diet pattern.

In this study, intake of sugars had a moderate correlation to the adherence to the Mediterranean Diet pattern ( $r= 0.586$ ,  $p= 0.596$ ).

**Conclusion:** Most of the subjects (90.7%) had sugar consumption above the recommended value. There was a moderate correlation between the good adherence to the Mediterranean dietary pattern and the value of sugar intake in these workers.

**Key words:** Mediterranean diet, Sugar, Workers

## (P1.35) Food Composition Table User's Utilization and Needs – PortFIR Assessment

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**Introduction:** Food composition tables (FCT) and databases (FCDB) are very important data resources that can contribute to the achievement of health gains through the improvement of knowledge and nutritional status of the population and the promotion of healthy eating, however they are far from complete. Therefore, a continuous development and update of these resources, with great focus in their user's needs, should be considered a priority.

**Objectives:** To identify and assess the type of utilization and needs of the Portuguese FCT/FCDB (TCA) user's, in order to define priorities for its development and update.

**Material and Methods:** Users Working Group (GTU) of the Portuguese Food Information Resource (PortFIR) developed a questionnaire to evaluate the type of use and needs of FCT/FCDB users. The survey was implemented online from March to June 2017.

**Results:** from the 395 respondents, 72.9% indicated its use due to professional activities. 29.7% of the total valid respondents stated to use these resources at least once a week, 55% standing out the TCA. In addition, 53.2% pointed that "Not always" have found the wanted answer in TCA. Regarding their needs, for TCA future updates, users referred "Glycemic Index" (28.8%) as a priority. Concerning other nutrients (1) and dishes/recipes/.../varieties (2) users indicated as more important (1) "omega-3 and omega-6 fatty acids" (27.5%) and (2) "Traditional Portuguese dishes" (15.5%), respectively.

**Conclusions:** The GTU survey results show that FCT/FCDB play an essential role in most nutrition related activities, with TCA being the main source of data (55%). However, 53.2% of TCA user's referred that "not always" have found the information they needed. An intensive and thoroughly work is needed in the development, update and sustainable maintenance of these resources, to ensure data availability accordingly to user's needs.

**Key words:** Food composition databases (FCDB), Food composition tables (FCT), Survey, TCA, Users utilization and needs

(P1.36) Comparison of bioactive compounds in vegetables grown traditionally and agroecologically.

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The efforts in more sustainable and environment friendly agricultural practices are increasing. Organic agriculture is expanding, offering an alternative of diversification in production and consumption. Some studies have shown that vegetables growth in organic conditions show higher amounts of nutrients and phytochemical compounds. Consistent epidemiological studies have suggested that the antioxidant molecules present in the foods can prevent oxidative damage. This protective effect is due to its phytochemical molecules including phenolic compounds and others.

The aim of this work is to compare phenolic compounds, antiradical activity and carotenoids contents in the most consumed vegetables from productive areas of Argentina.

Using the consumption data of the National Nutrition and Health Survey of Argentina, most consumed vegetables were selected. Then, a sampling of these vegetables was carried out in the productive area of General Pueyrredón. Samples of food were taken in its agro ecological crop and in its conventional version. Ethanol and acetone extracts of each sample were prepared in triplicate, then total phenol amount (Folin Ciocolteau) Antiradical Activity (DPPH) and carotenoids contents were measured.

The range for total phenol compounds was 13.47 to 70.07 mg GAE. The range for antiradical activity was IC50 7.06 to 156.46 mg/g. Carotenoids were found in ranges from 170.47 to 1324.7 µg/100 g. A total of 40% of the samples showed a higher content of phenolic compounds and antiradical activity in their agro ecological version compared with the conventional one (pumpkin; lettuce; chard; onions) .In some cases no significant differences were found regarding the mode of production. In no case values of compounds found in vegetables grown in the traditional way were higher.

As a conclusion, agro ecological growth not only offers a more sustainable way of producing foods, but also can contain higher values of beneficial compounds.

**Key words:** Carotenoids, Phenolic compounds, Sustainable agriculture, Vegetabl

(P2.01) Determining the amino acid content of four popular South African potato cultivars

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Increasingly there is an interest in the metabolic effect of specific individual dietary amino acids. In dietary protein evaluation, dietary amino acids should be treated as individual nutrients and wherever possible data for digestible or bioavailable amino acids should be given in food tables on an individual amino acid basis.

Protein is considered the most important macronutrient in the diet because it provides both essential amino acids and is a source of energy. Alternative sources of protein can make a significant contribute to protein intake of vulnerable individuals especially in countries where high quality proteins from animal source foods is scarce. Potatoes are a concentrated source of carbohydrates as well as containing other macro and micronutrients that contribute to human and dietary health and may act as an alternative source of protein in the diet.

Towards investigating the protein quality and amino acids content of alternative sources of protein, four of the most commonly consumed potato tubers (*Solanum tuberosum*) in South Africa were sampled and analysed. Protein content for these tubers varied between 1.65g/100g and 2.19g/100g. In order to draw conclusions from the amino acids data it was compared to the FAO/WHO Scoring Patterns for protein. This showed that tubers can be classified as a high quality protein. Furthermore, there were significant differences in the amino acid content of different South African potato cultivars, likewise there were significant differences in the protein content of the different staple foods.

Even though potatoes are not typically considered a good dietary protein due to the low content, its unique amino acids composition renders it a complete protein that can contribute to dietary protein intake. Currently there is a global strive to produce not only enough kilojoules but enough high quality nutrients with the limited resource without compromising biodiversity and support environmental sustainability.

**Key words:** Amino acids, Nutrients, Potatoes, Protein, Quality

(P2.02) Food composition data integral to assess complementary feeding diet of infants: a case study from Kwamashu, Kwazulu Natal, South Africa

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**Introduction:** The global focus on 1000 days from conception to 2 years stresses the importance this period has on improving infant health. A review of published studies on complementary feeding practices in South Africa showed that poor infant feeding practices still prevail.

**OBJECTIVE:** The objectives of this study were to ascertain the infant feeding practices of 6-11 month old infants and to test if infant nutrient requirements can be met with a food-based approach.

**Method:** Data was collected from a well-baby clinic in KwaMashu, Kwa-Zulu Natal Province, South Africa. Mothers and caregivers were interviewed by trained interviewers. Details on their sociodemographic characteristics and feeding patterns were collected. A quantified food frequency questionnaire was used to collect dietary information over the previous 7 days. This study made use of the World Health Organisation / London School of Hygiene and Tropical Medicine Optifoods linear programming software.

**Results:** One hundred and thirty-four interviews were completed. Results of analyses completed thus far are presented here. Almost a third of infants (30.6%) had started solid foods before 3 months of age. Cereals were the main first foods given, with 56.7% preparing foods at home and 43.3% using commercial products. Soft maize meal porridge and commercial infant cereals were the most popular foods eaten daily, followed by sugar, margarine and peanut butter. Fourteen (14) food items consumed by 40% of the infants were used in the modelling exercise.

**Conclusion:** Food composition data and information to translate household descriptions of portions consumed to grams are critical to improve accuracy of input in the modelling exercise. The outcomes of this study have direct relevance to nutrition communication on complementary feeding and will provide guidance on other actions needed to improve nutrient intakes of infants from KwaMashu.

**Key words:** Complementary feeding, Infant feeding practices, Infant nutrition, Optifood, South Africa



## (P2.03) Nutritional value and bioactive compounds of Thai indigenous plants

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Study of indigenous plants has been continuously conducted to conserve and utilize in local communities for the nutrition well-being. The objectives of this study are to survey vegetable biodiversity and to identify potential food sources in terms of nutrients, bioactive compounds, and antioxidant activities. Young edible leaves of indigenous plants from six varieties were collected from three sources (n=3) gathering at conservative area in Kanchanaburi province, Thailand during January-March 2019. They were investigated in fresh, blanch and/or boil forms, depending on habitual eaten in the local communities. One portion of each sample was freshly homogenized for nutrients analyses; another portion was dried by freeze drying system for bioactive compounds analyses and then kept at -20oC. All vegetables contained high amount of dietary fiber )7-12 g/100g edible portion, fresh weight, FW(. They contained small amount (<2 g/100g FW) of total fat and carbohydrate. Major mineral found in plants was potassium (>400 mg/100g FW). Albizia lebeck (L.) Benth, Melientha suavis Pierre, and Maerua siamensis (Kurz) Pax. contained high vitamin C at the level of 212+32, 146+19 and 126+7 mg/100g FW, respectively. Among studied vegetables, Maerua siamensis (Kurz) Pax provided the highest Oxygen Radical Absorbance Capacity (ORAC, 163478+36809  $\mu$ moles trolox equivalent/100g FW) and total polyphenol (1528+677 mg GA/100g FW). Good correlation ( $r = 0.998$ ) between ORAC and total polyphenol contents was obtained. Lutein and  $\beta$ -carotene were major carotenoids of all studied vegetables. Quercetin and kaempferol were dominant flavonoid species. This study provided information on nutritive values, phytochemicals and antioxidant activities of Thai indigenous vegetables into food composition databases. These vegetables have been conserved, utilized, and promoted for consumption as common foods.

**Key words:** Indigenous plant, Nutritional value, Bioactive compound, Antioxidant activity

(P2.05) Study of the chemical quality and sensory profile of walnut pastes elaborated with raw and roasted nuts.

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Walnuts (*Juglans regia* L.) are considered important snacks and confectionary foods, with essential nutritional value arising primarily from their high lipid content. The aim of the present work was to determine the chemical quality and sensory profile of walnut pastes prepared with raw and roasted nuts. Walnut fruits (var.Chandler) were collected from Belen location, Catamarca Province, Argentina. In order to select the adequate thermal process condition, six roasting treatments (100,120 and 140 °C, 10 and 20 min) were carried out. Oxidative stability index (OSI, 110°C, 20 L/h) and peroxide value (PV, meq O<sub>2</sub>/kg oil) were analyzed in all samples. A sensory analysis of preference and descriptive were also performed. The average PVs obtained were 0.33 for raw nut, 0.67 for nuts treated at 100°C and 120 °C during 10 and 20 min, 2.01 and 3.30 for nuts treated at 140°C during 10 and 20 min; respectively. OSI values were among 7.30 and 15.01 h, where the lower values correspond to the nuts treated at 140°C. The sensory analysis showed that nut treated at 120 °C - 20 min was preferred by the panelists. The pastes were formulated with 70 and 90% of raw and roasted walnuts. The rest of the ingredients were adjusted according to nut content. PVs were 1.33 and 2.67 for the paste elaborated with roasted nuts, and 0.67 for the paste based on raw nuts. In regard to the sensory test, the pastes with 70% of raw and roasted nut were chosen in first and second place, respectively. All the pastes presented an intense aroma and distinctive nutty flavour. The pastes with raw walnuts were characterized by a higher bitter value, while the roasted walnut pastes, by acid and salty values, with a toasted note in harmony with the set. The sweet attribute followed the expected trend of sucrodex content, emphasizing in formulations with roasted nuts. Finally, the chemical quality and sensory profiles of the pastes produced with raw and roasted nuts were statistically different from each other.

**Key words:** Chemical quality, Pastes, Sensory, Walnut

## (P2.06) Antioxidant activity of defatted wheat germ affected by hot air and microwaves

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The effect of hot air (HA) and microwaves (MW) on the antioxidant activity of wheat germ was evaluated. Processing conditions were: 150, 180 and 200 °C for HA (air temperature) and 50, 60 y 70 °C for MW treatments (sample temperature) with 4 intermediate times in each case. Total phenolic content (TPC), radical scavenging activity (ABTS) and reducing power (FRAP) were measured.

HA treatment was performed on a convective oven. MW system had a monochromatic wave (2.45 GHz, 300W). Irradiated power varied as a function of surface sample temperature.

Defatted raw wheat germ (not thermally treated) had  $34.15 \pm 0.46$  mg GAE/g,  $9.76 \pm 0.40$  mg Trolox/100 g (FRAP) and  $10.53 \pm 0.44\%$  inhibition (ABTS). In MW processing a significant decrease of TPC was observed, with reductions of 30, 15 and 29% with respect to raw sample at 50, 60 and 70 °C, respectively. In HA, small variations of TPC as a function of time were observed but there was not a general tendency, which could be attributed to the simultaneous degradation of native compounds and the formation of unstable Maillard reaction products. An increase of the reducing power was observed at 200 and 150 °C ( $p < 0.05$ ). Conversely, a decrease of this parameter was observed due to MW at all temperatures assayed. Final values were  $4.70 \pm 0.69$ ;  $6.82 \pm 0.59$  and  $7.47 \pm 0.75$  mg Trolox/100 g (50, 60 and 70 °C).

To conclude, wheat germ exhibited antioxidant activity. Two mechanisms were assayed, being the radical scavenging the predominant one. HA and MW affect differently wheat germ antioxidant activity. HA mainly increases the reducing power, while MW enhance radical scavenging capacity.

**Key words:** Antioxidant activity, Convective treatment, Microwave, Wheat germ

(P2.07) Zinc deficiency in an apparently healthy population living in Serbia,  
is there a reason for concern?

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**Background:** The burden of zinc (Zn) deficiency is most common in low income countries, however inadequate intake of Zn is very often seen in developed areas of the world where overeating becomes a public health concern. Deficiencies of Zn are not related to the quantity of food consumed, but rather to the quality of the diet.

**Objective:** This paper reports on Zn intake and investigates the link between dietary Zn intakes and associated biochemical parameters in a healthy Serbian adult population; 25-65 years old. In addition, it identifies patterns of Zn intake, recognizes main dietary sources, describes plasma Zn status and assesses the effect of some socio-economic factors on Zn intake.

**Methodology:** Food consumption was assessed by 24 h recall questionnaires. Zn content of foods and dietary assessments were determined using the Serbian food composition database, harmonized with EuroFIR and Balkan food platforms. The bioavailability of Zn was estimated using an indirect method by Jati et al. and plasma Zn status was measured by atomic absorption spectrometry.

**Main findings:** Mean daily Zn intakes were 9.1 mg for males and 7.3 mg for females. There was no association between the dietary Zn intake and plasma Zn status. 15-25 % percent of the study population had inadequate Zn intakes. There is a lack of data on the phytate content of foods in majority of food composition databases. Age, education level, marital status and income were not associated with differences in Zn intakes.

**Conclusion:** Considering the health consequences of prolonged inadequate Zn intakes regular follow ups are needed to determine the intake and status of this important nutrient and to make sure that potential deficiencies of Zn are recognized and addressed timely. Food composition databases need to be updated with the information on the content of phytate in various foods.

**Keywords:** adults, dietary Zn intake, healthy population, phytate, Zn, Zn status

**Key words:** Dietary Zn intake, Food composition database, Phytate, Zn status

## (P2.08) Nutritive value of different raw and processed eggs consumed in India

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**Introduction:** Eggs are a common food which are very good source of inexpensive, high quality protein as well as other minerals and vitamins. They are one of the most versatile ingredients used in cooking and are important in many branches of the modern food industry. Eggs of different species are available for consumption and there are many ways of processing it.

**Objective:** To study the effect of various cooking methods on the nutrient composition of eggs of different bird species.

**Methodology:** Eggs from four different birds i.e., poultry (whole, white and yolk), country hen, duck and quail were analyzed. Comprehensive nutrient composition of raw, boiled and roasted (omelet) for each type of egg was analysed.

**Main findings:** Protein content of raw eggs ranged from 10.84-15.74%. The boiled eggs had higher protein than raw, except poultry whole egg and duck egg. But all roasted (omelet) eggs had higher protein content than boiled and raw eggs. Total fat content was found to be higher in the cooked eggs. The highest fat content among the eggs and egg products was observed in the poultry egg yolk (26.34%) and least in poultry egg white (0.06%). Water soluble vitamin content decreased after cooking in the most of the eggs while, remained in the country hen egg and duck egg. The highest vitamin B6 (0.29 mg/100g) and B9 (112 µg/100g) was found in raw poultry yolk. Vitamin E content was decreased in boiled eggs but increased significantly in roasted eggs. Vitamin D3 content ranged from 0.74-5.73 µg/100g with highest in quail raw egg. Vitamin D3 content was found lower in boiled eggs and higher in roasted eggs. Fe, Zn and Ca content were higher in the cooked eggs than raw eggs. Boiled poultry egg yolk had the highest minerals content.

**Conclusion:** This study allows to understand not only diverse nutrient composition of eggs from different bird species but also the impact of different types of cooking on its nutrient content due to physico-chemical changes.

**Key words:** Egg and egg products, Food composition, Nutritive value, Poultry products, Processed eggs

## (P2.09) Nitrates contents in Portuguese TDS samples

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**Introduction:** Nitrates are common in nature and widely found in foods, waters and soils. Although nitrates are not apparently toxic, their metabolites and reaction products, such as nitrite, nitric oxide and nitrosamines make this substance of regulatory importance because of its potentially adverse health effects. Among all foodstuffs that can contribute to the exposure, vegetables are considered the main source of dietary nitrate intake. Although they are an important source of nitrate, the increase of consumption of vegetables is widely recommended because of their beneficial effects on health.

**Objectives:** Determination of the nitrate content in the samples of the Portuguese TDS.

**Methods:** A total of 164 samples were collected and prepared under the Total Diet Study Exposure Project (TDSExposure). The samples were purchased in Lisbon Metropolitan Area supermarkets between 2014 and 2016. Each sample was composed of 12 sub-samples and were prepared as consumed. FoodEx2 system was used to sample classification. The nitrates determination were performed by an HPLC method.

**Results:** As expected, the group of "vegetables and vegetable products" was the one with the highest levels of nitrates with a maximum value of 1729 mg/kg for lettuce. In the group of "composite dishes" the highlight is for a sample of lettuce and tomato salad with a nitrate value of 911 mg/kg. Processed meat samples (group of "meat and meat products") showed quantifiable nitrate levels, probably due to the presence of food additives (preservatives). The "fruit and fruit products" and "starchy roots or tubers and products thereof, sugar plants" groups had nitrate levels that also contribute to the intake.

**Conclusions:** Among all the food groups studied, vegetables, and among them, leafy vegetables (lettuce, turnip greens and cabbages) are those with the highest concentrations of nitrate. These results will be used for the evaluation of the exposure of the Portuguese population to nitrates.

**Acknowledgements:** Thanks to Ana Rita Laia and Ana Catarina Rebelo for analytical determination of nitrates.

**Key words:** Nitrates, HPLC, Total Diet Study, TDS

## (P2.10) Vitamin D in food samples based on a TDS approach

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**Introduction:** Vitamin D occurs in two distinct forms: vitamin D<sub>2</sub> (ergocalciferol) and vitamin D<sub>3</sub> (cholecalciferol). It is necessary in human diet to calcium absorption and regulation, as well as bone development and in the immune system. Humans naturally produce vitamin D through exposure to sunlight. Vitamin D deficiency became a major health concern in many societies, as ever-growing numbers of people began spending most of their daily routines indoors and removed from sunlight. According to EFSA, the daily intake values should be between 10 µg/day for infants and 15 µg/day for adults, for both genders. **Objectives:** To evaluate the vitamin D content of representative samples of the Portuguese consumption, based on a Total Diet Study (TDS).

**Methods:** Sampling and preparation of samples were carried out within the framework of the European project TDSExposure. 53 samples, consisting of 12 sub-samples, were selected from the total of 228 samples collected in 2014-16, corresponding to the non-logical zeros for vitamin D. Samples were classified using the FoodEx2 system. The identification and quantification of vitamin D in food were made by a normal phase semi-preparative HPLC method followed by a reverse phase analytical HPLC method using a DAD-UV-Vis detector, with internal standard.

**Results:** In the groups analysed, the major total vitamin D content found, in µg/100 g, were composite dishes (bread and fish based dishes 30.5 and seafood rice 15.2), fish and products thereof (white seabream 14.0, gilthead seabream 13.8, sole 9.2, sardines 6.6 and canned sardines 8.6).

**Conclusions:** Based on the results, fish and products thereof and fish based composite dishes are very good sources of vitamin D. The results obtained combined with food consumption will enable to evaluate the intake of vitamin D by the Portuguese Population based on a TDS approach, using a relatively low number of samples, laboratory analysed.

**Key words:** HPLC, Portuguese population, Total Diet Study (TDS), Vitamin D

## (P2.11) Content of vitamins B1 and B2 in meat and vegetable products consumed by the Portuguese population

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**Background:** Vitamin B1 and B2 are key nutrients in Food Composition Tables. Information on food composition is needed for diet quality assessment and the development and application of food based dietary guidelines, providing a useful tool for the field of nutrition in public health.

The purpose of this study was to evaluate the content of vitamins, B1 (thiamine) and B2 (riboflavin), in samples of meat and vegetable products consumed by the Portuguese population, in the context representative sampling plan of total dietary pilot study carried out in Portugal in the period of 2014-2016.

**Methodology:** The contents of thiamine and riboflavin were determined in 27 composite samples, collected between 2014-2015 in the metropolitan Area of Lisbon, according to the methodology of the TDS. Each sample was composed of 12 subsamples representative of the habits of consumption for that type of food. Samples were taken at four different times in order to be reflected seasonality and were prepared according to the most commonly used culinary processes.

The analytical methodology used for the quantification of vitamins was HPLC- liquid high-resolution chromatography with Fluorescence Detector, according to EN 14122 for thiamine and EN 14152 for riboflavin.

**Results:** For vegetable products, the values found for riboflavin range from 0.02 mg / 100 g in onion bulb and common melon to 0.330 mg / 100 g in mushroom.

For thiamine, all values were below the method quantification limit (LQ), 0.05 mg / 100 g. Meat products revealed riboflavin values of 0.06 mg / 100g in Frankfurter type sausages to 0.220 mg / 100 g in Sheep fresh meat.

For thiamine, the values range from 0.05 mg / 100 g (LQ) for rabbit fresh meat and Frankfurter type sausages to 0.660 mg / 100 g in raw cured meat.

**Conclusion:** According to the results, mushrooms was the sample with the highest riboflavin (B2) content in the vegetable group. For thiamine (B1), the values were below the method quantification limit.

For meat products, the food with the highest thiamine level was pork meat, whereas for riboflavin level the samples were all in the same range.

**Key words:** Thiamine, Riboflavin, Total Diet Studies



## (P2.12) Multielement fingerprinting, isotope ratios and chemometrics as tools to trace the geographical origin of wine

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The aim of the present work is to develop a chemical fingerprint using multielement analysis and isotope ratios, for tracing the geographical origin of Douro and Port wines. Both wines are produced within the Douro region, located in northeastern Portugal. Although the terroir is the same the fermentation of Port Wine is interrupted with the addition of “Aguardente Vínica” (alcohol distilled from wine) which alters the sweetness of the wine according to when it is added.

Thirty samples of wine were supplied by the Instituto dos Vinhos do Douro e do Porto. Samples were digested using closed vessel microwave digestion. Multielement analyses were carried out, in triplicate, in compliance with NP EN ISO/IEC 17025. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was used for the determination of 25 elements (Li, Be, B, Al, Cr, Mn, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Mo, Cd, Sn, Tl, Pb, Fe, Mg, Ca, Na, P and K). The digests were further purified for strontium isolation and determination of <sup>87</sup>Sr/<sup>86</sup>Sr ratio by Multicollector ICP-MS. <sup>18</sup>Oxygen was determined by Isotope Ratio Mass Spectrometry (IRMS).

Results showed that all legislated elements (B, As, Pb, Zn, Cu and Cd) complied with maximum admissible values. Cd and Tl were removed from the statistical analysis since results were below the limit of quantification in all samples. Principal Component analysis (PCA) was applied to the remaining samples. This unsupervised method returned 5 principal components (PCs) that explained 82% of total variance. Twelve parameters (Li, B, Rb, K, <sup>87</sup>Sr/<sup>86</sup>Sr, Cr, Ni, Cu, Pb, Fe, Sr, Mn) showed influence in the PCs and therefore were used for Hierarchical Cluster Analysis (HCA). Based on the results from HCA a predictive model using Linear Discriminant Analysis (LDA) was constructed. Samples were chosen either for building the LDA model or as cross validation data, according to the results obtained in the HCA.

According to the obtained results it is possible to distinguish between Port and Douro wines based on elemental inorganic analysis and Sr isotope ratios. However, the choice of samples used for the construction of the predictive model is crucial for correct identification. Data was produced in compliance with quality requirements therefore being adequate to integrate Food Composition Databases.

**Key words:** Geographical origin, Isotope ratios, Multielement analysis, Wine,

(P2.13) Identification of animal species and foreign tissues in Lahmacun and pita mixtures sold in Istanbul, Turkey

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Meat is one of the most important foods for human beings which contains high amounts of biologically relevant proteins and minerals. Cutting meat into pieces can reduce the quality and shorten the shelf-life of the products. Besides, the addition of undesired tissues, including inedible parts with high amounts of fat, bones, cartilage, horn and nails is prohibited, these tissues can negatively affect the structural elements of the manufactured products, can lead to unfair competition and can increase the potential risks for adverse consumer health effects.

Therefore, a total of 120 fresh processed beef meat mixtures used for lahmacun and pita productions were collected from local restaurants in the districts of Istanbul, Turkey were investigated by histological and biomolecular methods to determine the extent of product imitation and adulteration.

For this purpose, samples were analyzed for the presence of cattle, horse, chicken and pork meats and foreign tissues. Chicken and horse tissues were found in 22 (18.33%) and only in 1 (0.83%) of the analyzed samples, while pork tissue was not detected. Additionally, foreign tissues were detected in 35 (29.16%) of 120 samples that 16 (45.71%) of them were poultry originating tissues and 19 (54,29%) of them contained cattle based foreign tissues. The dispersion of these foreign tissues were kidneys (20%), liver (11.43%), skin (5.71%), heart (22.85%), lung (2.86%), bones/cartilage (14.28%), and gizzards (22.85%).

As a result, conscious and/or accidental contamination of foreign tissues from animal species, including bone and cartilage pieces, heart, kidneys, liver, gizzards and lungs, in a meat product obstructs the establishment of food safety. Thus, it can be concluded that the biomolecular and histological methods are functional tools for routine assessments of authenticity and quality of meat based products to protect the consumers from fraudulent practices of meat substitution.

**Key words:** Animal species, Authenticity, Foreign tissues, Lahmacun and pita mixtures

(P2.14) Insects functional foods source of macronutrients to prevent malnutrition.

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There is a large amount of information about functional foods, defined as part of a varied diet on a regular basis at effective levels of substantial evidence linking diet to health outcome, however controversy is regarding the standard of scientific evidence required to support health claims. Some countries consider functional foods as culture, others rely on scientific substation including improved welfare, or reduction risk in diseases by functional foods and food components, in humans. Population in Latin America suffer malnutrition due to lack of macronutrients intake, however insect consumption is a cultural tradition, but not in a regular diet. The aim of this research was to assess macronutrient composition of the insects consume and promote their inclusion in a daily diet to prevent malnutrition. Adult ants consume in 1) México, noku or chicanas, in 2) Colombia, culona ants, and in 3) Brazil, tanajura ants, were obtained at food markets of named countries in 2018 and chemical analysis in dry basis of proteins, lipids, minerals, fiber and soluble carbohydrates, provide according AOAC (1995) methods. Data obtained was: proteins 1) 45.01 %; 2) 43.95 %; 3) 42.69%. Lipids 1) 31.08%; 2) 37.07%; 3) 38.45%. Minerals 1) 3.24%; 2) 3.84%; 3) 3.01%. Fiber 1) 6.92%; 2) 7.57%; 3) 8.09%. Soluble carbohydrates 1) 13.75%; 2) 7.57%; 3) 6.76%. Ants are high in proteins and low in soluble carbohydrates source of energy, however excess of proteins by gluconeogenesis process is converted in glucose and energy, high in lipids essential for fat soluble vitamins, and minerals, not separate analyzed, in conclusion ants consumption are a good option to provide nutrients with other foods to prevent malnutrition.

**Key words:** Ants, Functional foods, Health, Insects, Malnutrition

## (P2.15) Sea cucumber underutilized food source of nutrients.

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People nutrition in the world nowadays is over-dependent on a few plant and animal species. Diversification of production and consumption habits to include low range of species in particular those currently identified as underutilized that can contribute significantly to improve health and nutrition, food security and ecological sustainability, such as Sea Cucumber marine specie consume in several countries in the world, closely tied to cultural tradition of sea side population can contribute to combat hidden hunger. México with 11,000 km of costal zones is a potential producer of sea cucumber species, foodstuff abundant and easy to collect near the sea shore. The objective of this paper is to assess macronutrients in sea cucumber Holothurais to inform population their nutritional benefits these echinoderms can provide to human health, and promote their consumption among costal residents. Conventional sampling was provided in 2018 at Acapulco, Guerrero state and sea cucumber macronutrients analyzed for proximal composition in dry basis according AOAC 1995 methods. Data obtain was: proteins 26.05%; lipids 3.53%; minerals 17.30%; fiber 1.78%; soluble carbohydrates 51.34%. Sea cucumber has a good amount in proteins essential for life, and carbohydrates source of energy, fiber and lipids are low and minerals are high as well, separate elements were not identify, composition can vary according environment biotic and abiotic conditions. Sea cucumber has delicacy sensory characteristics of softness and flavor and are well accepted by population therefore are a good option to improve health and food security.

**Key words:** Food security, Health, Nutrition, Sea cucumber, Underutilized food

(P2.16) Low-salt traditional dry-cured sausages manufactured from Portuguese native pure and hybrid swine breeds

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The Portuguese native swine breeds Alentejano (Al) and Bísaro (Bi) were on the edge of extinction at the end of the XX century. Both are traditionally bred in extensive systems and have not been submitted to genetic improvement programmes. Al is a fat pig from the Mediterranean pigs' group, related to the Iberian pig, while Bi belongs to the Celtic pigs' group. The main aim was to evaluate the effect of genotype and salt content on product quality, food safety and consumers' sensory acceptability. The final goal is to preserve native swine breeds, contributing to the biodiversity and sustainability of the natural ecosystems they inhabit, such as the Montado (Al) or the Trás-os-Montes highlands (Bi).

Standard (6% NaCl) and low-salt (2% NaCl) Portuguese traditional dry-cured sausages were produced in a local industry with four pig genotypes: Al, Bi, and the hybrid Ribatejano (Ri), BiAl and AlBi. Three independent batches were produced. Sausages' quality was assessed by physicochemical (pH, aW, fat content, biogenic amines), microbiological and sensory parameters.

Bi and BiAl sausages had a higher fat content ( $P < 0.001$ ). pH was significantly lower, while aW was significantly higher in low-salt sausages ( $P < 0.05$ ). The total content in biogenic amines was significantly higher ( $P < 0.05$ ) in Al sausages, due to the higher amounts of putrescine and cadaverine. Lactic acid bacteria counts are not influenced by genotype or salt content. Staphylococci numbers increase with salt content, while the number of enterobacteria decrease. No significant sensory differences were found between Al and Ri dry-cured sausages. Moreover, salt reduction did not compromise neither sausages' quality nor acceptability.

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**Key words:** Biodiversity, Biogenic amines, Microbiota, Native breeds, Salt content, Sensory acceptability

(P2.17) Eco-innovative iodine and selenium fortification in farmed fish:  
seabream and carp as case studies

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Iodine (I) and Selenium (Se) lower intakes are associated with cardiovascular, neurophysiological and hypo/hyperthyroidism diseases [1]. The development of tailor-made farmed fish with adequate nutrients levels through natural and sustainable ingredients represent a potential strategy to overcome population nutritional deficiencies [2]. This study aimed to evaluate an eco-innovative strategy towards I and Se fortification (iodine-rich macroalgae and selenized-yeast) in farmed seabream and carp. Fish were fed with four diets (control and three supplemented diets) for three months (350-400g), slaughtered following commercial practices and skinless fillets were collected: one fillet for raw assessment and other for steaming (105°C, 15 minutes). Iodine and Se contents were determined by ICP-MS [3]. Higher I and Se contents were found with supplemented diets. Iodine fortification was more effective in carp (increased over 100% in fortified in relation to non-fortified), than in seabream (increased up to 37%). Contrarily, Se fortification was more effective in seabream, increased up to 98% compared to 41% in fortified carp. Steaming increased I and Se contents in both non-fortified and fortified fillets. Concerning nutritional benefits, the consumption of 100g (children) or 200g (adults) fortified carp fillets, provide 25% and ~35-90% of the Adequate Intake (AI) set for I and Se, respectively. Contrarily, fortified seabream fillets provide ~15% and up to 100% of the AI set for I and Se, respectively [4,5]. Noteworthy, fortified seabream consumption still yielded Se intakes below the Upper Level (38% for adults and 66% for children) [5]. These results reveal that farmed fish fortified with natural ingredients following can be a sustainable, nutritious and cost-effective solution to overcome nutritional deficiencies of tomorrow's consumers.

**Key words:** Common carp, Fortification, Gilthead seabream, Iodine, Selenium, Steaming

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(P2.18) Vitamin D in wild and farmed Atlantic salmon (*Salmo salar*) – what do we know?

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Salmon as a fatty fish is generally regarded as having high vitamin D content.

Objectives: 1) to investigate if vitamin D content in fillet from wild Atlantic salmon (*S.salar*) is independent of catch area, 2) to investigate if high levels of vitamin D<sub>3</sub> addition to fishfeed (3.6- up to 20-times maximum allowable level in the EU), and 3) to conduct a review of the published data on vitamin D content of wild and farmed, raw *S.salar*.

Methodology and main findings: 1) Wild *S.salar* was caught in two different waters in North Europe. Mean ( $\pm$ SD) content of vitamin D<sub>3</sub> in the fillet from salmon caught in the Baltic Sea and the North Sea was significantly different ( $p < 0.05$ ), being  $18.5 \pm 4.6$   $\mu\text{g}/100\text{g}$ , and  $9.4 \pm 1.9$ , respectively. 2) The feeding trial in *S.salar* (initial weight  $\sim 1$  kg) with 4 levels of feed vitamin D<sub>3</sub> addition (270-57,000  $\mu\text{g}/\text{kg}$  feed) was run for 12-weeks. While the content in the fillets increased from  $2.9 \pm 0.7$  to  $9.5 \pm 0.7$   $\mu\text{g}$  vitamin D<sub>3</sub>/100 g with increasing level of vitamin D in feed, these were surprisingly low vitamin D contents considering the salmon were fed a minimum 3.6-times higher than the current EU upper-limit. Mean 25-hydroxyvitamin D<sub>3</sub> content did not differ ( $0.14 \pm 0.05$   $\mu\text{g}/100\text{g}$ ). 3) Our literature search identified four studies reporting the content in wild *S.salar* between 8-37  $\mu\text{g}$  vitamin D<sub>3</sub>/100g and 0.15-0.36  $\mu\text{g}$  25-hydroxyvitamin D<sub>3</sub>/100g. In farmed salmon, the reported content in eight studies ranged from 2.3-9.1  $\mu\text{g}$  vitamin D<sub>3</sub>/100g and 0.37-1.5  $\mu\text{g}$  25-hydroxyvitamin D<sub>3</sub>/100g. Data of vitamin D in Atlantic salmon are limited, which is likely related to the challenging nature of vitamin D quantification in foods.

Conclusion: Salmon is an excellent source for vitamin D, but these new results show a huge variation in the vitamin D content in farmed as well as in wild salmon. Further research is needed to understand the levels of vitamin D in salmon, and ensure a production of salmon with adequate vitamin D content for consumer health.

**Key words:** Atlantic salmon, Farmed, Vitamin D, Wild



## (P2.19) Sodium content in street food, fast food and artisanal foods consumed in Argentina

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The selection and consumption of food is determined by several factors that influence food habits and impact on people's health. Street food is currently a relevant phenomenon at economic and sanitary level; artisanal foods contribute to gastronomic wealth country and fast food was incorporated into the population habits. These three categories of foods are associated with non-communicable diseases. WHO/PAHO promote the reduction of sodium (Na) consumption, which is one of the associated risk factors. In Argentina there are voluntary agreements to reduce Na in industrialized foods and in bakeries but there is no control in the above mentioned foods.

Provide information on Na content in three food categories: street selling, artisanal and fast food.

Seven foods/category were selected and 9 units/food were analyzed. Artisanal: cheese, empanadas, tamales, humitas, maicenas, pastafrola, pickles and goat cheese. Fast food: pizzas, Neapolitan Milanese, loin sandwich, Milanese sandwich, hamburger, chicken with salad and chard cake. Street sale: choripan, hot dog, crumb sandwich, brochette chicken, tortillas, papuchas and meat empanadas. AOAC methods were used: Moisture(925.09), Ash(923.03), and Sodium(963.15). Values were expressed as mean $\pm$ SD. Analysis of variance was performed and the Tuckey test was applied.

Significant differences were found in the average Na content among the foods of the three categories and a wide variability within the same category. The average obtained Na contents were: Street foods 549.40 mg/100g (r:74.26-1085.20); Artisanal foods 627.88 mg Na/100g (152.23–1373.16); Fast foods 702.92 mg Na/100g (387.63–1501.59). The high sodium content in many of them shows that the intake of a portion would exceed the maximum recommended value (2,500 mg/day).

This study contributes to know Na content in three categories of unregulated foods. It is necessary to raise awareness among food processors about the importance for health of reducing sodium consumption.

**Key words:** Intake, Sodium content, Unregulated foods

(P2.20) Bioactive compounds content of *Scolymus hispanicus* L. grown in Aegean Region of Turkey

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Wild edible plants are collected by humans to be used as a food source since ancient times. Although there has been an increasing interest regarding the consumption of wild edible plants in modern diets recently, there is still a lack of sufficient data on the nutritional value of wild or underutilized species and they are seldom included in nutrition databases, programmes and interventions. This research was conducted as a part of the GEF funded “Bioversity for Food and Nutrition” Project which is working to increase information about nutritional value of agrobiodiversity and associated traditional knowledge and awareness about the conservation and sustainable use of agrobiodiversity in Brazil, Turkey, Sri Lanka and Kenya. *Scolymus hispanicus* or “Golden Thistle” is one of the prioritised species of Turkey in the Project and several studies have been carried out on this plant. Golden Thistle, locally known as “Şevketi bostan” or “Akkız” is one of the most appreciated wild vegetables in Aegean Region of Turkey. Roots and young leaves are consumed while extracts from the root barks has been used as medicine traditionally. Although it has grown in the wild, for sustainable and culinary use domestication and cultivation have been succeeded.

In this study, the roots and stems with leaves of golden thistle were characterized in terms of bioactive compounds using liquid chromatography/quadrupole time-of-flight mass spectrometry (LC/QTOF-MS). The chemical analysis revealed higher content of chlorogenic acid, D-(+) malic acid, 1-p-hydroxybenzoic acid, rutin, ellagic acid, isorhamnetin 3-O rutinoside and isorhamnetin 3-O glucoside in stems and leaves compared to root. The study showed a great diversity in terms of chemical composition of the different edible parts of golden thistle. These new findings suggest that Golden Thistle can be considered as a valuable food resource in human diet.

**Key words:** Bioactive compounds, Golden thistle, LC/QTOF-MS

(P2.21) Availability of baby foods among areas of higher and lower income  
in the municipality of Natal / RN, Brazil

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**Introduction:** There are several industrialized baby foods available on the market and their accessibility can also determine food choices. Inequalities in food availability have been directly related to income and spatial segregation, and it is important to assess whether these disparities also occur in the supply of food for children.

**Objective:** To compare the availability of baby foods available in the areas of highest and lowest per capita income in the city of Natal / RN, Brazil.

**Methodology:** A quantitative, transversal and exploratory study carried out in 32 supermarkets, markets and pharmacies in four neighborhoods of the city of Natal / RN, Brazil, two of the largest and two of the lowest income per capita. This work is part of the research "Nutrition composition of industrialized food for 0 to 36 months old children: case study in Brazil and Portugal". Data collection was performed through the Baby Food application, which evaluated the labels of all foods that in their packaging indicated consumption for children up to 36 months.

**Results:** Of the total of 550 foods in the application, 86.9% (n = 478) of them were found in the higher income neighborhoods and 13.1% (n = 72) in lower income neighborhoods (p<0.001). The highest income neighborhoods had an average of 36 products per establishment, while those with the lowest income had an average of 8 products per establishment.

**Conclusion:** It was possible to observe a great disparity between the availability of infant food in the areas of higher and lower income, being found food deserts in regions of social vulnerability. Therefore, it is possible to verify that the income of the region can influence the availability of industrialized baby food.

**Key words:** Baby Food, Industrialized food, Per Capita Income

## (P2.22) Nutritional and phytochemical characterization of colored barely germplasm

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**Introduction:** Barley is 4th important cereal of the world however only limited amount of produced barley is utilized for direct human consumption (up to 4%). Barley is available in different forms including hull-less, hulled and colored type. Colored barley may contain elevated levels of bioactive compounds, anthocyanin and polyphenols among cereals, which may help in management of NCDs.

**Objective:** To evaluate the nutritional, polyphenols and antioxidant potential of pigmented barley

**Methodology:** Barley samples - Different colored hull-less barley namely IC-444236 (Blue-Green), Sheikh-B1 (Blue-Green), IC-356119 (Pink-Purple), KP-706 (Purple-reddish), EC-667595 (Black Hulled) and normal hull-less (Karan) and hulled (DWR-137) were supplied by NBPGR, New Delhi (India).

**Main findings:**  $\beta$ -Glucan, a unique soluble dietary fiber in barley, ranged from 4.1% (Karan) to 6.3% (Sheikh-B1). The highest total flavonoid content recorded for barley KP 706 while TPC varied between 2533 to 2933  $\mu\text{g/g}$  among all barley accessions evaluated. Preliminary HPLC screening for the individual polyphenols of barley exhibited that the p-hydroxybenzoic acid, caffeic acid, sinipic acid, ferulic acid and 4-coumaric acid content was found the highest in barley germplasm sheikh B1. DPPH-free radical scavenging activity was found to be in range of 29 to 46% where pigmented barley exhibited the higher value of metal chelation than normal barley.  $\beta$ -Sitosterol was found to be the most predominant phytosterol and ranged between 28.84 to 58.07 mg/100g. Among the minerals, P (316 to 523 mg/100g), K (301 to 526 mg/100g), Mg (118 to 150 mg/100g) were found to be the predominant while Fe and Zn content varied between 2.85 to 7.56 and 2.73 to 7.08 mg/100g, respectively.

**Conclusion:** Colored barley accessions have shown the higher content of bioactive compounds including beta glucan, flavonoids and antioxidant potential which play important role human health. Therefore, it may be promoted as healthy cereal.

**Key words:** Anthocyanin, Antioxidants, Colored barley, Polyphenols

(P2.23) Peanut oil screw press extraction from seeds with and without tegument.

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The peanut (*Arachis hypogaea* L.) belongs to the botanical family of legumes. The nut contains high oil content (45 - 50% b.s.). The objective of this work was to optimize the extraction of peanut oil from seeds with and without tegument using mechanical pressing and to evaluate the chemical quality of the obtained oils. To carry out the extractions, a screw press was used (model CA 59 G, Komet brand, IBG Monforts, Germany). A complete multi-factor design was used to analyze the influence of the following process parameters: seed moisture content (SMC, 6 - 12%, bh), pressing temperature (PT, 50 - 90 ° C), pressing speed (PS, 20 - 40 rpm) and restriction die (RD, 5 - 6 mm). The response variables studied were: extraction yield and oil chemical quality (peroxide and acid values, oxidative stability and UV specific extinction coefficients). The optimization was carried out using the Statistics program. The extraction for each raw material was optimized: runner type peanuts with and without tegument. The maximum extraction yield was achieved by using peanut seed with tegument (82% of the total available oil) with a SMC of 9 %, PT of 90 ° C, RD of 5 mm and PS of 20 rpm. For peanut seed without tegument the maximum yield (76.4% of the total available oil) was obtained with a SMC of 9%, PT of 50 ° C, RD of 5 mm and SP of 20 rpm. Both models presented a good fit to the experimental data. The oils presented good quality according to the ranges suggested by CODEX for crude oils obtained by pressing. No significant differences were observed comparing tocopherols, carotenoids and chlorophylls contents among peanut oils with and without tegument and a commercial crude oil. The results suggest that it would be possible to adjust the industrial extraction processes using groundnut with tegument as a strategy to reduce energy consumption, obtaining a product with similar quality and extraction yields.

**Key words:** Chemical quality, Extraction, Optimization, Peanut oil, Tegument

(P2.24) Typical physicochemical profile of lemon honey from Tucumán, Argentina. A contribution to their identification.

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In recent years there has been a greater demand of honey whose composition, traceability and authenticity are well specified.

**Objective:** The aim of this work was to define a characteristic profile for monofloral citrus lemon honey (*Citrus limon* (L.)) from the province of Tucumán, northwest Argentina.

**Material and Methods:** The samples of honey (n=53) were collected in two seasons and from different geographical regions in Tucuman. Samples were analyzed to determine physicochemical parameters (AOAC methodology). Principal component analysis (PCA) and Cluster analysis (CA) were used as exploratory methods. The melissopalynological studies showed that 64% samples contained at least 15% Citrus lemon pollen. The physicochemical parameters complied with the Argentine and international food regulation (CAA, Codex Alimentarius).

**Results:** The results (mean  $\pm$  standard deviation) of the physicochemical parameters were: 16.96  $\pm$  0.77% moisture; 70.33  $\pm$  2.85% reducing sugars; 75.44  $\pm$  2.88% total sugars; 4.85  $\pm$  0.91% apparent sucrose; 0.11  $\pm$  0.03% ash; 25.38  $\pm$  6.00 (DN) diastase activity; 18.71  $\pm$  3.78 (meq/kg) total acidity; 25.38  $\pm$  9.55 (mg/kg) hidroxymethylfurfural and 0.41  $\pm$  0.07 (mS/cm) electric conductivity. More than 75% of the total variance was explained by the first two factors in the PCA. The most highlighted attributes were the electrical conductivity followed by the total acidity which are widely used as discriminants of botanical and geographical origin. The high value of the variability explained indicates the similarity between the honeys, corroborating that they belong to the same botanical and geographical origin.

CA applied to physicochemical data allowed to distinguish two different groups relating to the harvesting season.

**Conclusion:** Therefore, the profile analyzed with multivariate methods would allow using the physicochemical parameters together to differentiate citrus honeys and collect season.

**Key words:** Composition, Lemon citrus honey, Natural food, Quality parameters

## (P2.25) Occurrence of acesulfame k, saccharin and aspartame in table-top intense sweeteners

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**Introduction:** Artificial sweeteners are substances of low calorific value, used as food additives to give a sweet taste to foodstuffs, reducing the energy supplied by them. It is well known that the increase of sugar consumption is related with two severe health problems diabetes and obesity. In this way, artificial sweeteners are normally used in dietetic products and are often present in soft drinks and table-top intense sweeteners, among others products. The sweeteners occurrence data could be important in exposure studies to evaluate the intake of artificial sweeteners (with acceptable daily intake) since there is no legislation regarding maximum permitted levels for table-top intense sweeteners.

**Objectives:** Determination of acesulfame k, saccharin and aspartame contents in table-top intense sweeteners samples.

**Methods:** A total of 42 samples in powder, tablet and liquid of table-top intense sweeteners from six brands were analysed. For each brand, five packs of one batch and a pack for each other two batches were purchased on Lisbon city supermarkets. The analysis of each table-top intense sweetener was carried out with a validated HPLC-UV method, according to EN 12856.

**Results:** Sweeteners concentration vary from 1 to 14% for aspartame, 0.5 to 5% for saccharin and 1 to 10% for acesulfame K, being the highest concentrations found in samples of table-top intense sweeteners in tablets. Only one brand of sweetener shows variation in its content between batches.

**Conclusions:** The results obtained in this study are important for the evaluation of the exposure of the Portuguese population to sweeteners. Table-top sweeteners are not the products with intense sweeteners most used by the consumer. However, when used, they can be consumed daily as sugar substitutes, by diabetics or individuals on a diet regime, placing those individuals at risk of exceeding the acceptable daily intake.

Study funded by the MONITADITIVES Project (INSA).

**Key words:** Sweeteners, HPLC, Table-top intense sweeteners, Aspartame, Acesulfame k, Saccharin

(P2.26) The project “Bread Stamp with less salt, same taste” - an initiative to improve nutrition in Portugal.

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Salt consumption in Portugal (7.4 g/day) is still higher than the maximum recommended dose by the World Health Organization (5 g/day). The consumption of bread in Portugal represents 18% of the daily consumption of salt. In 2009, a Portuguese law limited the maximum salt content in bread to 1.4g of NaCl/100g of bread.

Consumers are concerned more than ever about sodium content in their foods, but refuse to compromise on taste. Numerous different strategies have been proposed to reduce the salt content of foods.

The “Bread Stamp with less salt, same taste” project comes under the protocol established between the General Directorate of Health (DGS), the National Institute of Health Doctor Ricardo Jorge (INSA) and the Associations of Industrial Bakeries, Pastry and Similar, with the aim of agreeing a set of measures to reduce the salt content in bread.

This initiative intended to grant a public distinction by giving a distinctive mention to the bakeries that currently meet the target set for 2021 regarding maximum salt content in bread (<1g NaCl/100g bread).

Bread samples from 12 bakeries (n=117) distributed throughout the country, were analyzed between September 2018 and January 2019 in two different moments. At each visit, 4 different types of bread were collected. Samples were analyzed by ICP-OES for sodium content and salt content was determined by calculation (Na x 2.5).

In 12 bakeries under study, 8 bakeries obtained all results below 1g of salt / 100g of bread and 4 obtained results that did not fulfill criterion. Thus, 8 stamps were awarded to the bakeries that complied with the salt reduction.

There is a growing concern about the reduction of salt content in bread, and 8 bakeries met the ambitious goal of salt below 1g/100g of bread, with gains for the Portuguese population’s health, with regard to hypertension and cardiovascular diseases.

Caution is required so that bread salt reduction is not accomplished by its replacement with other substances (eg. sugar).

**Key words:** bread, cardiovascular diseases, food reformulation, salt, taste



## (P2.27) Impact of malting process on the amino acid profile of buckwheat seeds

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Buckwheat is a gluten-free pseudocereal recognised as an important source of protein.

Malting is a form of processing that can improve the protein quality of food. The aim of this study is the optimization of malting conditions on protein content and its essential amino acids on buckwheat seeds.

To achieve this goal, soaking time was optimised to a moisture content of 50% (2h) and the drying time to a moisture content below 10% (4h). Quantification of protein and amino acid (AA) profile was determined after different soaking and germination conditions. Design of experiments was applied to optimise the malting process, considering 2 factors and 3 levels: time (24, 48 and 72 h) and germination temperature (18, 23 and 28 °C). The experiments were performed in 2 blocks considering the soaking temperature (20 °C and 30 °C). Moisture was determined by the AOAC method, 952.08. Total nitrogen content was assessed by the Kjeldahl method. AA profile was performed after acid hydrolysis by UPLC with a PDA detector.

Concerning protein, soaking temperature increased significantly at 30 °C, ( $13.7 \pm 1.45$  g/100g) when compared with soaking at 20 °C ( $12.08 \pm 1.43$  g/100g). For all essential AA, at a soaking temperature of 20 °C, germination time was the only significant factor with the best germination conditions at 48 h. The soaking temperature of 30 °C, produces the best germination conditions at 72 h, with an exception on methionine where both factors, temperature and time, constitutes significant factors. For methionine, the best conditions were found at 23 °C with 48 h of germination.

In conclusion, results demonstrate that in the tested conditions, the levels that can be used to improve the quality protein of buckwheat seeds were: 30 °C for soaking step and 18 °C during 48 h for germination step. This work reveals a valuable tool that can be used in domestic or in controlled environments, as industries, for the improvement of protein quality of this gluten-free pseudocereal.

**Key words:** Amino acids, Buckwheat, Experiment design, Malting process, Protein

## (P2.28) Portuguese fish as a rich source of iodine, selenium and iron

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The deficiency of iodine, selenium and iron, micronutrients essential for thyroid hormone synthesis, improve the risk of autoimmune thyroid diseases. A Portuguese Total Diet Study (TDS) representative of diets in Portugal was carried out since foods are the main natural sources of those micronutrients.

The main goal of this work was to evaluate the content of iodine, selenium and iron in fish consumed by the Portuguese population.

Three hundred and twenty-four samples were collected based on local markets and later analysed in pools of twenty-seven fish. After acid digestion, selenium and iron contents were determined using ICP-MS and ICP-OES, respectively. The iodine content was determined using ICP-MS after alkaline extraction.

In fish, the highest iodine content was found in bivalves and molluscs,  $157 \pm 6 \mu\text{g}/100\text{g}$  and the lowest content was determined in octopus,  $13.1 \pm 0.5 \mu\text{g}/100\text{g}$ . Regarding the subgroup of lean fish, it was in Atlantic cod where the higher content of iodine was found, with  $138 \pm 1 \mu\text{g}/100\text{g}$ . In addition, in Atlantic salmon was found the lowest iodine content ( $12.3 \pm 0.6 \mu\text{g}/100\text{g}$ ). In the subgroup of fat fish, the highest iodine content was for the mackerel ( $40.6 \pm 1.1 \mu\text{g}/100\text{g}$ ).

For selenium content, the European sardine was the fish with the highest concentration of  $132 \pm 5 \mu\text{g}/100\text{g}$ . The lean fish with higher concentration of selenium was the European conger ( $81.6 \pm 1.5 \mu\text{g}/100\text{g}$ ) and the seafood was shrimp ( $69.4 \pm 3.9 \mu\text{g}/100\text{g}$ ).

Concerning iron content had a very large range, from  $0.494 \pm 0.005 \text{mg}/100\text{g}$  (shrimp) to  $10.5 \pm 0.9 \text{mg}/100\text{g}$  (bivalve molluscs). In the subgroup of fat fish, the highest content for iron was found in canned sardines ( $2.32 \pm 0.07 \text{mg}/100\text{g}$ ). Horse mackerel was the lean fish with the higher content of iron, with  $0.967 \pm 0.057 \text{mg}/100\text{g}$ .

This work helps us to understand the pattern of iodine, selenium and iron dietary intake and how to avoid diseases resulting from these micronutrients deficiency. These results will be included in the update of the Portuguese Food Composition Database due to its analytical quality and to the robust sampling plan.

**Key words:** Iodine, Iron, Recommended nutrient intake, Selenium, Total Diet Study

## (P2.29) Nutrient content of food from burned areas of the Central Region

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Forest fires are usually unexpected events leading to dramatic changes in all kinds of forest ecosystems, and they have a significant impact on flora. Fire mineralizes soil nutrients and returns plant-locked nutrients to the soil. Nutrients are lost from the ecosystem through the release of particulates and volatile compounds during the fire, and later through surface transport and leaching by rains<sup>1</sup>. Wildfires can play an important role in the environmental distribution of major and trace elements, including through their mobilization by fire-induced runoff and associated transport of soil and ash particles<sup>2</sup>.

This study aimed to evaluate the selenium (Se), cobalt (Co), manganese (Mn), copper (Cu), lithium (Li) and zinc (Zn) content in cabbage, egg, potato and fruit samples in a total of 16 pools composed of 3 samples each at two different harvest periods. Cabbage samples from burnt zones were compared with a designated control sample from a non-burnt zone. Inductive Plasma Coupled Mass Spectrometry (ICP-MS) performed the determination of nutrient compounds. Previously, the samples underwent a heating block acid digestion with a validated time and temperature program. The analysis performed was under accordance with ISO 17025:2005<sup>3</sup> by analytical procedures.

The lowest concentration founded in all nutrients was in fruits. The selenium and zinc content varied as follows: eggs> cabbage> potatoes> fruits. In the other hand, cabbage contained the highest cobalt and manganese content while eggs had lower values of copper. For lithium content, potatoes were the samples, which had lower values, than the eggs that contained higher values. The amount of the nutrients present in this study when compared to the control sample, the more pronounced increase recorded was for copper in the potato samples. Monitoring studies based on accredited methods are a powerful aid in assessing of exposure of affected populations.

**Key words:** Forest fires, ICP-MS, nutrients, foods

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## (P2.30) Influence of storage conditions on the vitamin C content in 4 types of vegetables

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**Introduction:** Vitamin C is an important water-soluble vitamin that humans are not able to synthesize, so it needs to be provided by the diet. This vitamin is naturally present in fruits and vegetables. The oxidation of vitamin C is influenced by several factors, namely, temperature, presence of oxygen and light. Therefore, the storage conditions of foods are a very important factor, regarding the stability of vitamin C.

**Objective:** To evaluate the stability of total vitamin C, L-ascorbic and dehydroascorbic acids in 4 types of vegetables, stored at -20 °C, during four weeks.

**Methodologies:** In 2019, 4 types of vegetables (broccoli, cauliflower, white and purple cabbage) were purchased from major supermarket chains in the region of Lisbon (Portugal). The samples were manually separated between edible portion and non-edible portion. The edible portion was stored at -20 °C and determination of vitamin C was conducted at day 0, day 8, day 15 and day 30. Separation and quantification of total vitamin C was carried out using a previously validated method on an Alliance 2695 HPLC system, with diode array detection (DAD), using a Synergi<sup>TM</sup> Hydro-RP analytical column (150 x 4.6 mm I.D., 4.0 µm particle size). Samples were monitored at 245 nm.

**Main findings:** From the obtained results, it was possible to verify that broccoli and purple cabbage were the samples that, at day 0, presented higher levels of total vitamin C ( $93.30 \pm 8.57$  and  $60.65 \pm 0.99$  mg/100 g, respectively). Also, on day 15, only the broccoli presented L-ascorbic acid ( $0.21 \pm 0.04$  mg/100 g), whereas the remaining samples only presented dehydroascorbic acid.

**Conclusion:** The conditions and storage time of foods are very important factors, since they directly influence the content and quality of vitamins and other bioactive compounds. Adequate storage maintains the nutritional quality of food and it is of utmost importance to deepen the knowledge on this subject.

**Key words:** L-ascorbic acid, stability, storage, vegetables, vitamin C

## (P2.31) Nutritional quality of ready-to-eat breakfast cereals using the Front-of-pack nutrition labelling system - Nutri-Score

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According to the most recent Portuguese National Food, Nutrition and Physical Activity Survey (2015-2016), it is estimated that 5.9 million Portuguese are overweight (more than 50% of the population), and this prevalence increases to 8 out of every 10 among the elderly. In the context of government strategies to tackle obesity and diet-related disease, a number of different nutrient profile models have been proposed and several applications have been identified. One of purposes of nutrient profiling systems is nutrition labelling to help consumers to make healthier food choices. A French front-of-pack labelling system named Nutri-Score classifies food into 1 of 5 classes, each associated with a colour and letter (from green/A to dark orange/E). The aim of this study was to assess the healthiness of ready-to-eat breakfast cereals (RTEBC), within 5 categories of nutritional quality, using Nutri-Score system.

A nutritional database was constructed for 50 RTEBC that were collected from 3 food retail chains in the Lisbon area. RTEBC were classified as children's cereals and non-children's cereals. The nutritional data collected included: energy (kJ), saturated fat (g), total sugar (g) and sodium (mg). In our study, "Healthy" category corresponds to "dark green" and "light green" and "Less healthy" category corresponds to "yellow", "light orange" and "dark orange". The majority of breakfast cereals studied were categorized as "yellow" (60%; n=30) and that also apply to children's (57.1%; n= 16) and non-children's cereals (63.6%; n=14). Children's cereals were distributed within 3 categories (light green, yellow and light orange) and only 17.9% (n=5) can be classified as "Healthy". For non-children's cereals, 18.1% (n=4) can be classified as "Healthy". On the whole, only 18% (n=9) of RTEBC were considered as "Healthy". Nutri-Score system seems to be an important tool in allowing consumers to better understand nutritional labelling and making healthier food choices.

**Key words:** Front-of-pack labelling, Nutrient profile models, Nutri-score system, Nutrition labelling, Obesity

## (P2.32) Quantification of gamma-oryzanol and phytic acid bioactive compounds

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The growing demand for natural food ingredients with bioactive properties led to the interest on the extraction and quantification of those compounds. Bran is a by-product of the rice industry with a great potential for extracting bioactives compounds, mainly gamma-oryzanol (GO) and phytic acid (PA). The concentration of these compounds is influenced by environmental conditions and genetic variability. GO is a complex mixture of phytosterols and triterpenoids esters of ferulic acid and has been studied for its health benefits, mainly its role on the reduction of cardiovascular disease risk factors. PA is an organic acid, has the ability to chelate metal cations and is the main form of phosphorus storage in cereals. PA has been classified as anti-nutrient, affecting minerals biodisponibility; however it has also been studied for its positive effects on the protection against cancer and diabetes. The quantification of GO and PA and their genetic and environmental influences may have interest for the food industry.

GO and PA were quantified on rice bran of two Portuguese rice varieties (Ceres and Maçarico), grown in 6 environments.

The extractions were performed by acid (HCl) and isopropanol, followed by HPLC-RI and HPLC-PDA quantification for PA and GO, respectively. Compounds identification and quantification were performed by external standard calibration, standard retention times and GO compounds spectra comparisons.

The GO concentrations were mainly influenced by growth environment. Ceres variety showed higher values than Maçarico; this variation were more pronounced for  $\beta$ -sitosteryl ferulate and cicloartanyl ferulate. The PA values are within the expected variability, from 4.0 to 22.5 g/100 g of bran, and the Maçarico variety showed higher values. PA and GO are potential candidates for functional ingredients. Further work will focus on the purification of PA and evaluation of its alpha-amylase inhibitory action.

**Key words:** Bioactive compounds, Gamma-oryzanol, HPLC, Phytic acid, Rice bran

## (P2.33) Influence of cocoa origin on the nutritional characterization of chocolate

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Chocolate is a product obtained from cocoa fruit combined with sugars or sweeteners, as well as other additives by a suitable manufacturing process. In terms of nutrition, chocolate products represent a source of minerals, vitamins, methylxanthines, flavonoids, polyphenols and oleic acid. Due to high fat and sugar contents, chocolate contributes to obesity problems in developed countries, since chocolate products are a desired food by the general population, with an exceptionally attractive taste and health-beneficial properties, possessing the potential to arouse emotions and positive feelings. These foods present beneficial actions in the health, being anti-carcinogenic, anti-inflammatory, anti-bacterial and antioxidant, also being able to modulate or decrease platelets activation, aiding in maintaining the cardiovascular system. Chocolate functional properties depend on the cocoa origin and processing.

Evaluate and compare chocolate nutritional value with different percentages and origins cacao (Venezuela, Madagascar, Brasil, São Tomé e Príncipe, Santo Domingo, Cuba and México).

Accordingly aim, protein (Kjeldhal), moisture (JAOAC14,529:1931 adapted), ash (JAOAC55,1027:1972 adapted), total sugars (Munsen and Walker), fat (Soxhlet), fiber (enzymatically) were determined. Caloric value was calculated (EC Regulation 1169/2011) for all chocolates. The fatty acid (GC-FID), sugar (HPLC-RI) and organic acids (HPLC-PDA) profiles, mineral content (X-ray fluorescence spectrometry), and theobromine and caffeine (HPLC-PDA) were also determined. All determinations were made in triplicated.

Considering nutritional composition, no influence was observed due to cocoa origin. Fatty acid profile revealed similar composition for all chocolates, with stearic and oleic acids with the highest and very similar values, followed by palmitic acid. Future work will be done on antioxidant activity determination, phenolic compounds and vitamins profile.

**Key words:** cocoa, chocolate, fatty acid, organic acid profile, sugar profile, theobromine

## (P2.34) Tempeh as a substitute of meat protein

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According to the Portuguese Association of vegetarians, adherence to vegetarian diets, and conscience with a reduction of meat consumption is increasing in Portugal.

This study aims to describe the tempeh's protein and amino acid (aa) profile, including the impact of culinary procedures. The results will be then included on the National Food Composition Table increasing the available information in this alternative protein sources, before and after cooking.

Twenty tempeh samples from six different brands and production sets, representing the varieties available for consumption in Portugal, were purchased in commercial surfaces. Each sample was analysed "raw" (as it is on the package) and after two culinary procedures, sauteed and stewed after been marinated overnight, both procedures were executed in triplicate. "Raw" and cooked samples were grouped in different pools, each one with 20 sub-samples. Each pool was analysed in triplicate for aa profile. Amino acid profile was determined by UPLC/PDA (Ultra performance liquid chromatography with photodiode array detector). After quantification of aas, the protein quality was evaluated, by the calculation of protein scores.

Tempeh presents values of the sum of amino acids between 11.5g/100g in "raw", 12.6g/100g in sauteed and 10.05g/100g in stewed samples. Glutamic acid was the aa that shows the highest value in all samples. Protein scores present values above 1 for all aa, except for leucine and sulfur aa (methionine and cysteine) that represent the limiting aa. Concerning sum of aa, values decrease significantly ( $p > 0.05$ ), from salted to "raw" and stewed after marinated, respectively. The results demonstrate that the culinary method used on tempeh's changes the protein content. The existence of limiting aa confirms that we are in the presence of a legume. Thus requires protein complementarity, a combination of cereals with legumes, to obtain all essential aa demanded in one meal. However, tempeh constitutes one valid alternative for vegetable protein choices. The presented study reveals the importance of the inclusion of these results in the Portuguese Food Composition Table.

**Key Words:** Amino acids, Diets, Protein, Tempeh, Vegetarian

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2014DAN/932- desenrollo de Alimentos Andinos Processados: alternativa para la conservacion de la biodiversidade.



## (P2.35) Content of Vitamin A and E in representative samples of the Portuguese consumption

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**Introduction:** Vitamin A (all-trans-retinol and 13-cis-retinol) is naturally present in animal products. Vitamin E (dl- $\alpha$ -tocopherol) occurs naturally in foods of plant and animal origin. Vitamin A plays an important role in the mechanisms associated with vision and vitamin E as an antioxidant. To evaluate the ingestion of vitamins A and E by the Portuguese population, through a Total Diet Study (TDS), using the daily reference doses, 800  $\mu$ g and 12 mg, respectively for vitamins A and E, for adult subjects, analytical determinations in representative samples were done.

**Objectives:** To determine the vitamins A and E contents of 228 composite samples representative of the consumption of the Portuguese population.

**Methods:** Sampling and preparation of samples was carried out within the framework of the European project TDSExposure. 228 samples, each one consisting of 12 sub-samples, were collected in the Lisbon region in 2014-16. Samples were classified using the FoodEx2 system, distributed in 18 groups. The determinations of vitamin A and vitamin E were performed by normal HPLC with fluorescence detection.

**Results:** In the groups analysed, the major total vitamin A content found, in  $\mu$ g/100 g, were in "meat" (rabbit 142 and chicken 32), "milk and dairy products" (butter 440 and Flemish cheese 203) and "fish and seafood" (squids 130 and sardines 40); eggs were also an important source of vitamin A (59). With regard to the vitamin E, in mg/100 g, vegetables (turnip greens 2.2, turnip sprouts 2.2 and mushrooms 1.8), oils (olive oil 9.2), and cod and potatoes composite dishes (Brás and Gomes Sá 6.0) are important sources of vitamin E.

**Conclusions:** Based on the results, the adoption of a varied diet, without restrictions, seems to reach the intake of the recommended doses of these vitamins by Portuguese population. The results obtained will enable to evaluate the intake of these vitamins by the Portuguese Population based on a TDS approach.

**Key Words:** HPLC; Total Diet Study (TDS); Vitamine A; Vitamine E

(P2.36) Urinary sucrose and fructose as biomarker of total sugar intake:  
evaluation in the DUPLO study

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**Introduction:** Studies do not show consistent relationships between self-reported intake of sugar and health outcome. To overcome the drawbacks of methods of self-reported intake and often questionable information on sugar content of foods in food composition databases, the use of urinary sucrose and fructose as biomarker (BM) of sugar intake has been suggested. **Objective:** Investigate whether there is an agreement in ranking of individuals between their sugar intake and urinary sucrose and fructose.

**Methods:** We used data of 198 Dutch adults (104 women), aged 20–70 years, from the DUPLO study. Sugar intake was estimated by two 24-hour recalls – telephone (24hT) and web-based (24hW) –, and by collecting duplicate portions (DP); sugar excretion was based on two 24-h urine samples. Sugar content of DP and urine were analysed by LC (-MS-MS), and sugar content of 24hT and 24hW were calculated based on a newly developed sugar database. Measurement error models assessed validity coefficients (VC) and attenuation factors (AF) in a hypothetical scenario of infinite BM replicates. Coefficients were compared to those of urinary nitrogen, as the latter is considered a recovery marker of protein intake.

**Main findings:** DP, 24hT and 24hW estimated median total sugar intake (IQR) were 74.5g (38.5), 61.6g (27.2), and 34.8g (30.3), respectively. The VC for the BM, using DP as reference, showed comparable to substantially better ranking of participants (0.72 for women and 0.93 for men), than 24hT (0.57 and 0.78) or 24hW (0.70 and 0.78) as reference. The VC of the sugar models was within 10 % of the nitrogen models, except for the model with 24hT as reference, among women. The AF roughly followed a similar pattern as the VC.

**Conclusion:** Urinary sucrose and fructose as BM of sugar intake had a ranking performance comparable to urinary nitrogen as BM of protein intake. The performance of 24hT and 24hW as reference compared to DP gives an indication of the validity of the sugar database.

**Key words:** Biomarker of intake, Dietary assessment, Duplicate portion, Measurement error, Sugar database, Validity

## (P2.37) Dietary Intakes of Manganese, Copper and Zinc from Portuguese Total Diet Study

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Manganese (Mn), Copper (Cu) and Zinc (Zn) are essential micronutrients required for several vital functions in human beings. Recently EFSA reviewed adequate intake (AI) values for these nutrients. AIs of 1.6 mg/day for copper, 3 mg/day for manganese, and 7.5 to 12.7 mg/day for zinc were established for adults.

This work aimed to evaluate the contents of Mn, Cu and Zn in foods collected during the Portuguese Total Diet Study (TDS). Two thousand six hundred and sixteen foods prepared as consumed were analysed in two hundred and eighteen pooled laboratory samples. Samples were digested with nitric acid and hydrogen peroxide in closed vessels in a microwave assisted digestion and analysed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Analytical procedures were carried out under rigorous metrological control and traceable to SI units.

The following food groups were analysed: dairy products; meat; fish; cereals; pulses; starchy roots or tubers; fruits; vegetables; composite dishes; eggs; alcoholic beverages; coffee, cocoa, tea and infusions; sugar and similar; products for non-standard diets; seasoning, sauces and condiments and fruit juices. The lowest amounts of Mn, Cu and Zn were;  $9.4 \pm 0.1$  µg/kg (gelatine dessert),  $18 \pm 1$  µg/kg (stock cubes or granulate, meat), and  $22 \pm 6$  µg/kg (beer) respectively. The highest concentration of Mn, Cu and Zn were  $51543 \pm 731$  µg/kg (lupin (dry seeds)),  $7930 \pm 58$  µg/kg (shrimps), and  $51794 \pm 1447$  µg/kg (mussels), respectively.

The assessment of different food groups to overall AIs was based on a combination of analytical data with consumption data from a national food survey. In the case of Mn and Cu, these results showed that a diet including the analysed food groups, is not sufficient to suppress the AIs of these micronutrients for the Portuguese adult population. However, these food groups are adequate to suppress the AIs of Zn for the Portuguese adult population.

TDS is an essential tool of Public Health to evaluate the adequate intake of nutrients in the Portuguese Population; however, for monitoring these nutrients TDS should be conducted in a regular manner within shorter periods of time.

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## (P2.38) Vitamin B12 levels in mackerel – The influence of processing methods

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Vitamin B-12 is a water-soluble and relatively large and complex vitamin. It is an essential micronutrient that plays a fundamental role in cell division and one-carbon metabolism, in enzymatic processes and on lipid metabolism. Vitamin B12 deficiency is related to several pathologies, not only with macrocytic anaemia but also with peripheral neuropathy, combined subacute degeneration, dementia (including Alzheimer's disease) and cardiovascular diseases. One of the identified sources of this vitamin is fish, especially mackerel, which, is also the most economically affordable fish available on the Portuguese coast.

The main goal of this work was to determine the vitamin B12 content, in methylcobalamin form on mackerel, raw, cooked and canned using *Ultra Performance Liquid Chromatography-Tandem Mass Spectrometer (UPLC-MS/MS)*. Losses during the process were also evaluated.

The average content of methylcobalamin obtained was lower in cooked mackerel ( $8,6 \pm 0,19 \mu\text{g}/100\text{g}$ ) than in raw mackerel ( $9,7 \pm 0,91 \mu\text{g}/100\text{g}$ ), since leaching of water-soluble compounds to the cooking broth is present. Content of methylcobalamin in water canned mackerel ( $6,5 \pm 0,63$ ) was also lower than in raw mackerel. Taking into account the adequate intake indicated by EFSA (2015) the consumption of 100 g of mackerel represent from 65% to 100% of the recommended adequate intake. Regardless the cooking methods used or the form of consumption, mackerel should always be considered as an interesting source of its vitamin B12 content contributing significantly to achieve the appropriate intake of this micronutrient, for its consumption should always be encouraged.

**Key-Words:** Mackerel, Methylcobalamin, UPLC-MS/MS, Vitamins, Vitamin B12 (cobalamin).

## (P2.39) Folates content in white, black and red quinoa: Influence of cooking methods

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Folates or vitamin B9 refers to a group of vitamers belonging to the family of water-soluble vitamins and are considered essential nutrients. Folates are related to health benefits such as the reduced risk of cardiovascular diseases and neuropsychiatric disorders such as Alzheimer's. Quinoa is a food naturally rich in folates, whose content is higher than most cereals. The objective of this work was to evaluate and compare folate content in cooked and steamed white, black and red quinoa.

Quantification of five vitamers forms was performed by liquid chromatography coupled to a mass spectrometer with a triple quadrupole (UPLC-MS / MS) after tri-enzymatic extraction of folates with  $\alpha$ -amylase, protease and rat serum. Vitamers 5-formyltetrahydrofolate and tetrahydrofolate presented values below the LoD in the majority of the samples. 5-methyltetrahydrofolate was the vitamer that presents the higher concentration on samples.

In raw quinoa (white, black and red) total folates, presents values of 326, 237 and 253  $\mu\text{g}/100\text{ g}$ , respectively. For boiled and steamed quinoa results ranged from 313 to 399  $\mu\text{g}/100\text{g}$  in black quinoa boiled and black quinoa steamed. Results suggest that culinary processing increased folate content in cooked and steamed quinoa, with a significant increase of folates in steam cooking. This results can be explained by the low contact with water, on steam cooking and because the cooking methods let the seeds more permeable to enzymes action, decreasing the interference in the extraction method. According to the recommendations of EFSA (2014) to the dietary reference value for folate, a portion of two tablespoons of raw quinoa (35 g aprox.) contributes at least with 62% of the DRV for folates. The retention of folates was dependent on both the food matrix and the method of cooking methods. Quinoa revels to be a good source of folates being an excellent alternative to cereals on celiac patient's gluten free diets as well as to the population in general.

**Keywords:** Boiling, Folates, quinoa, steaming, UPLC-MS

(P3.01) A HPLC-UV method for quantification of nineteen flavonoids in Swedish berries

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Berries are a desirable source of polyphenols, especially flavonoids including anthocyanins, flavonols, flavan-3-ols and proanthocyanidins. However, few studies focused on concurrent quantification of several subgroups of flavonoid compounds in berries. There is also a lack of systematic studies on extraction conditions, e.g. the selection of extraction solvent, for flavonoids in berries.

**OBJECTIVES:** 1) Develop a robust HPLC-UV method to quantify 19 flavonoids and optimize the methodology for complete extraction of flavonoids from berries; 2) Apply the established method to quantify flavonoid compounds in different Swedish berry varieties

**METHODOLOGY:** For the widely applied HPLC-UV three major chromatographic conditions were optimized, i.e. mobile phase composition, the elution gradient and the solvent used for reconstituting standard compounds and berry extracts. With respect to berry extraction, three parameters i.e. the type of extraction solvents, the ratio of solvent to sample and the number of repetitions of extraction were optimized during ultrasonic-assisted extraction procedure. As for quality control, linearity, LOD/LOQ, intra- and inter-day precision and recovery were determined. LC/MS was used for compound confirmation during method application in 15 samples of lingon-, straw-, blue- and raspberries.

**MAIN FINDINGS:** 1) The developed HPLC-UV method enabled precise quantification of 19 flavonoids against corresponding standard compounds. 2) The optimized extraction resulted in recoveries >89% for each compound. 3) Varieties of the same berry showed similar flavonoid profile. Lingonberry was rich in flavan-3-ol and proanthocyanidins compared with other species (3- to 10-fold). Blueberry exhibited the greatest diversity of flavonoids, especially anthocyanin compounds among all. 4) Anthocyanin was the most abundant flavonoid subgroup in all berries.

**CONCLUSION:** The established methodology is suitable to quantify 19 flavonoids in various berry cultivars.

**Key words:** Berries, Extraction conditions, Flavonoids, HPLC-UV, Polyphenols

## (P3.02) Optimised Extraction of Lutein and Zeaxanthin from corn kernels

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**Introduction:** Corn (*Zea mays*) contains high levels of lutein and zeaxanthin. Solvent extraction and saponification or a combination of both is used for quantification.

**Objective:** To optimise the release of lutein and zeaxanthin from corn using ultra-sound assisted extraction. The extraction efficiency of using isopropylalcohol along with added antioxidants, such as ascorbic acid, butylated hydroxy anisole (BHA), butylated hydroxy toluene (BHT) was evaluated.

**Methodology:** Frozen corn kernels were freeze-dried and ground using a single-phase rotor mill. Samples were placed in an ultrasonic bath for 15 minutes (based on previous research), centrifuged, then analysed using HPLC. The efficiency of extraction with or without saponification using CentriVap or not were also compared.

**Main findings:** Saponification showed lower extraction efficiency than without. Lutein levels in samples with and without 1% BHT were 1889 and 1870 $\mu\text{g}/100\text{g}$ , respectively. Zeaxanthin was 216.1 $\mu\text{g}/100\text{g}$  with BHT and 213.9  $\mu\text{g}/100\text{g}$  without. Addition of 1%BHT seemed to be more effective though not significant ( $p>0.05$ ). Lutein with 1%BHT was 1889 $\mu\text{g}/100\text{g}$  and higher than with 0.1% BHT (1765 $\mu\text{g}/100\text{g}$ ). Similarly, zeaxanthin with 1%BHT (216.9 $\mu\text{g}/100\text{g}$ ) was higher than with 0.1%BHT (201.9 $\mu\text{g}/100\text{g}$ ). Using a CentriVap to evaporate extracts to dryness significantly reduced lutein (7927 $\mu\text{g}/100\text{g}$  to 1765 $\mu\text{g}/100\text{g}$ ) and zeaxanthin (906.8 $\mu\text{g}/100\text{g}$  to 201.9 $\mu\text{g}/100\text{g}$ ). Added BHA was much less effective at releasing lutein and zeaxanthin than without. Lutein and zeaxanthin with added ascorbic acid was 1592 and 0.8 $\mu\text{g}/100\text{g}$ , respectively.

**Conclusion:** The results suggest that isopropylalcohol without added antioxidants and saponification was most suitable to extract both lutein and zeaxanthin. Sonication seemed to release the carotenoids and improve the extraction precision. Degradation of carotenoids was more with the use to CentriVap for drying before analysis.

**Key words:** Corn, Extraction, Lutein, Zeaxanthin

### (P3.03) Processing of cereal-based food used to prepare complimentary food for infants and young children

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**Introduction:** The number of industrialized foods available on the market is increasing. Associated with this, it is necessary to know the type of processing and the presence of additives in these foods, mainly by the relation of the type of food processing with healthy eating practices in childhood.

**Objective:** To characterize the type of processing and the presence of additives in cereal-based foods intended for children younger than 36 months, available in Natal-RN, Brazil.

**Methodology:** Quantitative, transversal and exploratory research, carried out in 32 commercial establishments in four districts of Natal / RN, Brazil. The Baby Food app was used in the collection of food information that recommended on the label consumption for the age range of 6 to 36 months. The list of ingredients was queried to classify foods by processing type according to the "NOVA" classification (processed, minimally processed or ultra-processed). The types of additives in ultra-processed foods were also checked.

**Results:** Of the 111 cereal-based foods registered, 16 were analyzed after repeated exclusion. The cereals belonged to three distinct brands and all were classified as ultra-processed, since they had additives. Regarding the type of additive present, 31.3% (n = 5) of them presented dye, 37.5% (n = 6) emulsifier, 56.3% (n = 9) stabilizer and all of them contained antifouling, antioxidant and flavoring. None of the analyzed foods presented acidulant, conservative, glaciating and humectant.

**Conclusion:** All cereal-based foods were ultra-processed and contained antifouling, antioxidant and flavoring additives. As the consumption of these foods is very present in infant feeding, it is necessary to investigate the relationship of their consumption with health outcomes and feeding practices in childhood.

**Key words:** Baby Food, Edible Grain, Food Additives, Food Handling, Ultra-processed



(P3.04) Chia oil microencapsulation as a technological alternative to increase its oxidative stability

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Chia seed oil (CSO) is the major vegetable source of alpha-linolenic acid. Microencapsulation technologies protect these fatty acids against oxidative degradation, allow the handling of products rich in oils as solid materials and facilitate its incorporation in certain foods such as bakery products. Among them, spray drying is the most widely used due to its low cost, flexibility and scalability. The aim of this work was to analyze different alternatives of gas-droplet contact for the spray drying of chia oil-in-water emulsions. The former configuration corresponded to a laboratory scale tall type spray dryer, while the latter corresponded to a pilot scale short type spray dryer. Coarse emulsions were prepared by high speed homogenization of CSO and a mixture of soy protein isolate (SPI) and gum arabic (GA) as encapsulants; 1/1 SPI/GA and 2/1 [(SPI+GA)/CSO] ratios were used. The coarse emulsions were further homogenized in a high-pressure valve homogenizer. The pH of fine emulsions was adjusted to 3.0 to induce complex coacervation, and the reaction was completed with stirring at 40 °C and 30 min. Finally, maltodextrin DE 5 as carrier agent was incorporated before spray drying to achieve a 22% w/v final total solid content. The co-current contact gave microcapsules with greater oxidative stability (3 times higher than bulk oil), which was associated to less thermal degradation. Meanwhile, the mixed flow configuration yielded products with poor oxidative stability. It can be concluded that a co-current spray dryer configuration constitutes a better alternative for the protection of heat-sensitive ingredients.

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**Key words:** chia oil; microencapsulation; spray drying; laboratory scale; pilot plant scale.

## (P3.05) Training the next-generation scientists for analysis of vitamins

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**Introduction:** Optimised sample preparation and analytical detection methods are key for quantitative analysis of vitamins in foods and food products. Some of the challenges during analysis are the physicochemical instability of vitamins, lengthy and tedious extraction protocols and the complexity of food matrix.

**Objective:** The objective of the study was to train research students to be proficient in generating data for food composition purposes. Fortified wheat flour was chosen for extraction of multi-vitamins, such as retinyl-palmitate, thiamin, riboflavin, folic acid and cyanocobalamin.

**Methodology:** A student interested in research was selected based on academic merit under the UNSW Taste of Research program. Flour samples were initially fortified with vitamins. Samples were placed in an ultrasonic bath for 15 minutes, centrifuged, filtered through 0.45µm filter then analysed using a HPLC. The solvents used for extraction of retinyl palmitate and B vitamins were hexane:ethanol and 40% methanol in 0.1M hydrochloric acid. Immunoaffinity column was additionally used to concentrate cyanocobalamin.

**Main findings:** Mean retinyl-palmitate in fortified flour was 446 µg/g and measured cyanocobalamin was 0.92 µg/g. The efficiencies of simultaneous extraction of thiamin, riboflavin and folic acid were 94%, 98%, and 54%, respectively, compared with singular extraction of each vitamin was recognised. Essentially, the student obtained knowledge on the stability of the vitamins and skills in using a precision balance, following extraction protocols, operating HPLC, generating data, interpretation and reporting of data.

**Conclusion:** Key learning for the student was: the best method to obtain maximum extraction efficiency; possible reasons for differences in extraction efficiency; time taken to undertake the analysis – that the extraction is a crucial step and how continuous learning and practice was ongoing to generate reproducible data using appropriate methods.

**Key words:** Cyanocobalamin, Extraction, Flour, Folic acid, Retinyl-palmitate, Riboflavin

## (P3.06) Sample clean-up for HPLC analysis of cyanocobalamin

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**Introduction:** Cobalamin or vitamin B12 occurs naturally in several vitamins and compared to other vitamins, cyanocobalamin is known for its physicochemical stability. For quantitation purposes, endogenous cobalamin must be released and converted to cyanocobalamin in the presence of excess potassium cyanide. Cobalamin in foods is found in low concentrations, thus for accurate quantitation the food extracts are commonly concentrated using solid phase extraction (SPE).

**Objective:** This study aimed to evaluate the extraction efficiency of cyanocobalamin from lupin flour. Particularly, different cartridges were compared during SPE before the HPLC analysis.

**Methodology:** Pepsin and 0.1% potassium cyanide were dispensed into samples that were initially dissolved in sodium acetate. The extracts were then concentrated using either C18 cartridges or immunoaffinity columns. Sample eluents were evaporated to dryness using a CentriVap. Different brands of cartridges and elution buffers were also tested to optimise the SPE process.

**Main findings:** The C18 cartridges seemed to be suitable for cleaning-up and concentrating cyanocobalamin. The recoveries of the cyanocobalamin standard using C18 cartridges were 71-92%, where the highest was obtained when ethanol was used as elution solvent. However, the recovery of cyanocobalamin from lupin extracts was not successfully obtained using C18 cartridges and quantitation was possible. Only immunoaffinity columns were able to fully concentrate and recover cyanocobalamin, which was confirmed by the presence of a HPLC peak. Mean cyanocobalamin measured in lupin flour was 6.8 µg/100g.

**Conclusion:** Extraction efficiency is crucial for quantitative analysis of vitamin in foods. SPE must be carried out to remove the matrix effect and its recovery plays an important role for the accurate determination of cyanocobalamin.

**Key words:** Cyanocobalamin, Extraction, HPLC, Lupin, SPE

## (P3.07) Low vitamin E intake in lactating women: Case study in Northeast Brazil

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**Introduction:** Vitamin E is an important antioxidant found mainly in vegetable oils, oilseeds and whole grains. During lactation, a higher intake of this micronutrient is recommended to ensure its transfer into breast milk and protect the mother-child binomial of vitamin E deficiency.

**Aim:** To evaluate the vitamin E intake of lactating women in Northeastern Brazil. **Methodology:** This is a cross-sectional study of 442 lactating women, based on two cohorts conducted in Rio Grande do Norte, Brazil. Data collection of food consumption occurred in three moments, from seven days postpartum with interval of 15 to 30 days among the 24-hour recall. The consumption of vitamin E was analyzed at Virtual Nutri Plus software and its adequacy from the Estimated Average Requirement (EAR) for lactating women. The frequency of consumption of the main dietary sources of vitamin E was also evaluated, considering foods that provided in 100 g the minimum amount of 0.55 mg of vitamin E.

**Results:** The mean intake of vitamin E was 5.95 mg / day and 99% of them had inadequate vitamin intake (<16 mg / day). Among the food sources, the pumpkin was the most present (47% of the women, n = 206), followed by papaya (27%, n = 120). Olive oil was observed in the consumption of only 10% of the women (n = 42) and, among the oilseeds, the cashew nut in the registry of only 3 women (0.7%). None of the women consumed the main dietary sources of the vitamin.

**Conclusion:** The results showed a low intake of vitamin E among lactating women, and low participation of food traditionally sources, alerting to the importance of nutritional strategies to ensure increased consumption of food sources such as promoting adequate nutrition during lactation, fortification with vitamin E of foods usually consumed by the population, among others, as a way to prevent vitamin E deficiency and avoid health damages of the mother-child binomial.

**Key words:** Alpha-tocopherol, Food consumption, Lactation

## (P3.08) An HPLC method for soy isoflavone extracts quantification using internal standard methodology

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The isoflavone family belongs to the group of polyphenols, known as powerful antioxidants. Soybean and most of its by-products are rich in isoflavones as derivatives of the aglycones genistein, daidzein and glycitein. It is important to advance in the development of methods and processes to obtain extracts of isoflavones useful in the formulation of functional foods, dietary supplements and cosmetics. The purpose of this work was the development of an HPLC chromatography method including an internal standard (IS, caffeic acid) to improve isoflavones quantification. The identification of mother solutions both internal standard and each of the standards and of the mixtures of isoflavones corresponding to each point of the calibration curve was carried out in a Waters HPLC, Equipped with a UV-Visible detector. The separation was achieved with a ZORBAX Eclipse XDB-C18 column (4.6 x 250 mm, 5 µm), maintained at 40 ° C during the running time. The mobile phase consisted of a 1% solution of acetic acid in water (Solvent A) and a 1% solution of acetic acid in acetonitrile (Solvent C). The spectra were readed between 230 and 280 nm with a UV-Visible detector and the compounds were detected at 254 nm. The glycosides and aglycones of each family of isoflavones, as well as IS were identified by comparing their retention times and UV spectrum with commercial standards. Standards were evaluated daily for system quality assurance. The limit of detection (LOD) of Daidzin was 0,0230 µg/mL, for Glycitin 0,0608 µg/mL, for Genistin 0,0270 µg/mL, for Daidzein 0,1315 µg/mL and for Genistein 0,0017 µg/mL. The limit of quantification (LOQ) Daidzin was 0,0768 µg/mL, for Glycitin 0,2027 µg/mL, for Genistein 0,0900 µg/mL, for Daidzein 0,4383 µg/mL and for Genistein 0,0057 µg/mL. This work pretends provide a method to perform routinely analysis of soy isoflavone extracts from different matrices using conventional detectors for HPLC.

**Key words:** chromatography, internal standard, isoflavone, quantification, soy

(P3.09) Nutri – Intelligent Solutions in Nutrition: design a computational tool to elaborate personalized menu

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Introduction and objectives: Computational tools, with integrated food composition table, have been used to assist the nutritionist's decision making in their professional practice. The aim of this work was to design a computational tool using the Nutrient Intake Evaluation Database of the Brazilian Food Composition Table (TBCA NIE-BD) to generate personalized menu, considering the food preferences and nutrient requirements of the patient. Methodology: The steps for the development of this work included: (i) differentiation between the available computational tools; (ii) characterization of the nutrition care process; (iii) definition of the protocol of clinical care for the nutrition consultation; (iv) adequacy of TBCA NIE-DB to be used in the computational tool; (v) definition of preferences; (vi) implementation of the computational tool; (vii) evaluation of the results generated by the computational tool. The computational tool developed, called Nutri – Intelligent Solutions in Nutrition, a web application, characterized as Expert System (ES), used the Finite State Machine (FSM) technique to represent the nutritionist's expertise in the elaboration of menu. Main Finding: The evaluation of 105 daily menus (7 food plans for 15 fictitious cases) was adequate for the nutritional recommendations and preferences proposed, besides selecting foods/preparations of the different groups (according to the meal), besides considering sensorial characteristics, showing 89.7% agreement for the evaluated items. Conclusion: The proposed tool can contribute to: optimization of clinical care, because the nutritionist will be more time in consultation nutrition with patient, because to reduce time in calculations performed; decision support, since menu are more likely to be adequate for nutritional recommendations; adherence to the dietary prescription, since the menu will be elaborated based on the patient's preferences.

**Key words:** Computational tool, Food Composition Table, Menu planning, Nutrient Intake Evaluation Database, Preferences, TBCA NIE-DB

(P3.10) How to quantify vitamin D activity in foods that contain several vitamin D vitamers?

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Vitamin D-active compounds are mainly vitamin D<sub>3</sub>, 25-hydroxyvitamin D<sub>3</sub>, vitamin D<sub>2</sub>, 25-hydroxyvitamin D<sub>2</sub>. Historically, the quantity of vitamin D was quantified using a biological assay. The chemical methods developed in the 1980s focused on the parents forming vitamin D<sub>3</sub> and vitamin D<sub>2</sub>, and comparing the two methods showed similar results for enriched foods with vitamin D<sub>3</sub>. Since the mid-1990s, knowledge of content of 25-hydroxy vitamin D vitamers in food increased. Some food composition tables include 25-hydroxy vitamin D<sub>3</sub>, if included the method to convert 25-hydroxy vitamin D to vitamin D activity is not consistent, and values between 1 and 5 are used.

Objective: Aim to evaluate current, published data for the the difference between vitamin D vitamers and 25-hydroxy vitamin D vitamers.

Methodology: Literature review, and use of SLAMENGI-factors (Species, Linkage, Amount, Matrix Effectors of absorption, Nutrient status, Genetic factors, Host-related factors) to describe the knowledge.

Main findings: Animal models, parallel human intervention studies, cross-over human intervention studies, and in-vitro digestions models combined with human cell lines, have been used to investigate differences between vitamin D vitamers. The results show that the 25-hydroxy vitamin D<sub>3</sub> are estimated within the range 1-5 compared to vitamin D<sub>3</sub>. The most recent review estimate the vitamin activity of 25-hydroxy vitamin D to be 2-3 times vitamin D<sub>3</sub>, while a more recent human intervention study found 1.5. For vitamin D<sub>3</sub> and vitamin D<sub>2</sub> a CODEX recommendation that vitamin D<sub>2</sub> equals vitamin D<sub>3</sub>.

Conclusion: There is a gap in the knowledge regarding the vitamin D activity from each of the vitamin D vitamers. Until such new results have been published, the vitamin D vitamers should be regarded equal ie. vitamin D activity is the sum of content of each of the vitamin D vitamers quantified, where all contents are converted to vitamin D<sub>3</sub> based on molar weight.

**Key words:** 25-hydroxyvitamin D<sub>2</sub>, 25-hydroxyvitamin D<sub>3</sub>, Total vitamin D activity, Vitamin D<sub>2</sub>, Vitamin D<sub>3</sub>

### (P3.11) Towards the application of isotope-dilution ICP-MS for the routine determination of trace elements in food products

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Nowadays, isotopic dilution inductively coupled plasma-mass spectrometry (ID ICP-MS) is recognized as a primary method for trace element determination providing results directly traceable to the International System of units (SI). ID ICP-MS is currently applied mainly to the development of analytical procedures required to provide high accuracy and small uncertainty that is necessary, for instance, for the certification of reference materials or to be used as reference method. Achieving a small measurement uncertainty is important in official analyses of foodstuffs where the acceptance or the rejection of a lot/sub-lot is largely dependent on the measurement uncertainty especially when a result is close to the maximum admissible level. Hence, a truly accurate method providing a small uncertainty can play an important role in terms of public health but also in trade. Despite its advantages in terms of accuracy and precision, ID ICP-MS is not used yet for routine determination of trace metals in foodstuffs due to its relative high complexity and cost.

This work aims at the development of an analytical approach based on ID ICP-MS for routine determination of Pb, Cd and Hg in food of animal origin as they are the only contaminants being regulated in this type of food by the European Commission. The parameters affecting the method trueness and precision such as the detector dead time, mass discrimination factor and the sample/spike ratio were optimised. The method was validated by means of the accuracy profile approach by the analysis of various food matrices according to the French AFNOR guidelines NF V03-110. A comparison of the measurement uncertainty calculated based on the accuracy profile approach as well as by using the GUM (Guide to Uncertainty measurement) is also addressed.

**Key words:** Foodstuff, ICP-MS, Isotope dilution, Trace metals



## (P3.12) Optimization and application of a method for the characterisation of TiO<sub>2</sub> nanoparticles in food additives by Single particle-ICP-MS

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Titanium dioxide (TiO<sub>2</sub>) is used as food additive (E171) in order to make products whiter and/or shiny. Since 2012, it has been demonstrated that TiO<sub>2</sub> in E171 can be partially present under NanoParticle (NPs) form. Despite the regulation imposing the reporting of nanoparticles presence in foodstuffs, it remains difficult for food analysis laboratories to accurately quantify the nanoparticle fraction in food products with common analytical approaches.

This study focuses on the development of liquid methods for TiO<sub>2</sub> NPs characterization in food, namely Single Particle approach with Inductively Coupled Plasma – Mass Spectrometry (Sp-ICP-MS). Sp-ICP-MS approach for NPs characterisation is a recent and promising method that allows size measurement of particles without any upstream separation technique. In this study, several parameters have been optimised such as titanium isotope analysed according to matrix effect. The dwell time and the solvent chemical nature were also optimised. The signal background was decrease by self-aspiration mode of sampling. Moreover, the data treatment software has been compared with the data treatment with internal spreadsheet. Then, an extraction protocol of NPs has been developed from food products.

Finally, this optimised analytical method was applied to the analysis of several food products containing the E171 additive and allows obtaining an accurate size distribution of TiO<sub>2</sub> NPs containing in these samples. The size limit detection obtained with the isotope <sup>48</sup>Ti is around 25-30 nm.

**Key words:** E171, NanoParticle (NPs), Sp-ICP-MS, Titanium dioxide (TiO<sub>2</sub>)

## (P3.13) Novel Approaches for the Determination of Dithiocarbamate Fungicides and of their Degradation Products in Fruits and Vegetables

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Dithiocarbamates (DTC) have been extensively used as fungicides due to their cost-effectiveness and antifungal properties against a large panel of plant diseases. To broaden their activity spectrum and enhance plants resistance to various pathogens, DTCs are often used in combination with modern systemic fungicides leading to elevate levels already reported for food samples collected from the European Union. Despite the significant environmental and food chain impact of DTCs, the current analytical approaches for their determination suffer from serious drawbacks. The European reference method relies on non-selective quantification by indirect determination: after acidic hydrolysis, the sum DTCs is measured via the generated carbon disulfide by gas chromatography.

A multi-approach strategy was applied throughout this study in order to increase knowledge on the DTCs determination from the following perspectives:

- (i) determination of DTCs per class, depending on their chemical structure, as well as of their degradation products. The methods are based on hydrophilic interaction liquid chromatography (HILIC) or reverse phase (RP) HPLC hyphenated to molecular or elemental mass spectrometry (MS) techniques through the detection of organic DTCs, metals and/or sulfur moieties;
- (ii) selective and simultaneous determination of the three individually EU regulated DTCs (thiram, ziram and propineb) as well as of the DTCs degradation products by the use of HILIC-MS/MS.

The proposed analytical methodologies were in-house validated for the determination of the target analytes from several fruit and vegetable matrices. The results of the present study show that the analysis of DTCs by class as well as of their degradation products from fruits and vegetables can be achieved by a multi-approach methodology especially when employing soft surface extraction techniques and further separate and detect by the use of HILIC or RP-HPLC coupled to electrospray-MS/MS or to ICP-QQQ-MS.

**Key words:** dithiocarbamate fungicides, ethylene thiourea, propylene thiourea, HILIC-MS/MS, HPLC-ICP-QQQ-MS

### (P3.14) PortFIR and TCA – An integrated data provider as support for the food policy-makers

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**Introduction:** Portuguese Food Composition Table (TCA) is managed by the National Institute of Health Doutor Ricardo Jorge (INSA) and is publicly available on the Portuguese Food Information Resource (PortFIR) platform. PortFIR, besides food composition data, was designed to include data on food contamination and food consumption. **Objectives:** Availability of food composition data as a first step of an integrated source of data, including food composition, contamination and consumption essential to exposure assessment, providing science-based information, to support food policy-makers. **Material and Methods:** PortFIR platform was developed to release updated versions of the full composition data of TCA, including several functionalities to answer to the needs of different users. Also, PortFIR Networks, which include a wide range of expertise and the PortFIR Working Groups, such as User Needs, Portions or Communication, contribute to improve the platform by suggesting priorities and the inclusion of new useful data. **Results:** PortFIR platform allows the download of the TCA, in Excel format containing all the foods in the Portuguese Food Composition Database, allowing a more frequent update and immediate availability of new versions as they are released. Thus, the book edition was discontinued. The areas of food contamination and consumption are in the specification phase. **Conclusions:** The current system of publishing the TCA is usable to assess the nutritional value of foods and as a scientific base for public health promoting programs. It is also a source of information to be used by consumers, for literacy promotion. The expected future availability of food safety hazards occurrence and food consumption data, to assess exposure, will provide a basis to design more comprehensive food related public health policies and improving the already existing ones, such as the Integrated Strategy for the Promotion of Healthy Eating, published in 2017.

**Key words:** Food composition databases (FCD), Food composition tables (FCT), Food policy makers, Scientific support

## (P3.15) Blank Samples Assessed through Multivariate Control Chart as an Internal Quality Control tool of ICP-MS

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Inductively coupled plasma mass spectrometry (ICP-MS) is one of the most suitable analytical techniques used to quantify inorganic components at trace concentrations. Being considered one of the key activities in a Quality Assurance system, the Internal Quality Control (IQC) reveals is of utmost importance when ICP-MS is used. Involving a continuous and critical assessment of the analytical methods and work routines of an analytical chemistry laboratory, the main purpose of IQC is to continuously monitor the developed methodologies, as well as, to assess the reliability of the results. Within the IQC, the blank sample is an excellent tool, allowing to evaluate and monitor the quality of reagents, identify possible contaminations from the analytical processes resulting from the method and analytical processes, as well as to estimate the detection limits and the quantification limits for the trace elements analysed by ICP-MS.

This study presents a methodology based on multivariate control (T2) charts for monitoring and assessing the stability of blank samples for Copper, molybdenum and lead. The proposed methodology grounds on the Statistical Process Control, where the T2 chart was designed to detect possible contaminations that may occur during the analytical method. To validate this approach, three univariate control charts, based on the Z scores, were built for each element and compared with the multivariate control chart output.

The data analysis was performed using a set of blank samples collected between the years 2016 and 2018. Based on the data analysis results, the T2 chart was built and then validated through the correspondent three univariate Z charts. By comparing this set of charts it is possible to conclude that the T2 chart is in accordance with the results obtained by the three univariate charts. Although the mathematical complexity is high, this T2 chart revealed to be an appropriate IQC tool, when multi-elemental analyses are performed by ICP-MS.

**Key words:** Blank sample, ICP-MS, Internal Quality Control, Multivariate control charts, Trace elements

(P3.16) Development of a sustainability index for potato products in relation to other staple foods

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Addressing and overcoming issues of sustainability requires a systemic approach and cooperation among actors operating in the supply chain, from producer to final consumer. A projected world population of 9.5 billion people by 2050 dictates that future food-related policies must support a sustainable food system. An urgent need to define recommendations and actions are high on the international agenda and a new set of Sustainable Development Goals have thus been implemented in an attempt to ensure improved quality of life for all.

It is becoming increasingly important to consider concerns about nutrient density (ND) in relation to environmental impact. To develop a strong quantifiable case for potatoes, a project was done to mathematically evaluate the nutrient density of South African potato products and staple foods in relation to their carbon footprint and water usage. In this project greenhouse gas emissions (GHGE's) of specific food products were merged with nutrient composition data for those foods. Nutrient density scores were calculated and linked to GHGE's and embodied water values and plotted.

Potatoes proved to have the highest ND score associated with lowest GHGE values of maize meal, bread, pasta and rice. Furthermore, it was found that potatoes had the lowest embodied water value per unit nutrient density indicating that potatoes are extremely water efficient in terms of nutrients delivered when compared to the most commonly consumed staple foods.

**Key words:** Greenhouse gas, Nutrient density, Nutrition, Potatoes, Staple foods, Sustainability

## (P3.17) Development of a dietary glucosinolate database in the United States

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Recent studies suggest that Brassica vegetables are protective against different types of cancers. Glucosinolates (GLSs), a group of sulfur containing phytochemicals in these vegetables, are believed to be the major bioactive compounds. However, due to lack of adequate GLS composition data, the dietary intake of GLSs is poorly understood in the US. The purpose of this study was to develop a dietary GLS database in the US based on the published data. The literature review was conducted through PubMed, SciFinder and Google Scholar to cover the years 1980-2018. The inclusion criteria are: 1) clear description of the plant source; 2) common edible plant and/or plant parts; 3) analytical methods allowing quantification of individual GLSs; 4) normal growing conditions; 5) raw forms. One hundred sixty four research papers were found containing the original data, of which, 32 were conducted in the US and 132 were carried out in 29 other countries of the world. Most studies were published after year 2000, with HPLC analysis of desulfated GLSs being the primary quantification method. The data of individual GLSs from the literature using the food/plant materials in the US were extracted. The results were expressed as mg/100 gram fresh weight. As plant secondary metabolites, the profile and content of GLSs in the same food are greatly affected by the plant species/cultivars, as well as various environmental factors (e.g. soil condition, climate, irrigation, fertilizer, etc.). To make the GLS database more relevant, it is suggested to be developed as country/region specific. Since most studies focused on several commonly consumed vegetables, more data are needed in the future for less studied Brassica and non-Brassica GLS containing vegetables. The current database included 17 aliphatic, 4 aromatic and 4 indole GLSs in 20 different foods. It provides a useful tool to estimate dietary intake of GLSs in the US, which will help assess their roles in promoting human health.

**Key words:** Brassica, Database, Glucosinolate (GLS), Vegetables

## (P3.18) Using Google Analytics tool as an indicator for a South African food composition website data dissemination strategy

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**Introduction:** The South African Food Data System (SAFOODS) website first introduced in 2010 as a standalone data dissemination tool for the food compilation unit and updated in 2018. One of the newer features include online ordering of ePublications and dietary analysis software, reducing administrative burden on compilers. Web analytics tool provides valuable tracking and trending information of client “behaviour” and offers valuable feedback to team for future direction of nutrition messages aimed at clients.

**Objective:** To identify web analytics data extracted from SAFOODS website for further and future enhancements to a stand-alone data dissemination tool.

**Methodology:** New website was designed and created specifically for SAFOODS, by the institution’s in-house, Web and Social Media Manager and implemented in June 2018. Reports of website performance data captured via diagnostic reporting tool, Google Analytics, for reporting period 07 June 2018 – 07 April 2019.

**Main findings:** Reporting period, shows a summary of new users (1783, 81%) and returning users(433, 19%), presented graphically. Additionally, a visual display and detailed account of countries accessing website is reported.Of 1783 users listed over reporting period, information for 69 countries is known to have accessed website. This can be further detailed and grouped by continent (Africa-1481, Americas-118, Europe-97, Asia-72 and Oceania-15). Further exploration of African countries accessing site, can be investigated. Reporting tool shows sessions by device and reports clients to access via desktop (72%), mobile (26%) and tablet (2%). Top pages visited ranked:Online food database, Products tab and information relating to Food labelling. Full report of client sales order profile are captured.

**Conclusion:** The new responsive website provides valuable food composition data dissemination to users.Google web analytics tool influences future food composition directives for users.

**Key words:** Data dissemination, Food composition, Google analytics tool, South africa, Website

(P3.19) A web-application for nutritional reformulation of food products according to French front-of-pack “Nutri-Score” label

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In France, over half of processed food consumed on daily basis is made by food industry. Dietary behaviors play a key role in development of chronic diseases. In order to help people make healthier choices, French government, among others actions, implemented Nutri-Score label, on a voluntary basis for food packaging. A recently adopted law made it compulsory for advertising as of 1 January 2021. This scoring adapted from FSA (Food Standard Agency) score ranges from A (best score) to E (worst score), taking into account contents per 100 g of product of 3 favorable (proteins, fibers, fruits and vegetables) and 4 unfavorable (energy, saturated fatty acids, sugars and salt) common components in food.

We developed a web-application under R-Shiny package to help agribusiness professionals calculate and improve the Nutri-Score of a list of products. A first feature consists in loading products nutritional composition database and automatically calculating Nutri-Score for all products at once. The user analyses score and nutrient repartition in her/his products database through several graphic visualization, filtering according to default settings or ones settings. As a second feature, from a single product and Nutri-Score target (from A to E) chosen by the user, the combinations of the 7 Nutri-Score components complying with target are generated. The combinations are ordered according to the distance from the initial composition and the user can choose to fix some components as equal to their initial value.

In just a few clicks, the user calculates the Nutri-Score of an entire food product database and analyzes her/his food offer for internal purposes or against the competing offer. Then, she/he can identify new nutritional contents to upgrade the Nutri-Score ranking for any food products of her/his food products database by saving her/him valuable time.

**Key words:** Food reformulation, Front-of-pack labelling, Nutritional quality, Nutri-Score



## (P3.20) Implementation of a web-based dietary intake analysis tool: Challenges and Opportunities

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**Introduction:** South Africa's first dietary intake analysis software program, FoodFinder was launched in 1991 and two additional desktop versions has been released since. Due to advancing technology, there was a need for development of a web-based application that is current, mobile and independent of computer operating system.

**Objective:** To report on opportunities and challenges experienced with the implementation of a web-based FoodFinder.

**Methodology:** The project started with a tender process which was awarded in 2017. The scope of the project was detailed in the functional requirement specifications document which included various upgrades to the client interface of the application. Furthermore, a first ever SAFOODS instance consisting of a review admin, data compiler and super-admin was added to the application. Three rounds of user acceptability testing (UAT) were performed by the SAFOODS team whilst one round of external testing was performed to ensure that the application function as intended.

**Main findings:** The main opportunities of the web-application were easy streamlining of a new order and payment system, the SAFOODS instance that assist with compilation of new and checking and updating established nutrient data, the system is expandable, and more features can be added without extensive redevelopment and mobility of the application as it can be accessed anywhere with internet access. The major challenges were limited capacity, unexpected extent of UAT required to get the application to satisfactory state, cost of development, time required to implement changes and fix bugs and difficulty of translating nutritional principles and calculations to developers.

**Conclusion:** The new web-based FoodFinder has improved ordering, paying and use of the software. Furthermore, the application assists SAFOODS in updating and releasing new data to users more rapidly. It is critical to understand the scope of such a project to properly prepare for implementation thereof.

**Key words:** Dietary intake analysis software, nutritional principles, User acceptability testing, Web application

(P3.21) Development of a protocol based on linear programming to assess the amount of free sugars in processed foods in France

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Free sugars (FS), defined as monosaccharide and disaccharide added to food and total sugars naturally occurring in honey, syrups, fruit juices (from concentrate or not), are not mentioned in French food composition databases. Our aim was to develop a protocol using linear programming (LP) to estimate FS content in a batch of products.

The protocol was applied on 8 different processed food items (orange nectars, marbled cakes, 2 types of biscuits, puffed corns with honey, soft breads, pizzas and fresh cheeses with fruits) selected in the Oqali French database. For each item, 3 products were selected: that having the lowest, median and highest amount of total sugars and also 2 specific products for nectars. An ingredient composition database with macronutrients, salt and FS (based on Louie et al. method) was specifically produced. Four different LP models were designed to find a modeled amount of ingredients in each product which minimized the deviation from Nutrition Facts Label in various ways: absolute difference, relative difference, weighted difference with nutrients tolerance from literature or with EU nutrients tolerance for labelling. In all models, the total amount of ingredients was set to 100g, the total sugar content and the proportion of ingredients were set to the labeled values while conserving ingredients order. FS content was calculated from the modeled ingredient amounts. An additional biscuit, whose all ingredients amounts and yield factor were known, was also tested in the protocol.

For 2 products, LP models were unfeasible. For the 24 feasible products, the 4 models resulted in similar ingredients amounts and FS contents (from 15.3 to 15.8g/100g on average). For the additional biscuit, estimation of FS content is 0.4g lower than FS content calculated from known ingredient amounts and yield factor. This easily reproducible protocol seems to provide an acceptable FS estimation, but further work might be needed to improve and validate the approach.

**Key words:** Food composition, Free sugars, Ingredients, Linear programming, Nutrition facts label

## (P3.23) Tailor-made predictive model for food fortification to attenuate low vitamin D intake in Serbia

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**Introduction:** Previous studies on vitamin D in Serbian population subgroups indicated low dietary vitamin D intake. Serbia is country without food fortification strategy.

**Objective:** To assess vitamin D intake in Serbian adults and measure the span of the inadequacy. Based on the findings develop specific predictive model for vitamin D food fortification for Serbian nutritive context.

**Methodology:** Following EFSA – EU Menu methodology 2x24HDR were conducted on 605 adult participants (54% women) in 4 different regions in Serbia. Data were analyzed using Diet Assess & Plan software, and habitual dietary intake (HI) was assessed using SPADE statistical program. The predictive model is based on mathematical formula that calculates amount of vitamin D (fc) to be added to fortification-adequate food vectors. These fc values were added to/as vitamin D content to chosen vectors in food composition database. Simulation was performed on seven scenarios of foods and vitamin D intake. Distribution of HI of vitamin D in the population toward reaching adequate intake (AI) (15 µg/d) and upper tolerable intake (UL) (100 µg/d) were plotted using SPADE.

**Main findings:** HI of vitamin D in study group was  $4 \pm 1.4$  µg/d, without significant difference between age and sex, whereas 95% study group had intake below EAR. Most consumed food group vectors were white bread, milk, yogurt, sour cream, cheese, eggs and tomato puree. Calculated fc values were added to 70 chosen foods. In an optimal scenario 65% population reached AI, while in maximal scenario 50% population was between AI and UL. No one reached UL. Optimal and maximal amount of vitamin D for addition to each food vector was determined.

**Conclusion:** Low vitamin D intake in Serbia urge for development of strategies on food (bio)fortification to accommodate needs of wider span of consumers. The predictive model showed that wider choice of food vectors with lower concentration of vitamin D provides broader population with adequate vitamin D.

**Key words:** Dietary intake, Food composition, Fortification, Predictive model, Vitamin D

(P3.24) A system for updating EuroFIR Thesauri used for harmonised documentation of food composition data.

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**Objective:** EuroFIR ([www.eurofir.org](http://www.eurofir.org)) tools and systems enable large-scale food composition data (FCD) interchange across Europe. Harmonized food description and value documentation and the use of defined standard vocabularies (thesauri) in European food composition databases is one of the key elements for this success. Application of thesauri for data documentation enables the generation of language independent, codes covering the most essential information about documented FCD to the receiver/user. The EuroFIR Thesauri are neither closed nor fixed lists of terms and can be mapped to other thesauri (e.g. FAO/INFOODS, EFSA, ChEBI). They must be updated continuously to reflect the needs of the compiler community and new knowledge in the domain of food composition and nutrition.

**Methodology:** A procedure for updating EuroFIR Thesauri comprises collection of requests from the compilers, processing of drafts of thesauri terms, discussion about the drafts, detailed documentation of background information and dissemination of the updated thesauri versions.

**Main Findings:** Updating of the EuroFIR Thesauri is performed in a 2-3 year updating period. One main thesauri curator and 2-3 co-editors are involved in processing of drafts of terms that are made available for discussion within the EuroFIR Documentation Working Group.

Current and archive versions of the thesauri are accessible at <http://www.eurofir.org/ourresources/eurofir-thesauri/>. Cooperation with FAO/INFOODS is also provided – representatives of INFOODS are informed about inclusion of new terms into the EuroFIR Component Thesaurus

**Conclusion:** A procedure for updating EuroFIR Thesauri was developed. Its main principles are observance of EuroFIR specifications for data processing, needs of compilers, maintenance of consistency of thesauri, respect to scientific background, traceability and detailed documentation of the updating process. The updates in 2016 and 2018 comprised 138 and 197 requests, respectively

**Key words:** EuroFIR thesauri, dissemination of EuroFIR thesauri, updating procedure

(P3.25) The electronic infrastructure of METROFOOD-RI: towards an integrated data platform supporting data interoperability for the agrifood sector

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**Introduction:** Research Infrastructures (RIs) are facilities, resources and services to conduct and support top-level research. METROFOOD-RI is a RI for promoting metrology in food and nutrition, which combines a physical and an electronic infrastructure (e-RI). It completed its early phase on 2017 and was included in the ESFRI Roadmap 2018 for the domain Health and Food. 48 Institutes from 18 countries are currently involved.

**Objective:** The e-RI consists of a service-oriented architecture providing a platform accessible to the user community in Europe and beyond, for sharing data and information about food analyses, food composition, levels of contaminants, markers. It will collect the results provided by the physical component, organizing and complementing them with existing data and providing tools for its uses. Metrofood will be fully operational in 2023.

**Methodology:** The e-RI is being developed by integrating different data sources. Services are being implemented to compare food data and make them interoperable with other data relevant for the agrifood and health sector and research. Other services focus on the metrological tools for analytical purposes related to food and nutrition.

**Main findings:** The approaches adopted allow to comply with the FAIR and Responsible Research Innovation principles, considering impacts on environment and society and keeping high ethical standards in science. A major challenge is data harmonisation and standardisation needed for data integration.

**Conclusion:** The METROFOOD e-RI can promote higher levels of transparency across the entire food chain and allows to implement new approaches to food quality & safety, traceability and food protection, with a wider approach to food integrity, addressing multiple perspectives on food system circularity and sustainability. The e-RI creates interoperability of food data, and overcomes fragmentation of data sources by federating essentials to address production, diet, health, and consumer behaviour.

**Key words:** Agrifood, E-Infrastructure, E-services, Food chain data, Interoperability, METROFOOD

## (P3.26) Mobile nutrition apps and food data: insights and challenges in the practitioners' perspective

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The literature suggests that technology in general, and mobile technology in particular, can play a relevant role on health and nutrition outcomes. Within this framework, nutrition mobile applications (apps) have gained popularity and a widespread use. Previous studies on nutrition apps have investigated the functionalities, content and also quality of nutrition apps and their contribution among the population, either with pathologies that require nutritional care or simply to obtain nutritional information. Yet, their role for the practitioners' activity remains elusive.

**Objective:** The purpose of this study is to examine the role of nutrition apps for registered dietitians (RD) in the nutrition care process as well as the opportunities, insights and challenges associated with this specific type of mobile technology in the practitioners' perspective.

**Methodology:** This exploratory qualitative research involved conducting 25 semi-structured in-depth interviews with RD in Portugal. These interviews were transcribed and subsequently coded and examined using content analysis.

**Main findings:** We found that the practitioners were not fully convinced of the benefits of using nutrition apps and, in most cases, their use was circumscribed to specific functionalities. Although they were often under the impression that these apps were easy to use, their utility in the nutrition care process was viewed as limited due to several functionalities that are lacking in many of these apps. Yet, their usefulness is acknowledged for nutrition education and use for specific groups of patients, under a careful supervision of the RD. This research also identified different roles of the nutrition apps on the RD, population and patient exchange processes.

**Conclusion:** In the practitioners' perspective, nutrition apps do not entirely reflect the practices established for reference entities in the nutrition. Although that, these apps can be useful tools for the systematization of information

**Key words:** Dietitian, Food data, Mobile apps, Mobile technology, Nutrition apps

## (P3.27) Use of Acidulant Fruit Extracts in Formulation of Paneer with Improved nutritional and functional properties

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**Introduction:** The food industry is now frequently seeking to incorporate ingredients such as bioactive components from fruits and vegetable extracts as a source of dietary diversity, tool to food and nutrition security as well as natural remedies against non-communicable diseases.

**Objective:** To study the effect of milk coagulation with fruit acidulants on the physico-chemical characteristics, functional components, sensory attributes and shelf life of paneer (Indian soft cheese).

**Methodology:** Paneer was prepared by coagulating heated milk with 2% citric acid solution (control), lemon or amla extracts then stored both at ambient and refrigeration temperature. The physicochemical properties, mineral profile, antioxidant activity, ascorbic acid, total phenols and tannins were analysed.

**Main findings:** The paneer yield was highest in citric acid whereas the solids recovery with amla extract. Paneer obtained from both the fruit extracts contained greater quantity of functional components including antioxidant activity, ascorbic acid and total phenols and had lower amounts of fat and sodium than control. The raw and curried paneer from both the fruit extracts exhibited high sensory scores. There were significant changes in physico-chemical and functional properties, sensory attributes and microbiological quality of stored samples, being greater at room than refrigeration temperature. The SPC and yeast and mould counts respectively were higher in control and amla than lemon paneer at room temperature. However, refrigerated samples showed greater increase in SPC and psychrotrophic count in control whereas yeast and mould count was higher in amla paneer than other two types. The paneer made from fruit extracts had a shelf-life of 1 and 15 days at ambient and refrigeration temperatures respectively.

**Conclusion:** The good quality paneer with high bioactive components which are lacking in native paneer can be manufactured from both the lemon and amla extracts.

**Key words:** Amla, Bioactive components, Dietary diversity, Lemon, Paneer, Quality

(P3.28) Effect method protect on folic acid lost via microencapsulation method in Thai noodle

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**Introduction:** Folic acid is a nutrient-soluble vitamin B group that is very rare in general food. Caused by synthesis, resistant to oxidation and heat well The body absorbs 100%, stable for 3 months. WHO issued supplementary food measures in 1998 to prevent Folate deficiency for women of reproductive age. Folic acid that has been processed with water will cause loss. In order to prevent loss from dissolved water, therefore, it must first be added to the Thai noodle flour.

**Objective:** To study the effectiveness of folic acid loss prevention by encapsulation method supplemented in the noodles.

**Research:** Microencapsulation production of folic acid at 30 ug / 100 g starch by gel particle technique using pectin proportion Sodium alginate And chitosan, blended food grade, made into dry powder before adding to flour, noodles to produce noodles, folic acid supplementation, water, folic acid, pH, sensory analysis by Drying method, HPLC method, pH meter and Hedonic scale : Thai noodles, supplemented with 100 grams of folic acid, water 60, 72, 74 and 78%, folic acid 244.82, 244.21, 230.46 and 244.99 ug by wet weight The acidity - alkalis 3.62, 3.91, 3.92 and 3.97 in the supplementary starch process, sprinkling water lines 1 time and 2 times, respectively. Sensory tests compared with non-folic acid that noodles were not significantly different. Statistically,  $p < 0.05$ .

**Conclusion:** The folic acid encapsulation with the pre-fortified gel particle technique in starch reduces the loss during processing. When sensory tests were not different from noodles, no folic acid was added.

**Key words:** Folic acid, Microencapsulation, Thai noodles



## (P3.29) Determination of Allergen Peptides in Turkish Hazelnut Cultivars with Proteomics Approach

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Food allergy is a widespread disease affecting millions of people all over the world and now recognised as an important food safety issue. The primary treatment for food allergy is avoidance of the allergen. A very small amount of an allergenic protein can cause the symptoms of allergy so it is very important to know all the components present in a food. Various methods have been used for food allergen detection. Both immunoassay and PCR methods have been routinely employed. Proteomics approach has been used as complementary to common immunoassays for detection and quantitation of food allergens in the last decades. Proteomics include separation and protein identification by mass spectrometry, followed by data analysis. Hazelnut (*Corylus avellana* L.) is among the food allergens list in The Regulation (EU) No 1169/2011 and determination of hazelnut allergens in food products is important in terms of ensuring food safety and protecting consumer health. The aim of this work was identifying and selecting marker peptides after extraction and trypsin digestion of hazelnut proteins in five Turkish hazelnut cultivars using liquid chromatography/quadrupole time-of-flight mass spectrometry (LC/QTOF-MS). A database search for proteins and peptides identification was performed and five peptides were selected as marker peptides to determine the presence of trace levels of hazelnut in food samples. The study shows that combined multiple enzymatic digestion and MS is a powerful tool that enables the detection of specific peptide sequences in Turkish hazelnut cultivars.

**Key words:** Food allergens, Hazelnut, LC/QTOF-MS

(P3.30) Implications and outputs of historical recipe calculation method changes, across national database versions

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**Introduction:** The South African food consumption survey (1999), identified maize as a commonly consumed food item. Maize meal porridges, a staple food, consumed in various forms (crumbly, stiff or soft). In the absence of chemically analysed data, recipe calculations fill the void for combination foods. This impacts results of consumption studies and can affect conclusions if a significant difference between methods is observed.

**Objective:** To highlight recipe calculation methodology changes over time and impact on nutrient data outputs.

**Methodology:** Method comparisons of porridges (super & special) was evaluated for 12 foods. Recipe methodology for 3 variations of preparation methods (soft, stiff and crumbly porridges), to both fortified and unfortified items, were recorded. Pearson's correlation between method A and B for macronutrients- carbohydrate, total lipids, protein and moisture and selected minerals linked to fortification (vitamin A, thiamine, riboflavin, niacin, pyridoxine, folic acid, iron and zinc); across all types and within similar types. Wilcoxon signed-rank test to test for differences between method A and B for each of the nutrients and minerals was conducted.

**Main findings:** Calculations for 24 porridge types were compared. Method A (2017 version), applied yield across recipe and retention factor at ingredient level, whilst method B (2010 version), applied a mixed method approach. Correlations were strong across porridge types ranging from 0.95 to 0.99 for all nutrients and minerals except for riboflavin ( $r = 0.615$ ) and niacin ( $r = 0.692$ ). Method A produced significantly higher values for total protein, total carbohydrates, zinc and vitamin B6 ( $p = 0.002$ ). Moisture and iron were found to have significantly lower values under Method A ( $p = 0.002$ ).

**Conclusion:** Nutritional quality changes amongst similar food items over time are resultant of the recipe calculation methodology applied. The resultant impact can affect conclusions to national consumption study outputs.

**Key words:** Database versions, Level of agreement, Porridges, Recipes

### (P3.31) Occurrence of Polycyclic Aromatic Hydrocarbons (PAHs) in Chicken Doner Kebabs Cooked Under Different Heating Sources

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Doner kebab is a traditional Turkish meat product produced from lamb, veal, beef or poultry meat and then seasoned with salt, pepper, onions, cumin, allspice and thyme. The intact or ground muscle and some animal fats (20 – 40 %) are shredded and then mixed with seasoning materials and melded to give a cone like shape and impaled on a doner kebab stick. The raw doner is slowly rotated in a vertical position in front of a heating source such as open gas, electric oven or charcoal to roast the surface.

During the thermal processes some harmful compounds such as polycyclic aromatic hydrocarbons (PAHs) may be occurred on the surface of doner kebabs. The aim of this study is to determine 16 EU priority PAHs in 200 chicken doner kebab samples which are produced under four different heating sources (50 open gas, 50 electric oven, 50 wood and 50 charcoal roasted chicken doner kebab) obtained randomly from various buffets and restaurants located in Istanbul. The samples were analysed by means of GC-MS.

According to results all analysed PAH compounds were detected in different levels and benzo[a]pyrene (BaP) which is an important marker for total PAHs in foods, ranged between 0.33 – 29.32 µg/kg. The average of BaP, sum of PAH4 and sum of PAHs were 6.36, 12.36 and 27.20 µg/kg for electric oven, 5.61, 12.01 and 22.82 µg/kg for open gas, 3.99, 10.37 and 25.82 µg/kg for wood and 5.08, 18.33 and 33.35 µg/kg for charcoal roasted chicken doner kebab samples, respectively.

Formation of PAHs in foods is affected by several factors such as the methods used for preparation of food (grilling, frying, smoking, roasting etc.), temperature and time of cooking, distance from the heat source and drainage of fat. Thus, it is concluded that fatty foods such as doner kebab should not be overcooked and contacted with flame directly.

**Key words:** BaP, Chicken Doner Kebab, GC-MS, PAH, sum of PAH4

(P3.32) Traditional foods sold in Calabar restaurants: contributions to recommended nutrient intakes (RNI) and the risk for non-communicable diseases (NCDs).

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**Introduction:** Traditional foods/diets are said to be healthier compared to Western diets. Restaurants prepare and sell these meals in order to meet consumer demand/choice for healthy foods. Unfortunately, the quality of restaurant foods has been under attack with the emergence of NCDs.

**Objective:** This study determined the nutrient contribution of serving portions of restaurant prepared traditional meals to the FAO/WHO RNI of adults and the potential risk of these meals for NCDs.

**Methodology:** Commonly consumed traditional soups: “afang” (*Gnetum africanum*), melon (*Citrullus* spp.) and Okro (*Abelmoschus esculentus*) with the accompanying “gari” (a cassava product) and meat/poultry); “moi-moi” (dehulled, cowpea paste pudding), fried rice and coconut rice were purchased as served from randomly selected restaurants in Calabar. They were immediately taken to the laboratory for sample preparation and subjected to triplicate determinations for nutrient composition using standard methods. Their contributions to FAO/WHO RNI were calculated. Meals satisfying 28-40% of the RNI were adjudged adequate. Data were analyzed using ranges, means  $\pm$  SD and percentages.

**Main Findings:** Serving sizes of the meals varied from one restaurant to the other with soups and meat having greater variations; 129-389g and 34-176g, respectively. The meals made substantial contributions to RNI for energy (30-57%) except “moimoi” (12-16%), eaten alone. All the meals studies contributed significantly to protein (29-132%), vitamin A (167-322%), iron (28-300%), zinc (28-300%) and sodium (44-89%) but very low potassium (7-23%). Only soup meals contributed 24-36% of calcium, 24-31% vitamin C and 32-60% of crude fibre to RNI.

**Conclusion:** Although the meals were nutrient-dense for macro- and some micro-nutrients, the high sodium, low potassium, and very high levels of protein are potential risks for NCD and cause for concern. Their consumption in relation to other meals of the day must be controlled.

**Key words:** Adults, Contributions, Recommended nutrient intakes, Restaurant, Serving portions/sizes, Traditional foods/diets

## (P3.33) Sweeteners and sweetness enhancers: Impact on health, obesity, safety and sustainability

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on the behalf of the SWEET Consortium

**Introduction:** SWEET is an EU-funded H2020 project with 29 research, consumer, and industry beneficiaries that is examining the use of new sweeteners and sweetness enhancers (S&SEs) in the reduction of dietary sugar.

**Objectives:** SWEET is exploring barriers and facilitators in the use of S&SEs as well as risks:benefits, in the context of health, obesity, safety and sustainability. The project is developing measures to understand more about the impact of replacing sugar and determine the roles of behavioural and biological differences in S&SE food choice.

**Methodology:** Acute and repeated effects of S&SEs will be explored to evaluate metabolic, sensory, neuro-behavioural, and microbiota-mediated processes involved in satiety, preference and health. Mechanistic processes, genetics, safety and psychological drivers will also be determined. A multi-centre intervention trial will utilise a whole diet approach to investigate the effects of sugar replacement on weight control, appetite, food choice and energy intake. Evidence from European longitudinal datasets will be examined for relationships between S&SE use and obesity as well as health and safety in geographic and demographic cohorts.

**Main findings:** SWEET will identify factors affecting replacement of sugar including economic, environmental and social and, for the first time, life cycle sustainability. The project will establish safety and health risks as well as reviewing regulatory barriers to innovation. SWEET will also determine the role of behavioural and biological differences in shaping food preferences and consumption and will examine the biological mechanisms underlying these choices.

**Conclusions:** SWEET will characterise new S&SEs and blends, determine the roles of behavioural and biological differences in food behaviours, and bring a range of new lower sugar products (cereals, yoghurt, chocolate, cakes and biscuits) closer to market.

**Key words:** Genetics, Obesity, Reduced dietary sugar, Safety, Sustainability, Sweetness database

## (P3.34) Development a decision support system in menu planning of patients

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**Objectives:** The objective of this work is to describe the development of a decision support system, considering the nutritional requirements of life cycles, preferences and presence or absence of non-communicable diseases. The Nutrient Intake Evaluation Database of the Brazilian Food Composition Table (NIE-DB) is being used to generate personalized menu of patients. **Methodology:** For development a decision support system it is necessary: characterization the information in nutrition care process; definition of the information needed during decision-making process for the menu planning; adequacy of NIE-BD to be used in the computational decision support system; development of the algorithm to menu planning. To represent the data structure concerning NIE-DB, ontology was used. The Finite State Machine (FSM) technique was used to represent the nutritionist's expertise in the elaboration of menu. **Main Finding:** The nutrition care process (NCP) is composed for 4 steps: nutrition assessment; nutrition diagnosis, nutrition intervention, nutrition monitoring and evaluation. To determine the set of data of the nutrition assessment (step 1 of NCP), volunteer nutritionists was consulted. To represent data structure of the NIE-DB, the concept of FOOD was developed. From this class the following sub-classes are presented: food\_group; food\_type; preparation\_type; meal\_type. For the menu planning, the following characteristics is being considered: energy and nutrient requirements; number of meals/day; preferences; method of preparation; sensory characteristics. **Conclusion:** The proposed tool can contribute to: optimization of clinical care, because the nutritionist will be more time in consultation nutrition with patient, because to reduce time in calculations performed; decision support, since menu are more likely to be adequate for nutritional recommendations; adherence to the dietary prescription, since the menu will be elaborated based on the patient's preferences.

**Key words:** Computational decision support system, Food Composition Table, Menu planning, Nutrient Intake Evaluation Database, Preferences, TBCA NIE-DB

(P3.35) Collection of data for practical examples of recipe calculation for the EuroFIR Recipe Calculation Guideline for Food Business Operators.

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**Objective:** In the European Union, Regulation EU 1169/2011 permits calculation of food composition values for use in mandatory nutrition declaration of pre-packed foods. EuroFIR ([www.eurofir.org](http://www.eurofir.org)) prepared a set of guidelines on description of recipe calculation procedures aimed at food business operators (FBOs). These guidelines present also practical examples of calculations and acceptable tolerances considering variations of nutrient levels. The aim of this study was to collect data for practical part of the EuroFIR Recipe Calculation Guideline with the aim to demonstrate recipe calculation of different types of composite foods.

**Methodology:** A set of model cooking tests was established to document preparation of composite foods. Ingredients profile, weight changes during processing and chemical analysis of the final products were determined. Recipe calculation based on the ingredient profile was conducted and results were compared with analytical values with respect to tolerances of nutrient levels according to the compliance rules for the Regulation 1169/2011. Technological steps were photo-documented.

**Main Findings:** 16 composite foods were prepared according to model recipes. The set comprised fried foods, dumplings, meat products (e.g. sausages, headcheese), fine bakery products, potato or legume dishes, sauces, potato salad. Values obtained by model recipe calculation were within the tolerance limits almost in all foods for mandatory labelled nutrients (fat, saturates, carbohydrates, sugars, proteins, salt). An exemption was observed for fat, saturates and especially for salt content in some foods.

**Conclusion:** The collected data on ingredient profile, weight changes and chemical composition of composite foods were prepared using model recipes to demonstrate recipe calculation of different types of foods. The obtained results can be used as a training material within a practical part of the EuroFIR Recipe Calculation Guideline for FBOs.

**Key words:** Composite foods, Food labelling, Guidance for calculating nutrient content, Model cooking tests, Nutrient level tolerance limits evaluation, Recipe calculation

(P3.36) Are nitrate/nitrite-free dry-cured sausages safe for consumption?

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Nitrates and nitrites have been used as curing agents in the manufacturing of dry-cured sausages. They are mainly responsible for the stability of the red colour, flavor development, and for food safety. Nitrites have antibacterial activity against several spoilage and foodborne bacteria and they specifically prevent the growth of clostridia and their toxin production. Legal limits for the addition of nitrates and nitrites have been set by several EU countries (Commission Reg. (EU) No. 601/2014), because these might undergo biochemical transformations into potentially carcinogenic compounds.

**Objective:** The main aim was to characterize dry-cured sausages produced without the addition of nitrates and nitrites, and to evaluate food safety regarding microbiological hazards.

**Methodology:** Portuguese traditional dry-cured sausages were produced in a local industry under standard conditions and without the addition of nitrates and nitrites. Three independent batches were produced and two sausages per batch analysed both throughout the curing process and the storage period. Safety and quality of dry-cured sausages was assessed by physicochemical (pH, aW) and microbiological parameters.

**Main findings:** Preliminary results indicate that no significant differences are observed regarding microbial safety between dry-cured sausages manufactured with or without nitrates and nitrites (P>0.05).

**Conclusion:** The addition of nitrates and nitrites to dry-cured sausages seems to be unnecessary for assuring food safety for this type of dry-cured sausages. Further studies are underway to evaluate the sensory acceptability of these nitrate/nitrite-free sausages by consumers. The final goal is to recommend food manufacturers not to use nitrates and nitrites.

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**Key words:** nitrates, nitrites, spoilage bacteria, foodborne pathogens, clostridia, sensory acceptability



### (P3.37) Characterization of Serpa Cheese Microbiome by High Throughput DNA Sequencing (HTS) as a Tool to Ensure its Authenticity

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The aim of this study was to assess the specificity and biodiversity of microbiota associated with Serpa cheese by HTS, thus contributing to the preservation of the authenticity of this portuguese dairy heritage. In fact, the composition of the food microbiota is often related to the place and process of production and can be used as a tool for the traceability of food. HTS technology seems to be adequate since it allows an insight into total microbial community.

As a PDO cheese, Serpa must be manufactured in the defined geographic area. Traditional manufacturing process requires the use of raw ewe`s milk and vegetable rennet (*Cynara cardunculus*) from the region, without commercial starter. These conditions emphasize the role of the autochthonous microflora that comes from milk and surrounding environment. Its proliferation and qualitative composition will play a fundamental role in the specificity of this cheese. Under these conditions, the Serpa autochthonous microbiota may reflect its authenticity.

The sample consisted of thirty days ripened cheeses from five dairies located in the geographic area of production, sampled during production season. Microbial diversity was evaluated by culture-dependent and independent-methods. Through the culture-independent methods we used HTS (V3-V4 region of the 16S rRNA gene and ITS2) to characterize both the bacterial and fungal total cheese community and to propose sequence affiliation down to the species level whenever possible.

Both approaches confirm the diversity of the Serpa cheese microbiota and that microflora mainly corresponded to lactic bacteria and to lesser extent, enterobacteria, estafilococos and yeasts. The culture-independent HTS results identify *Lactococcus* genus contributing to approximately 40% to 60% of the population, followed by *Leuconostoc* and *Lactobacillus*.

Cheese fungal community results confirmed the prevalence of *Debaryomyces* spp. And *Kluyveromyces* spp. But also of *Galactomyces* spp.

**Key words:** Authenticity, Autochthonous microbiota, HTS, Serpa cheese

(P3.39) Semi-automatic linkage of Brazilian Food Composition Table (TBCA) with food consumption data described by GloboDiet: reference matching file

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Introduction: Systematization of diet assessment methods is crucial to investigate the nutritional status of populations. In Brazil, efforts from the Brazilian Network of Food Data Systems (BRASILFOODS/INFOODS) and from the Global Nutritional Surveillance Initiative have contributed to recent releases of an updated food composition table (TBCA 6.0) and an adapted version of the GloboDiet software, allowing standardized collection and analysis of 24-hour dietary recalls (24HR). Currently, a semi-automatic system is being built to match the TBCA with the GloboDiet output. Objective: To describe a TBCA to GloboDiet matching file and to demonstrate its use in an observational study context using INFOODS criteria. Methodology: Food codes from GloboDiet was manually aligned to counterparts in TBCA, based on their names/synonymies, excluding not ready-to-eat items. Unpaired foods were attached to closest alternatives, considering conceptual and nutritional similarities. For selected TBCA codes, a set of important characteristics for their precisely linkage to food consumption data were documented in the format of GloboDiet's facets-descriptors. Then the file was manually applied to 24HRs from an ongoing observational study. Based on selected facets-descriptors as well as on nomenclatures and taxonomies, the overall quality of each matched food was classified according to INFOODS guideline. Main Findings: The 1,742 foods from GloboDiet were aligned with 1,675 TBCA codes. While 1,208 foods were deemed to have a suitable one-to-one match, others 534 were aligned to several codes, totalizing 3,887 matching possibilities. Application of the file on 24HRs (n=22) containing 702 registers yielded food matchings mainly classified with high (60.3%) or medium (31.6%) qualities. Conclusion: The file will support the building of a semi-automatic system for converting the GloboDiet output into nutrient intakes using the TBCA, further allowing quality assessment of employed food matches.

**Key words:** BRASILFOODS, Data Quality Assessment, Food matching, INFOODS,

# 13<sup>th</sup> INTERNATIONAL FOOD DATA CONFERENCE

## *Challenges for Food Databases in the Bioinformatics Era*

## PARTICIPANT LIST

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Albuquerque, Tânia	Portugal	P1.25; P1.26
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Araújo, Célia	Brazil	P1.27; P2.21; P3.03
Arcot, Jayashree	Australia	O7.3; P1.17; P3.02; P3.05; P3.06
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Castanheira, Isabel	Portugal	P1.24; P1.25; P1.34; P2.11; P2.12; P2.17; P2.26; P2.27; P2.28; P2.29; P2.31; P2.34; P2.37; P2.38; P2.39; P3.15
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Delgado, Inês	Portugal	P1.24; P2.17; P2.28; P2.29; P2.36
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Einar, Santillán Julio	Argentina	P2.05
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Glibetić, Marija	Serbia	O3.4; O8.4; P1.20; P1.22; P2.07; P3.23
Gonçalves, Carla	Portugal	P1.23; P1.33; P1.34
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Graça, Pedro	Portugal	P1.33
Grande, Fernanda	Brazil	O1.1; O3.1; O4.1; O6.3
Gueifão, Sandra	Portugal	P2.28; P2.29; P2.37; P3.15
Gurinovic, Mirjana	Serbia	O8.4; P1.20; P1.22; P3.23
Güzelsoy, Nurcan Ayşar	Turkey	O3.2; P2.20; P3.29
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Hasselberg, Astrid Elise	Norway	O5.3
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Kjellefold, Marian	Norway	O5.3; O5.4; P1.07
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Kongoli, Renata	Albini	P1.29
Lageiro, Manuela	Portugal	P2.32; P2.33
Laranjo, Marta	Portugal	P1.21; P2.16; P3.36
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Machackova, Marie	Czech Republic	O6.2; P3.24; P3.35
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Menezes, Elizabete Wenzel de	Brazil	O4.1; O6.3; P1.03; P3.09; P3.34

<b>Names</b>	<b>Country</b>	<b>Presentation Code</b>
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