Food and Agriculture Organization of the United Nations

Pacific Community
Communauté du Pacifique

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## BASED ON ANALYSIS OF THE 2019/20 HOUSEHOLD INCOME AND EXPENDITURE SURVEY

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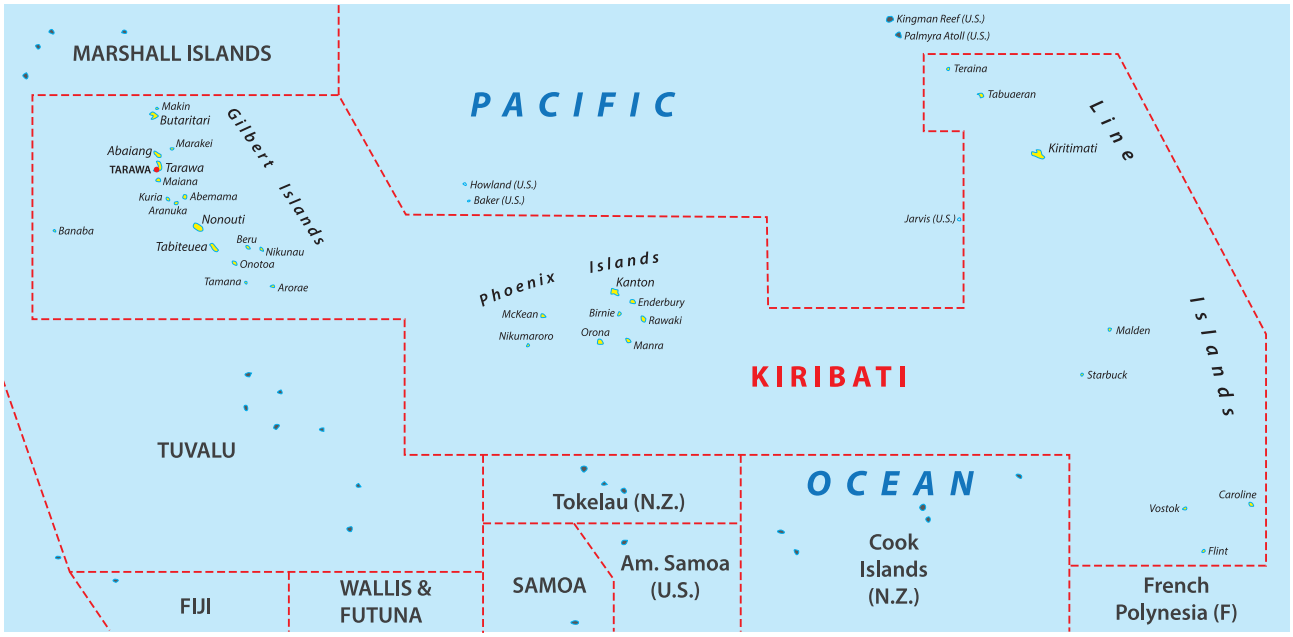
# Acronyms

| | |
|---|---|
| AUD | Australian dollar |
| CV | coefficient of variation |
| DEC | average dietary energy consumption |
| FAO | Food and Agriculture Organization of the United Nations |
| FIES | Food Insecurity Experience Scale |
| GIFT | Global Individual Food consumption data Tool |
| KHIES | Kiribati Household Income and Expenditure Survey |
| KNSO | Kiribati National Statistics Office |
| KSDIS | Kiribati Social Development Indicator Survey |
| MDER | minimum dietary energy requirement |
| NCD | non-communicable disease |
| PNDB | Pacific Nutrient Data Base |
| PoU | prevalence of undernourishment |
| SDG | Sustainable Development Goal |
| SPC | The Pacific Community |
| UNU | United Nations University |
| UOW | University of Wollongong |
| WB | The World Bank |
| WHO | World Health Organization |

# SUMMARY OF MAIN FINDINGS

The analysis of the food data collected in the 2019/20 Kiribati Household Income and Expenditure Survey (KHIES) found that on average one I-Kiribati in 12 does not have access to the amount of dietary energy needed to maintain a normal, active and healthy life. This prevalence is further confirmed by the analysis of the food insecurity experience scale data collected in the KHIES, which found that one I-Kiribati in 12 spent a whole day without eating in the last 12 months. The data further reveals that one I-Kiribati in three had to compromise on the quality of the food they could access because of a lack of money or other resources. The 2018/19 Kiribati Social Development Indicator Survey (KSDIS) found that 15 percent of children younger than the age of five years are stunted, and one child in 16 dies before reaching the age of five, which ranks Kiribati as the Pacific Island nation with the lowest child survival rate. But undernourishment, and child malnutrition or mortality are not the only burdens in Kiribati; the number of deaths or amputations linked to non-communicable diseases (NCDs) has risen as a consequence of, among other factors, the increasing concentration of obese adults in the population. Based on World Health Organization (WHO) estimates, 46 percent of the population aged 18 years and older is obese.




SOURCE: ShutterStock/Rainer Lesniewski[1]

To address the multiple burdens of malnutrition in Kiribati, it is important to get a better understanding of the dietary patterns of the population. In the absence of dietary intake surveys, the food consumption data collected in the 2019/20 KHIES present a valuable option to reveal the main trends in the food consumption of an I-Kiribati.

The analysis finds that, on average, an I-Kiribati consumes 2 760 kcal/capita/day. This relatively high level of dietary energy consumption combined with relatively high inequality in accessing dietary energy explains the coexistence of undernourishment and obesity in Kiribati. Important differences can be observed at the regional level, with rural households consuming on average 300 kcal/capita/day less than urban households. But income remains the main factor of inequality in access to food, with the wealthiest households consuming, on average, double the energy in kcal of the least wealthy households. Households with no children, or households located in urban areas, or those with a household head who possesses a high education level also present higher levels of dietary energy consumption than others. Conversely, households that have a male head who is married, or is a female, or older than 55 years, or who is experiencing severe food insecurity present lower dietary energy consumption.

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On average an I-Kiribati spends AUD 3.5 per day to obtain food and this expenditure represents 60 percent of the total daily expenditure at the national level, but the proportion is lower for urban households than for rural households, with a ratio of food expenditure to total expenditures of 56 percent for urban households compared with 64 percent for rural households. The wealthiest households spend around four times the sum spent by the least wealthy households to obtain food. Two kcal in three consumed is purchased, while dietary energy consumed from own produced food represents less than 12 percent of the average dietary energy consumed. Of the dietary energy consumed in Kiribati, 12 percent is consumed away from home and one kcal in ten comes from food received in kind or through exchange. But food consumed from own production or received in kind represents an important source of dietary energy in rural areas, contributing 19 percent and 16 percent, respectively, of the average dietary energy consumed.

In terms of composition of the diet, cereals, sweets and sugars, and fish and fish products contribute 70 percent of the average dietary energy consumed. With an average quantity consumed of 250 grams/capita/day, rice alone brings more than 30 percent of the dietary energy consumed, followed by sugar and bread, which contribute 14 percent and 7 percent respectively of the dietary energy consumed.

Fresh fish (reef, ocean or not further specified) is also an important component of the diet in Kiribati and the main source of protein, with an average consumption of 135 grams/capita/day. But with an average edible quantity of 130 grams/capita/day, the overall consumption of fruits and vegetables is very low and well below the WHO recommended level of 400 grams of fruits and vegetables per capita per day for a healthy diet.

Fats, proteins and carbohydrates contribute 17 percent, 12 percent and 70 percent respectively of the average dietary energy consumed, and therefore constitute a diet within the WHO recommended norm for a balanced diet, even if the contribution of carbohydrates is close to the upper limit. Two kcal in three is sourced from energy-dense foods to limit or avoid, such as rice, sugar, bread and cooking oil. Protective foods that are rich in vitamins A or C, such as fruits and vegetables, and body building foods that are rich in vitamin B12, calcium or proteins, such as fresh fish or chicken, represent less than 11 percent of the dietary energy consumed. Therefore, the average I-Kiribati diet is dense in energy from imported foods that are rich in fats and sugar and low in nutritional value. Adequate amounts of vitamin B12 and vitamin C are reached mainly through the high consumption of fresh fish and fresh coconut toddy, respectively. Conversely, levels of vitamin A, vitamins B1, B2 and calcium are

too low to reach the average requirements of an I-Kiribati.

The above trends not only point towards difficult access to safe and nutritious foods, but also to a degree of inequality in accessing dietary energy. The cross-analysis of the food consumption data with the food insecurity experience scale data provides a better understanding of the food insecurity pattern in Kiribati. The Food Insecurity Experience Scale (FIES) finds that around 36 percent of households in Kiribati experience moderate or severe levels of food insecurity, which means that these households do not have access to safe and nutritious foods, or to a sufficient amount of food because of a lack of income or other resources. South Tarawa is the region with the highest concentration of food insecure households, as 41 percent of households living in South Tarawa are food insecure compared with around 20 percent of households living in the Southern Gilberts and the Line and Phoenix Island groups. A higher concentration of food insecure households is also found among households with the lowest income, or with more than four children, or among households involved in fishing or handicraft activities, or households not selling copra. Compared with food secure households, households experiencing moderate levels of food insecurity are consuming on average 170 kcal/capita/day less than food secure households, but 170 kcal/capita/day more than households experiencing severe levels of food insecurity. Food insecure households spend on average 50 cents/capita/day less on food than food secure households and are consuming more affordable sources of dietary energy, since 1 000 kcal consumed by food insecure households cost on average 6 cents less than 1 000 kcal consumed by food secure households.

Except for tobacco and kava, quantities of food products consumed, on average, by food insecure households are lower than those consumed by food secure households. Except for calcium, nutrient adequacy of food secure households is reached for all vitamins, while it is reached only for vitamin C and vitamin B12 for food insecure households.

Note from the authors: Even if the results from the survey are consistent with the overall food security status of the country, they need to be treated and interpreted with caution. The survey was not designed to conduct an in-depth analysis of food consumption and dietary patterns. The food data presented some imperfections, such that levels or indicators need to be interpreted as reflecting survey trends rather than recorded facts. It is only through anthropometric data and individual food consumption surveys that the nutritional status of individuals can be properly established.

# INTRODUCTION

Kiribati is a remote Pacific Island nation of Micronesia comprising 33 scattered atolls. It includes three island groups – Gilbert Islands, Line Islands, and Phoenix Islands. It has a population of around 118 744 people (2020, SPC). Half of the population lives on South Tarawa atoll, bringing the population density to levels similar to those in Tokyo and Hong Kong. South Tarawa is the capital city of Kiribati.

Kiribati has few natural resources and is considered one of the least developed countries in the world.[I] A little less than one in four people live below the basic needs poverty line, and the number is higher in South Tarawa. The shortage of skilled workers, undeveloped infrastructure, and remoteness from international markets impede economic development. The economy greatly benefits from foreign aid, which contributed to over 32.7 percent of the government's finances in 2016.[2] Fishing license revenue and foreign workers' remittances, especially from seafarers, are important sources of income. Agriculture, forestry and fishing together contribute 26 percent to the GDP of Kiribati,[3] and over 80 percent of the population participates in farming or fishing. Copra plantations serve as a second source of employment; however, the significant exposure of Kiribati to climate change and sea level rise may compromise this source of livelihood in the future. If sea levels rise by 50 cm by 2100, as predicted, it is likely that within a century the nation's arable land will become subject to increased soil salination and will be largely submerged.[4]

Whereas copra and fish represent the bulk of production and export earnings (around 60 percent of the total value of exported goods in 2016[5]), most essential foodstuffs are imported (foodstuffs contributed to around 40 percent of the value of imports in 2016) and rice and poultry are among the main imported foods (around 23 percent of the value of food imports[6]). However, processed foods made from meat, fish or cereals, as well as sugar and sugar confectionery, contribute 36 percent of imported foods, consumption of which is widely increasing, because they are the cheapest source of energy, preferred by younger generations, and easy to prepare when compared with locally grown products like breadfruits and pandanus fruit, which are among the few agriculture varieties tolerant to the harsh atoll conditions.

The rapid decline of the traditional diet and replacement with cheap and unhealthy processed food not only increases the economic vulnerability of the country to external shocks, but it has a major impact on the health status of I-Kiribati people, which is demonstrated through the increase in the number of cases of diabetes, obesity and heart disease. With 46 percent of the adult population being obese, Kiribati ranks as the country with the ninth-highest prevalence of adult obesity[7] and it ranks first in terms of tobacco consumption, as 52.2 percent of the population identified as smokers in 2018.[8] Tobacco consumption increases smoking-related diseases and further undermines the health of I-Kiribati.

Non-communicable diseases are not the only source of preoccupation in Kiribati; access to an improved water source also is a concern, as 28.4 percent of the population still do not have access to an improved water source.[9] Because of the recurrent droughts caused by La Niña, rainwater tanks cannot be used and instead water needs to be drilled for, which has led to further water-borne illnesses. Indeed, 85.1 percent of household members have access only to a source of water that tested positive for the presence of *E. coli* contamination.[10] In addition to lack of access to an improved drinking water source, the majority of people in Kiribati do not have access to private toilets, and the majority of the population uses the beach or the bush for defecation, which further contributes to the contamination of the water supply.[11]

The poor access to improved water and sanitation is associated with a higher incidence of diarrhoeal diseases causing the death of many babies and children, with an average of 29.2 deaths for 1 000 live births[12] and a probability of dying between birth[13] and fifth birthday of 61 per 1 000 live births. Access to

[I] As of December 2018. See https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf

contaminated or unhealthy foods translates into relatively high rates of child malnutrition, with 15.2 percent of children less than age five being stunted (that is, presenting a low height for their age).[14]

All these trends point towards a country where ensuring access to safe and nutritious food is a real struggle, and meeting the 2030 Agenda for Sustainable Development will be a difficult endeavour if proper policies targeting food security and nutrition are not adopted. To better orientate policies aimed at achieving food security and improving nutrition,[15] data informing food consumption patterns of individuals or groups are needed. To date and to our knowledge, only administrative data are available to inform the recent situation on food supply in Kiribati,[16] and the last survey on household food consumption was conducted in 2006.[17] The rapid change in diet that is observed in Kiribati, and in the Pacific as a whole, needs new data.

In 2019 the Kiribati National Statistics Office (KNSO) conducted a large-scale socioeconomic survey (hereafter referred to as the 2019/20 KHIES), collecting not only information on food consumed by households, but also, for the first time, on food insecurity through the introduction of the food insecurity experience scale (FIES).[18] Five years after the adoption of the 2030 Agenda for Sustainable Development, this survey, in providing indicators on food security and food consumption in Kiribati, presents a timely opportunity to inform the development of policies aiming to improve the food security status of I-Kiribati.

This report presents the main trends derived from the analysis of the food consumption data collected in the 2019/20 KHIES. The analysis was conducted using ADePT-FSM software[I] developed jointly by the World Bank and FAO to derive food consumption indicators at the national level and for representative groups of populations.

The first section of this report discusses the Sustainable Development Goal (SDG) Target 2.1: "by 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round". The second section presents the main features of food consumption in Kiribati in terms of dietary energy consumption and food expenditure, cost of food or sources of acquisition of food products. The third section further focuses on the composition of the diet in terms of products consumed. The fourth section presents the consumption of essential nutrients and the last section presents the profile of food insecure households and their related food consumption.

The ADePT-FSM software produced more than 50 output tables[II] with disaggregation levels going up to the tenth percentile of expenditure. As not all indicators or disaggregation levels are relevant, only the most meaningful trends and groups of population are analysed. The tables are referred to throughout the report and they are accessible via the following link: https://microdata.pacificdata.org/index.php/catalog/760/download/3319

It is important to note that the survey started in May 2019 and stopped in February 2020, which was one month before WHO declared COVID-19 a global pandemic on 11 March 2020, and therefore it will not be possible to infer from the results presented in this report the impact of COVID-19 on food consumption and food security in Kiribati. The report describes only the pre-COVID-19 situation.

[I] ADePT-FSM is a free downloadable software developed by World Bank and FAO to analyse food data collected in the Household Income and Expenditure Survey and derive indicators of food consumption by population groups. The software can be downloaded at: http://www.fao.org/food-agriculture-statistics/statistical-domains/food-security-and-nutrition/methodology/en/

[II] For more information on output tables see "Analysing food security using household survey data", FAO/WB. 2014 (http://www.fao.org/economic/ess/ess-fs/fs-methods/householdsurvey/en/#.XtTC3W5uI2w) and "Optimizing the use of ADePT-FSM for nutrient analysis" – ADePT-FSM V3. FAO. 2018. http://www.fao.org/fileadmin/templates/ess/foodsecurity/Optimizing_the_use_of_ADePT_FSM_for_nutrient_analysis.pdf

# CHAPTER 1
# SDG Target 2.1 and Kiribati

Kiribati adopted indicators SDG 2.1.1 and 2.1.2 to monitor Target 2.1 on ending hunger and food insecurity. At the time when Kiribati presented its Voluntary National Review and Development Plan Mid-Term Review,[19] only information on SDG 2.1.1 (prevalence of undernourishment) was available and it was based on FAO estimates. By collecting both food insecurity experience scale and food consumption data, the 2019/20 KHIES presents an important opportunity for Kiribati to report on SDG 2.1.2 (prevalence of moderate or severe food insecurity based on the food insecurity experience scale) and provide background information needed to estimate and update the SDG 2.1.1 indicator.

## 1.1 SDG 2.1.1 – Prevalence of undernourishment

The prevalence of undernourishment, or percentage of the population whose habitual food consumption is insufficient to provide the dietary energy levels that are required to maintain a normal, active and healthy life, has been regularly monitored by FAO and reported annually in the State of Food Security and Nutrition in the World.[20] The prevalence of undernourishment has been used to monitor and report on global hunger since 2000 with the Millennium Development Goals and was endorsed in September 2015 as SDG 2.1.1. In order to provide a comparable estimate over time and across countries for global monitoring, the prevalence of undernourishment is based on the Dietary Energy Supply compiled by FAO in the Food Balance Sheets.

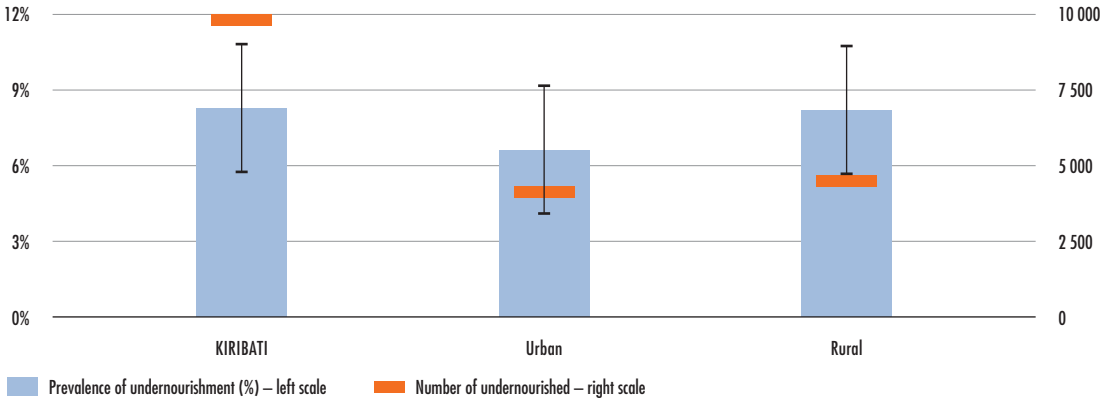
However, when food consumption data are collected in a large-scale representative national survey, it is possible to derive the average amount of energy consumed in the country together with the indicator of dispersion of the dietary energy consumption within the population (see Methodological Annex 1.1).

Based on the food consumption data collected in the 2019/20 KHIES, around 8 percent of the population in Kiribati[l] is undernourished, with a margin of error of 2.5 percentage points. This means that more than 9 800 I-Kiribati do not have access to enough dietary energy to meet their basic dietary energy needs.

Undernourishment is slightly lower in urban areas (around 7 percent) than in rural areas (around 8 percent) and this is due to the higher level of dietary energy consumption observed in the urban areas than in rural areas, which offsets the higher inequality in access to dietary energy observed in urban areas compared with rural areas, as shown by the coefficient of variation of the per capita dietary energy distribution (29 percent and 23 percent, respectively).

[l] This estimate is much higher than the FAO estimate (3 percent on average for the period 2017/19) based on a higher estimate of the Dietary Energy Supply of 2 990 kcal/capita/day in 2015/17 from the Food Balance Sheet (excluding losses at retail level) and a smaller coefficient of variation of 27 percent compared to 29 percent from survey data. See SOFI 2020: http://www.fao.org/publications/sofi/2020/en/

**FIGURE 1**
Percentage and number of people undernourished in Kiribati




SOURCE: Kiribati 2019/20 HIES.

## 1.2 SDG 2.1.2 – The prevalence of moderate or severe food insecurity based on the FIES

The Food Insecurity Experience Scale (FIES) is composed of eight dichotomous questions asking respondents to report on their experience in accessing enough and/or nutritious food with respect to their resources. The scale has been adopted to monitor progress towards SDG Target 2.1 through the SDG 2.1.2 indicator of the prevalence of moderate or severe food insecurity based on the FIES. The FIES was introduced for the first time in Kiribati through the 2019/20 KHIES. Food insecurity measured by this indicator refers to limited access to food, at the level of individuals or households, due to lack of money or other resources (more detail in the Methodological Annex 1.2).

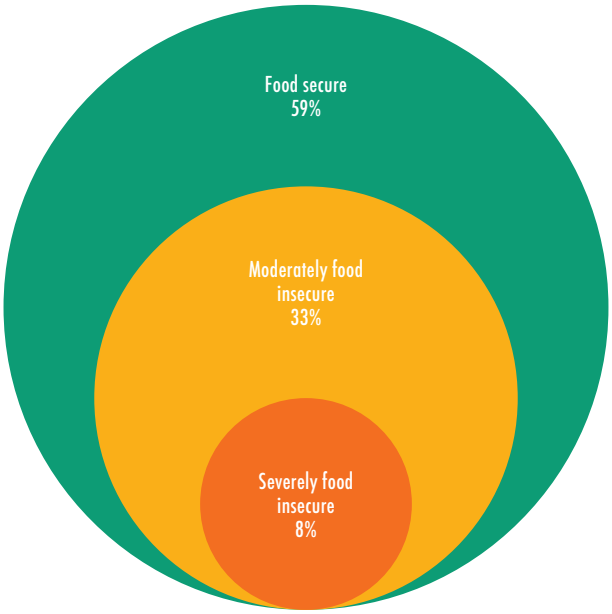
The analysis of the FIES finds that around 8 percent of I-Kiribati were exposed to severe levels of food insecurity in 2019, implying reductions in the quantity of food consumed to the extent that they have possibly experienced hunger. This estimate is in line with the percentage of undernourished people.[1] Both indicators are a measure of severe food insecurity and difficulty in accessing enough dietary energy.

A broader look at the extent of food insecurity, beyond severe levels and hunger, reveals that an additional 39 100 individuals have experienced food insecurity at moderate levels (about one third of the population). This implies that these additional people did not have regular access to safe and nutritious foods, even if they were not necessarily suffering from hunger, putting them at greater risk of various forms of malnutrition and poor health than the food secure population.

Estimates for severe food insecurity based on the FIES and the prevalence of undernourishment are similar at the national level; the results diverge when looking at sub-national estimates. Based on the FIES, severe food insecurity is higher in the urban areas than in rural areas, with around one person in ten being severely food insecure in urban areas compared with a little less than six in one hundred in rural areas. But these results need to be appreciated with respect to the margin of error around the estimate, which is much higher in urban areas than in rural areas (see Table 1).

[1] SDG Indicators 2.1.1 and 2.1.2 are both measures of severe food insecurity, but compared with the prevalence of undernourishment, the prevalence of severe food insecurity based on the FIES is a direct measure of people's access to a sufficient quantity of food, and it complements the information provided by the prevalence of undernourishment, which is only an indirect measure of lack of access to dietary energy.

**FIGURE 2**
Prevalence of food insecurity in Kiribati based on the FIES (percent of population)




SOURCE: Kiribati 2019/20 HIES.

**TABLE 1**
Prevalence of food insecurity based on the FIES at regional level (percentage)

| | Kiribati (%) | Rural (%) | Urban (%) |
|---|---|---|---|
| Moderate or severe food insecurity | 40.9 ± 4.2 | 35.2 ± 4.7 | 45.9 ± 6.8 |
| Severe food insecurity | 7.9 ± 2.4 | 5.5 ± 2.2 | 10.1 ± 4.1 |
| **Size of the sample** | **2 182** | **1 584** | **598** |

NOTE: Margin of error into bracket with a design effect of 2 and confidence level of 90 percent.
SOURCE: Kiribati 2019/20 HIES.

# CHAPTER 2
# BASIC FEATURES OF FOOD CONSUMPTION BY POPULATION GROUPS

The ADePT-FSM software has been developed to allow for an in-depth analysis of food data collected in a household income and expenditure survey at the national level and for groups of population or groups of products. ADePT-FSM can provide estimates up to the tenth percentile for each population group; however, to allow for robust estimates it is recommended to have population groups relatively balanced in terms of size with at least 250 households per group. In the case of the 2019/20 KHIES, there are valid estimates on food consumption for 2 182 households, which means that not all population groups can be considered for the analysis. The selection of the categories below were therefore based on their relevancy in the context of food security analysis and the possibility of being disaggregated at a level allowing for reliable estimates[I] (see Annex 2 for basic information on the groups).

- Geographic characteristics
  - Kiribati (national)
  - Urban/rural
  - Region (South Tarawa, Northern, Central, Southern, Line and Phoenix Islands)
- Demographic characteristics of the household, or the head of the household
  - Gender of the head of the household
  - Age of the head of the household
  - Number of children less than 14 years of age (no child, one child, two children, three children, four children and more)
  - Marital status of the head of the household (married or widowed/divorced/separated/ never married)
- Health and sanitation
  - Percentage of adults more than 15 years of age that are overweight or obese in the household[II]
  - Access to a safe source of drinking water (yes/no)[III]
  - Access to toilet facilities (yes/no)[IV]
- Socioeconomic characteristics of the household, or head of the household
  - Quintile of household per capita total expenditure
  - Education level of the head of the household (preschool/primary school, lower secondary school, higher or post secondary/tertiary education)[V]

[I] The analysis by ethnic group could not be performed because the percentage of I-Kiribati compared with other ethnic groups was too high (92 percent).

[II] This population group was created using information on the height and weight collected in the anthropometric section of the survey. A person older than age 15 years is considered as overweight or obese when his/her body mass index is higher than 25. Four classes were created: “less than 33%”, “33% to 50%”, “50% to 75%” and “more than 75%” of adults older than age 15 years living in the household who are overweight or obese.

[III] This group is created using information on the main water source used for drinking. A dichotomous variable was created taking the value of “Yes” when the source for drinking water is a public piped or protected well and “No” when the source for drinking water is an unprotected well, ground water or rainwater tank.

[IV] This group is created using information on access to toilet facilities. A dichotomous variable was created taking the value of “No” whenever household members have no access to toilet facilities and “Yes” otherwise.

[V] This population group is created using the information on the highest education level reached.

- Household member was engaged in fishing, hunting or seafood collection during the last seven days (yes/no)
- Household member was engaged in handicraft or home processed food activities in the last 30 days (yes/no)
- The household is involved in livestock activities (yes/no)
- The household is selling copra (yes/no)
- The household receives remittances from another household (yes/no)
- Level of severity of food insecurity based on the FIES[I]

In addition to the above population groups, indicators are also provided for each of the 178 food products collected in the survey and for each of the 19 food groups of the FAO/WHO Global Individual Food consumption data Tool (GIFT)[II] classification. Based on this classification we have 19 food groups, but, as the survey does not collect information on insects, this group was replaced with that of "Tobacco and kava". The latter are not considered as food products but analysed because of their consumption in Kiribati and negative impact on health. See Table 2 for the list of the 19 food groups and Annex 2.2 for their composition.

Further to this grouping, products were also classified following the Pacific guidelines for healthy living developed by SPC's experts in nutrition.[21] On page 5 of the guidelines, the authors propose a categorization of food products as energetic foods, body building foods and protective foods, and they further disaggregate these groups and distinguish between foods to choose, limit or avoid.

Household Income and Expenditure Surveys are designed to collect information at the level of the household, and therefore only the total amount of food consumed by the household is reported, from which it is not possible to infer intra-household food allocation. For this reason, all indicators are expressed in per capita per day, and do not consider the age and sex of the individuals. Further, due to measurement error around the food consumption estimates associated with the survey design and processing (see Annex 3), the analysis is performed for representative groups of people and not on a single household or individual. The units of measurement are kcal, grams, AUD and percentage.

Finally, as already mentioned, it is only through individual intake surveys that it is possible to infer the food consumption of individuals. Food data collected in the 2019/20 KHIES does not substitute for such surveys and they are, at best, an approximation of the amount of food that is available to the household to be consumed over a certain reference period. Therefore, results presented herein reflect only a pattern and whenever the term consumption is used it does not refer to actual intake.

## 2.1 Dietary energy consumption

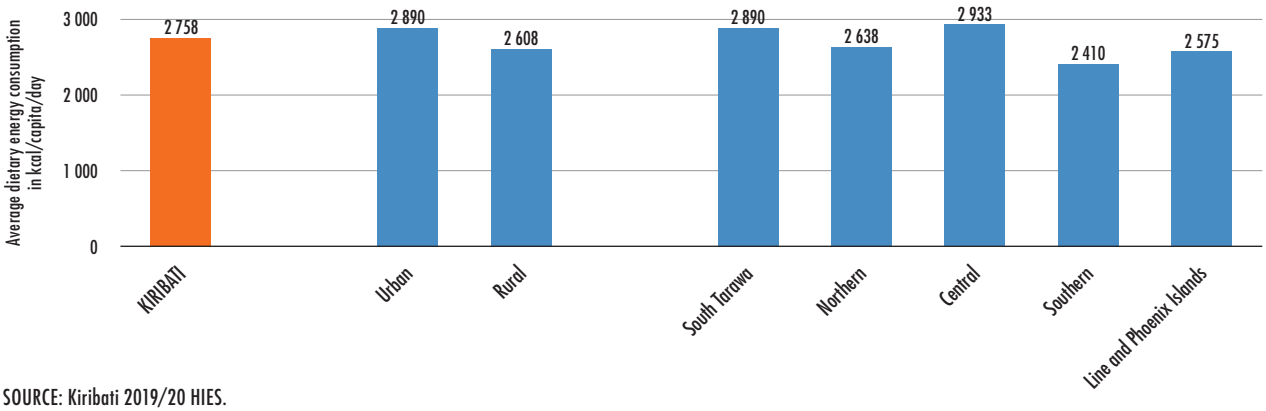
On average, an I-Kiribati consumes 2 760 kcal per day (ADePT table 1.3). This amount of dietary energy consumption (DEC) is not equally distributed among the population, as reflected by the relatively high coefficient of variation of the per capita dietary energy consumption distribution, which highlights the coexistence of overweight/obesity (people consuming an amount of dietary energy higher than that needed to be in good health) and undernourished people (people having access to less dietary energy than the minimum required to maintain a normal, active and healthy life).

Indeed, a deeper look at the distribution of the household average dietary energy consumption reveals that inequality in accessing dietary energy is relatively high in Kiribati, as not all population groups enjoy the same amount of dietary energy. The most important differences in the average DEC are mainly observed between the least and most wealthy households and between urban and rural households. In fact, the average amount of dietary

[I] This categorization is performed using the affirmative answers to the Food Insecurity Experience Scale (FIES) module. Before associating a level of food insecurity to the number of affirmative answers (raw score), the statistical validity of the scale was assessed. Based on the statistical tests it was found that the scale performs well in Kiribati but because of its low infit (0.7), relatively high correlation with the last question of the scale (0.45), and the fact it is unique to Kiribati when equating to the global standard, the item HUNGRY referring to the question "were you hungry but did not eat because there was not enough money or other resources" was excluded from the analysis. Keeping or not this question does not impact on the overall analysis. Based on this, the cut-off points to set the moderate level of food insecurity are a raw score of 7 for households experiencing severe food insecurity and a raw score between 4 and 6 for households experiencing a moderate level of food insecurity. At these levels, the probability of being moderately food insecure and the probability of being severely food insecure are higher than 50 percent. Three classes are therefore created: 1 for "Food secure or mildly food insecure", 2 for "Moderately food insecure" and 3 for "Severely food insecure".

[II] The food products were grouped according to FAO nutrition experts who developed the GIFT platform http://www.fao.org/gift-individual-food-consumption/data-and-indicator/en/ developed from the FoodEx2 classification. FoodEx2 is a comprehensive food classification and description system aimed at covering the need to describe food in data collections across different food safety domains. https://efsa.onlinelibrary.wiley.com/doi/pdf/10.2903/sp.efsa.2015.EN-804.

**FIGURE 3**
Average dietary energy consumption by region




SOURCE: Kiribati 2019/20 HIES.

energy consumed by the wealthiest households is twice that of the least wealthy households, and the average DEC in urban areas is around 300 kcal/capita/day higher than that in rural areas. But even within rural areas dietary energy is not equally distributed, as significant differences in the average DEC can be observed. With an average DEC of 2 400 kcal/capita/day, the Southern region exhibits the lowest DEC, whereas in the Central region the average DEC per capita per day is almost 500 kcal/capita/day higher.

Further differences in the demographic or other socioeconomic characteristics of the households can also be observed. For instance, the average DEC of households not engaged in fishing activities seems to be higher than that of the households engaged in this activity. Conversely, households who are selling copra present a higher DEC than households not selling copra. Whether or not the households are involved in livestock or handicraft activities does not seem to be a determinant to access to dietary energy and there do not seem to be differences in the DEC of households that receive remittances (one household in three) compared with those who do not. The marital status (married or not married) and the gender of the head of the household do not seem to impact the average DEC, but some important differences in the average DEC can be observed between households whose head is 55 or older compared with households that have a head who is younger.

As expected, the composition of the household also matters, but in this case the difference needs to be compared when the DEC is expressed in adult male equivalent (AME)[I] rather than when it is expressed on a per capita basis. On average, an I-Kiribati belonging to a household without a child consumes 600 kcal (per AME) more than an I-Kiribati belonging to a household with at least four children. The average DEC tends to increase when the percentage of adults older than age 15 years who are overweight or obese in the household increases. Hence the average DEC in households where more than three adults in four are overweight or obese is 500 kcal/capita/day higher than the average DEC in households where less than one adult in three is overweight or obese.

Based on the 2019/20 KHIES, around one household in two does not have access to a safe source of drinking water and around 40 percent do not have access to private toilets. Low access to adequate quantity and quality of water for domestic use (including for hygiene) is a leading cause of water-related diseases, which is a major driver of malnutrition, as it reduces the body's absorption of nutrients. Poor-quality drinking water is an important risk factor for diarrhoea.[22] A lack of access to toilet facilities further increases the risk of contamination of the water with *E. coli* and the risk of infection. Poor access to safe water and sanitation is usually linked to lower dietary energy consumption, lower cost of calories, lower nutritional values of food available

[I] The DEC expressed in adult male equivalent (AME) refers to the total dietary energy consumed divided by the size of the household expressed in adult male equivalent. To obtain this denominator, the normative average dietary energy requirement of each household member is estimated and divided by the average normative requirements of a male adult. These ratios are then summed up for each household to obtain the size of the household in adult male equivalent. The higher the number of children in a household the lower the denominator and the higher the value of the DEC expressed in adult male equivalent compared to the DEC expressed in per capita.

for consumption and so on. Usually the least wealthy households are those with the poorest access to safe water and sanitation, but in many Pacific Island countries and territories, the inequality in access to safe water and sanitation is more at the level of the community than of income, and we therefore find trends that are not necessarily 100 percent correlated to income. In the case of Kiribati, it seems that access to a safe source of drinking water is not a factor affecting the average DEC,[I] while a significant difference in the average DEC can be observed between households with or without private toilets – the latter presents a much lower average DEC.[II]

Not surprisingly, and because of the positive correlation between income and education level (significant at 1 percent level), households with heads who have high levels of education also tend to access higher amounts of dietary energy than households with heads who have lower levels of education. Finally, the average DEC is higher for households that are food secure than for households that are experiencing moderate to severe levels of food insecurity.

As seen in Figure 4, income (proxied by total expenditure) is the main factor of inequality in access to dietary energy, and hence, to assess which characteristic affects the average DEC controlling for income, a simple linear regression was performed, linking the logarithm of the DEC distribution to the logarithm of the total expenditures and all the regional, demographic and socioeconomic characteristics of the households.[III] The regression confirms most of the results discussed above. The average DEC is significantly lower in the Southern region and in Line and Phoenix Islands than in the other regions. The total number of children, the age of the head of the household and the nutritional status of the adults composing the household significantly affect the DEC. Households with a high education level present a higher DEC than those with a lower education level, but after controlling for income, the impact of education is no longer significant. The same applies for households involved in livestock, handicraft or copra activities. The model confirms that households involved in fishing activities have a lower DEC than those not involved in fishing activities even if the statistical significance of the coefficient is relatively low (*p* value = 0.087). Marital status and gender of the head of the household also affect the DEC, as the average DEC of households whose head is a female or is married is statistically significantly lower than households whose head is a male or not married. The model also confirms that, on average, food insecure households consume less dietary energy than food secure or mildly food insecure households, although the severity level of food insecurity of the household is not statistically significant. Finally, the model finds that the average DEC is statistically significantly lower for households with access to a safe source of drinking water or private toilets than households with no access to a safe source of drinking water or private toilets. But this result is biased by some measurement error affecting the distribution of DEC in urban areas,[IV] where most households with access to a safe source of drinking water or sanitation facilities live.[V] Indeed, after further correcting for measurement error we found that the average DEC of households with access to a safe source of drinking water or with access to a private toilet is statistically significantly higher at 10 percent level.[VI]

## 2.2 Main sources of dietary energy consumption

Around 70 percent of DEC, on average, per day by an I-Kiribati is purchased in cash and 10 percent is received for free or obtained in exchange for other foods. Dietary energy coming from own-produced foods represents only 12 percent of the average DEC consumed; the rest of the dietary energy is sourced from meals[VII] consumed away from home (ADePT table 1.5).

I The *p* value for the difference between the unweighted DEC of households with access to a safe source of water and DEC of households with no access to a safe source of water is 0.38, leading to the conclusion that the difference in means is statistically significantly equal to 0.

II However this difference is not statistically significant as the *p* value for the difference between the unweighted DEC of households with private toilets and unweighted DEC of households with no access to private toilets is 0.32.

III The regression is performed using the sampling weights, as we could see that weights affect the average DEC of some population groups.

IV Inequality as measured by the coefficient of variation (CV) of DEC is higher in urban areas than in rural areas with respective CVs of 47 percent and 37 percent before correcting for excess variability due to measurement error, and 29 percent and 23 percent after correction.

V To verify this statement, we performed a simple binomial logistic regression linking access to safe water or private toilet with the logarithm of income and region of residence (urban used as reference). We found that the *p* value for income was statistically significant at 5 percent level for toilet but not for access to safe water (*p* value of .000 and .037 respectively) but the area of residence was statistically significant in both cases with a *p* value of .000.

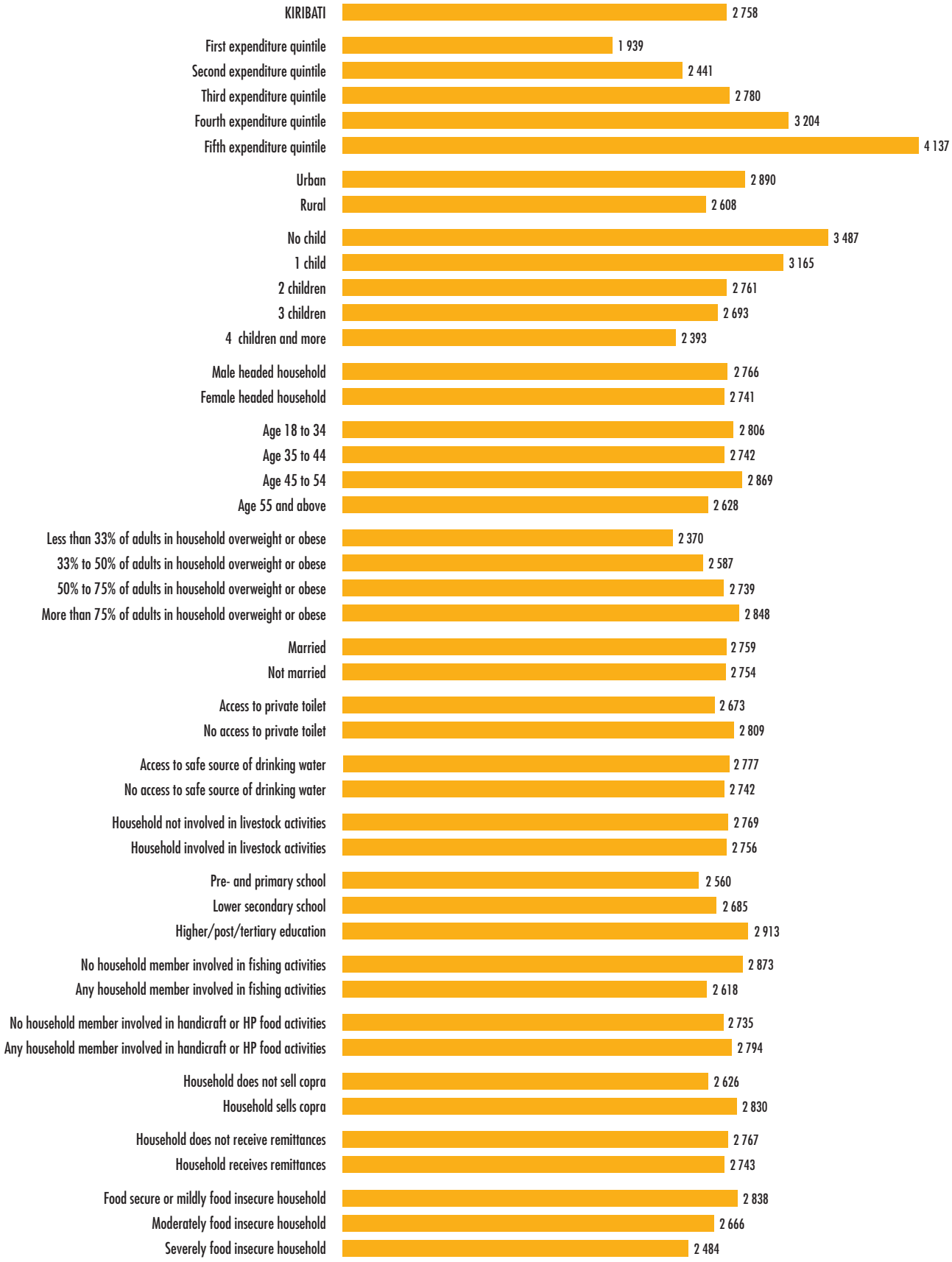
VI *p* value = .118 and .000 respectively for access to safe water and access to private toilet.

VII Breakfast, lunch, dinner, snacks, hot drinks, non-alcoholic drinks and bottled water.

**FIGURE 4**

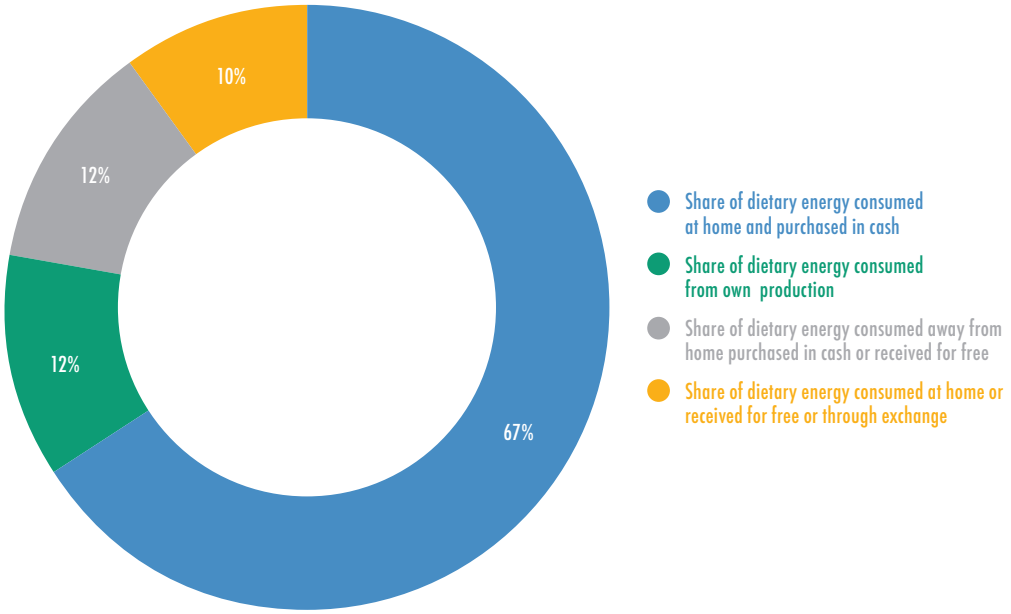
## Average dietary energy consumption by demographic and socioeconomic characteristics of the household

Average dietary energy consumption in kcal/capita/day




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 5**
Contribution of the main sources of acquisition to the average dietary energy consumed (percentage)



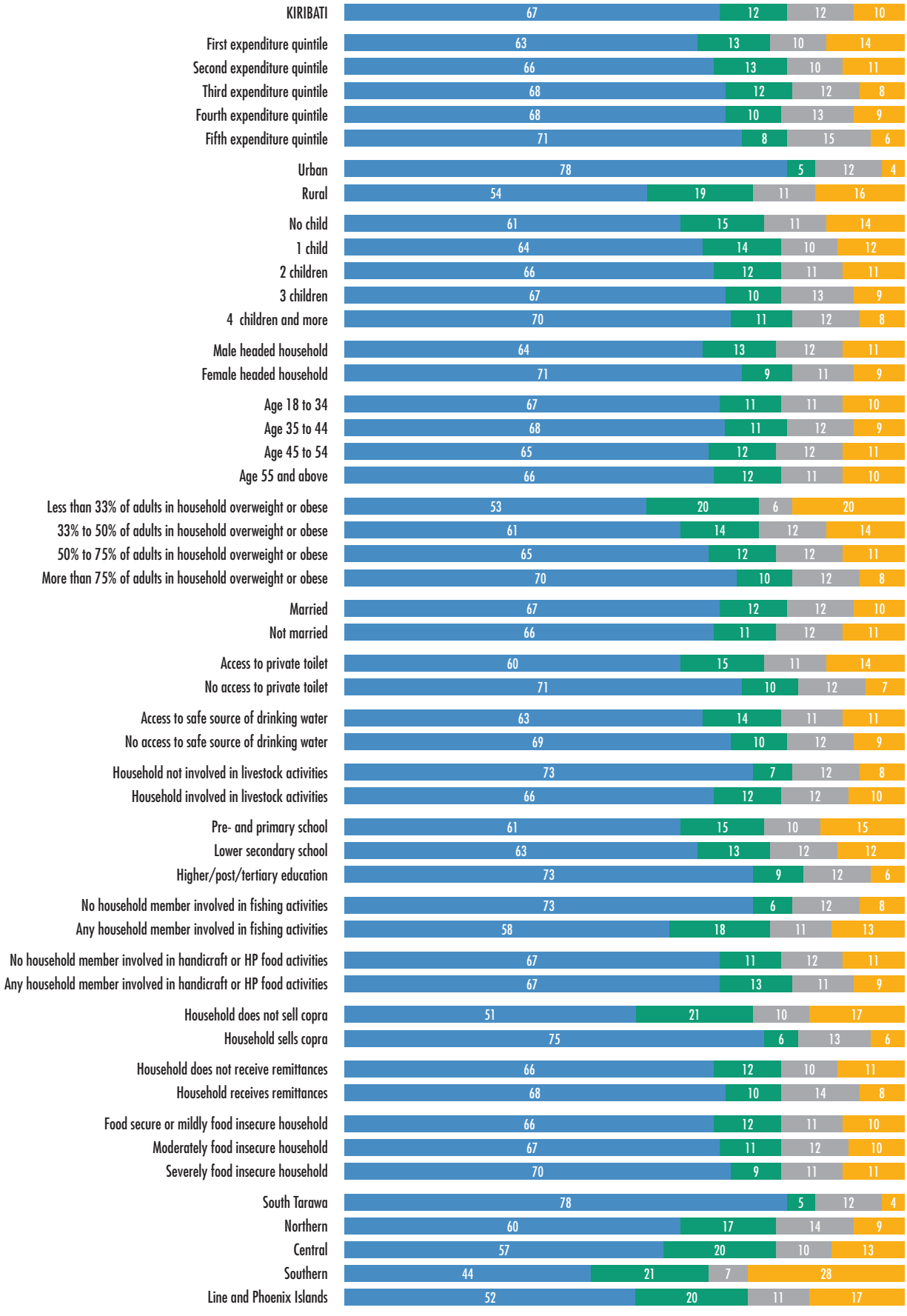

SOURCE: Kiribati 2019/20 HIES.

These trends slightly differ by geographic, demographic or socioeconomic characteristics of the households. Around 80 percent of the dietary energy consumed in urban areas is purchased in cash, and food consumed away from home contributes 12 percent of the energy consumed. Conversely, around 20 percent of the dietary energy consumed in rural areas is own produced and 16 percent is received for free or obtained through exchange. More than 28 percent of the dietary energy consumed in the Southern region is obtained through exchanges or is received for free, which might be explained by the stronger influence of the *bubuti* system[I] in this region compared with other regions.

With more than 70 percent of the dietary energy consumed coming from cash purchases, female headed households are more vulnerable to price hikes than male headed households, which obtain 13 percent of their dietary energy from their own production. As expected, the contribution of own production to the average DEC of households involved in fishing or livestock activities is higher than that of the households not involved in these activities. Surprising is the low contribution of food received for free or exchanged among households selling copra compared with those who are not selling copra, as coconuts are a commonly exchanged food item in Kiribati. Instead, households selling copra purchase in cash 75 percent of the dietary energy they consume, while households not selling copra purchase 50 percent of the dietary energy they consume. Finally, the higher contribution of foods purchased in cash and the lower contribution of own-produced foods among households experiencing severe food insecurity than among food secure households seem to confirm that food insecure households have difficult access to food because of a lack of resources.

[I] In Kiribati, egalitarian values are strong and equality was maintained through sharing surplus wealth. While much sharing was voluntary, the *bubuti* system was key in maintaining equality, as it forced those with a surplus to share it with extended family members in need. See more at https://savekiribati.com/

**FIGURE 6**
## Contribution of main sources of acquisition of dietary energy by household characteristics

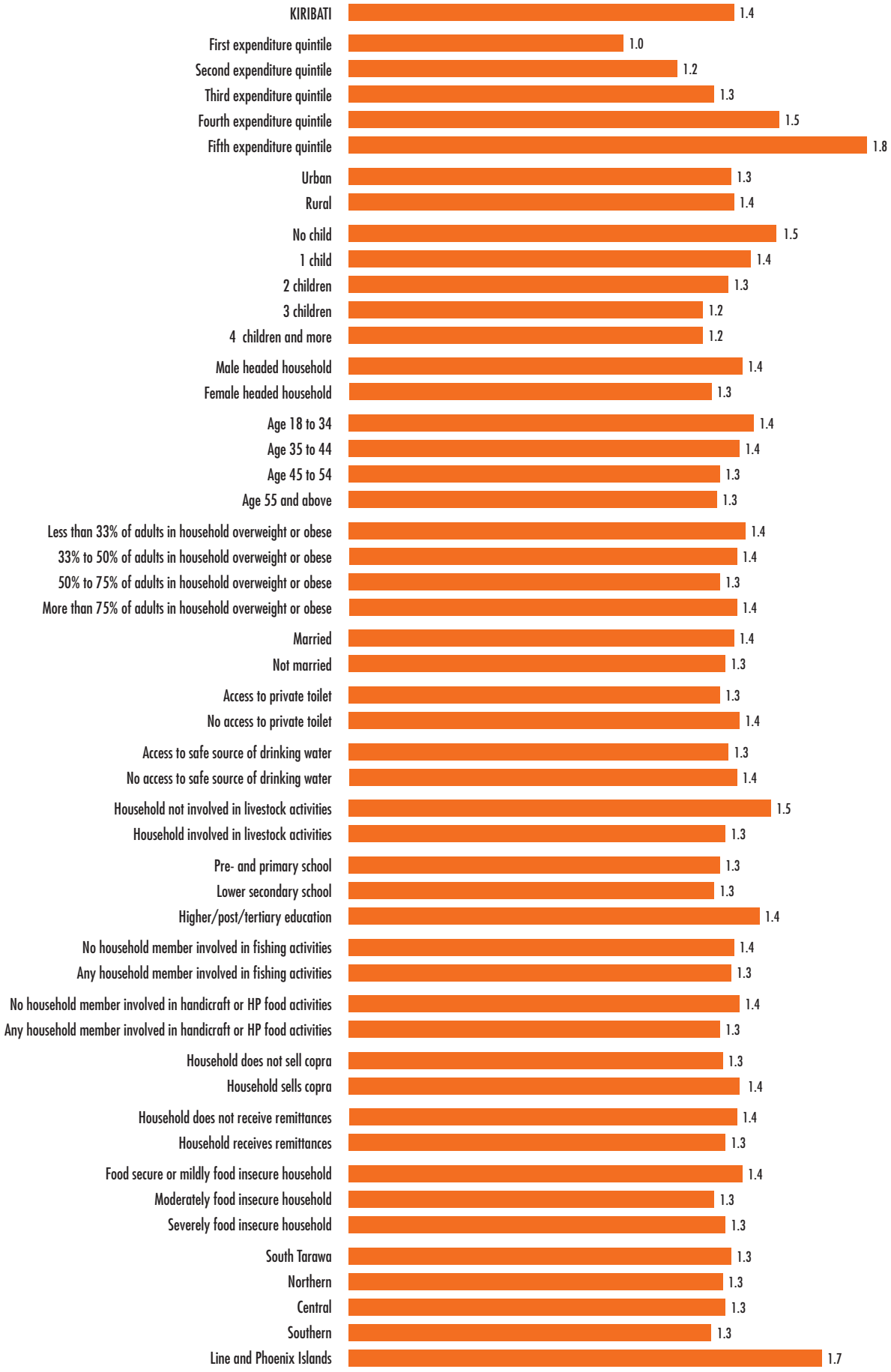



SOURCE: Kiribati 2019/20 HIES.

**FIGURE 7**

## National disparities in the average cost of 1 000 kcal

Average dietary energy unit value in AUD/1 000 kcal




SOURCE: Kiribati 2019/20 HIES.

## 2.3 Cost of the dietary energy

To acquire the daily 2 760 kcal consumed on average by an I-Kiribati, a household spends, on average, AUD 3.5 per day, which means that it costs a little less than AUD 1.4 to obtain 1 000 kcal (ADePT table 1.3). Not all households spend the same amount to acquire food and not all households enjoy the same quality or diversity of foods. Income and region remain the main factors of inequality in the cost of dietary energy. In fact, in the region of Line and Phoenix Islands, the cost of 1 000 kcal is around 23 percent to 29 percent higher than in the other regions, and wealthy households would spend around twice as much to get 1 000 kcal than the least wealthy households. The cost to acquire 1 000 kcal is a good indicator of the quality of the dietary energy consumed between population groups, controlling for income and regional disparities. The higher the cost, the higher the diversity or the nutritious quality of the foods consumed. To see the main factors affecting the cost of 1 000 kcal, a linear regression linking the household cost of 1 000 kcal to the logarithm of total expenditure, region and other socioeconomic or demographic characteristics of the household was performed.

The regression finds that, after controlling for income and region, households headed by a female spend less on average to acquire 1 000 kcal than male headed households. It is the same pattern for households with children compared with households with no children, and the higher the number of children, the lower the amount spent to obtain 1 000 kcal. Households in which the head is married also spend statistically significantly less to obtain 1 000 kcal than households in which the head is not married. Also, the higher the percentage of adults overweight or obese in households, the lower the cost to obtain 1 000 kcal, which means that households with a high concentration of adults overweight or obese tend to consume low-cost and energy-dense food when compared with households with a lower proportion of adults overweight or obese.

Households involved in livestock, handicraft, fishing or copra activities also spend less to acquire 1 000 kcal compared with households not involved in these activities, although the difference is not statistically significant for households involved in fishing or copra activities ($p$ value ~ 0.65). Households with access to a safe source of drinking water tend to access sources of energy of higher quality than households with no access to a safe source of drinking water, but the statistical significance of the coefficient is relatively low (25 percent). Conversely, whether households have access to or no access to private toilets does not affect the cost of dietary energy. Even if not statistically significant, the sign of the parameter associated with the level of severity of food insecurity is interesting. Households experiencing moderate levels of food insecurity spend on average less to acquire 1 000 kcal than food secure households. This result tends to corroborate the finding that food insecure households have access to less diversified foods, or a diet of lower quality. The positive trend associated with households experiencing severe food insecurity can be associated with the fact that these households are experiencing hunger because of a lack of resources; these households have already compromised on the quality of their foods (see results of the regression in Annex 5).

Expenditures on food account for around 60 percent of total household consumption expenditure (ADePT table 1.7). Households belonging to the first quintile of expenditure devote 62 percent of their total expenditure to obtain food while the wealthiest households devote 56 percent of their total budget. Rural households also devote a larger share of their total expenditure to food than do urban households (64 percent versus 57 percent).

# CHAPTER 3
# COMPOSITION OF THE DIET OF AN I-KIRIBATI

## 3.1 Contribution of main food groups

To provide a broad overview of the main categories of food products consumed, products were categorized according to 19 food groups defined on the basis of their nutritional relevance following the classifications used in the FAO/WHO Global Individual Food consumption data Tool (GIFT). In the case of Kiribati, out of the 19 food groups, only 18 were covered by the food recall section of the 2019/20 KHIES[I] and the group of "tobacco/kava" was added because of the importance of consumption of tobacco in Kiribati and its negative impact on health (see the mapping of the food products into GIFT groups in Annex 2.2). Around 178 food products were reported, of which seven products referring to breakfast, lunch, dinner, snacks, hot drinks, beverages and bottled water were consumed away from home. With more than 20 food products, the group of "vegetables and their products" is the most diversified, followed by the groups of "beverages", "fish, shellfish and their products" and "sweets and sugars", each with 19 food products. The groups of "eggs", "foods for particular nutritional uses" and "savoury snacks" are the less diversified, being only represented by one food product. But not all households are consuming all the products reported in a group. Out of the 178 food products collected, only 21 food products are consumed by at least 33 percent of the households. Only one kind of fruit, meat or pulses/seeds/nuts[II] and four different kinds of fish or fish products are consumed by at least one household in three. Conversely, less than one household in three is consuming at least one kind of vegetable or is consuming eggs. Of note is the importance of meals consumed away from home, as more than 33 percent of the households are consuming at least one meal away from home.

Six of these groups bring 90 percent of the dietary energy consumed, and the group of "cereals and products" alone brings 44 percent of the dietary energy consumed, followed by the group of "sweets and sugars" (17 percent). Meals consumed away from home contribute around 12 percent of the average dietary energy consumed. "Fish and fish products" represent the first most important source of proteins and contribute 7 percent of the average dietary energy consumed compared with "meat and meat products" that bring only 2.5 percent of the dietary energy consumed. With an average of 130 grams/capita/day, the consumption of fruits and vegetables is well below the 400 grams/capita/day recommended by WHO as one of the 25 indicators of its Global Action Plan for the Prevention and Control of Non-communicable Diseases.[23] Of note is the very low contribution of roots, tubers and plantains[III] to the average dietary energy consumed in Kiribati, mainly due to the low production of these products.

I None of the food products belonging to the groups of "insects, grubs and their products" were collected in the food recall section of the questionnaire.

II In GIFT, brown coconut is classified in the group of pulses/seeds/nuts.

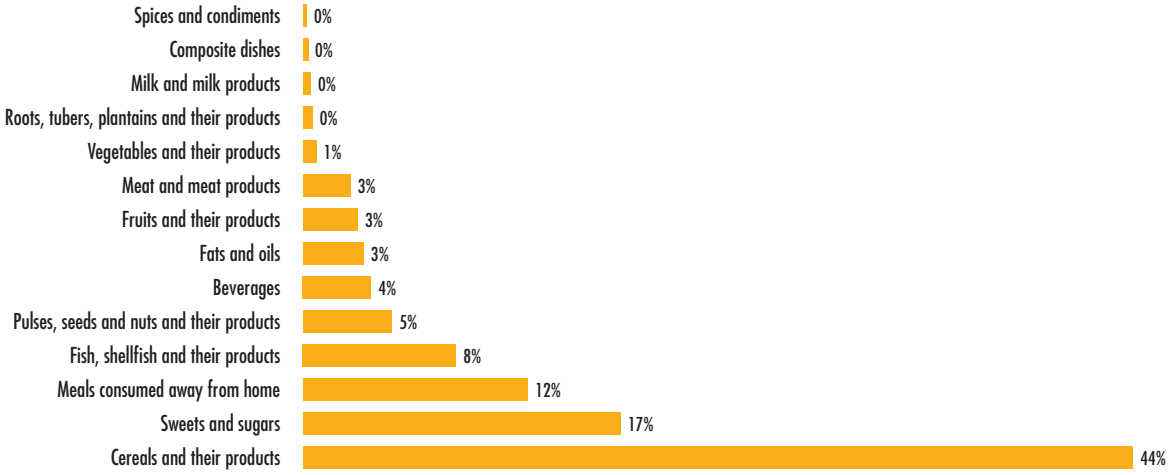
III Note that based on GIFT classification, breadfruit belongs to the group of fruits and their products.

**TABLE 2**
## Number of products reported by food group

| Food group | Number of food products | Number of products accessed by at least one third of the households |
|---|---|---|
| Cereals and their products | 6 | 3 |
| Roots, tubers, plantains and their products | 8 | 0 |
| Pulses, seeds and nuts and their products | 5 | 1 |
| Milk and milk products | 4 | 0 |
| Eggs and their products | 1 | 0 |
| Fish, shellfish and their products | 19 | 4 |
| Meat and meat products | 13 | 1 |
| Vegetables and their products | 21 | 0 |
| Fruits and their products | 17 | 1 |
| Fats and oils | 7 | 1 |
| Sweets and sugars | 19 | 2 |
| Spices and condiments | 8 | 2 |
| Beverages | 19 | 1 |
| Foods for particular nutritional uses | 1 | 0 |
| Food not classified (meals consumed away from home) | 7 | 3 |
| Food additives | 2 | 0 |
| Composite dishes | 18 | 0 |
| Savoury snacks | 1 | 0 |
| Tobacco/kava | 2 | 2 |
| **Total** | **178** | **21** |

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 8**
## Average dietary energy consumption by food groups




SOURCE: Kiribati 2019/20 HIES.

## 3.2 Main food products consumed

Out of the 178 products collected in the food recall section of the 2019/20 KHIES, 20 contribute 90 percent of the average dietary energy consumed. With an average quantity consumed of 255 grams/capita/day, rice alone brings almost one third of the dietary energy consumed, followed by sugar and bread, with an average quantity consumed of respectively 95 grams/capita/day and 80 grams/capita/day. Fresh fish (reef, pelagic or not further specified) is also an important contributor to the daily diet with an average edible[I] quantity consumed of around 140 grams/capita/day (ADePT table 3.1). With an average of 160 kcal/capita/day, lunches consumed away from home also represent a significant source of dietary energy, contributing 6 percent of the average dietary energy consumed. Breadfruit, which is one of the rare locally grown products, contributes less than 2.5 percent of the average dietary energy consumed, with an average edible quantity of 60 grams/capita/day, three-quarters of the quantity of rice consumed. Consumption of roots and tubers, such as cooking bananas or taro, is minimal, with an average daily consumption of around 10 grams per capita. Even if it contributes around 2 percent of the average dietary energy consumed, fresh coconut toddy is the second main food consumed in terms of quantity after rice, with an average of 100 grams/capita/day. With an average quantity of around 6 grams/capita/day, consumption of salt is above the WHO recommendation of no more than 5 grams of salt per day per adult,[II] as high sodium consumption contributes to high blood pressure and increases the risk of heart disease and stroke. Finally, and importantly, on average an I-Kiribati consumes 50 grams per day of tobacco and more than 80 grams per day of kava. Considering the toxicity of these products, the impact on health of such excessive consumption is of real concern.

## 3.3 Main products accessed by households

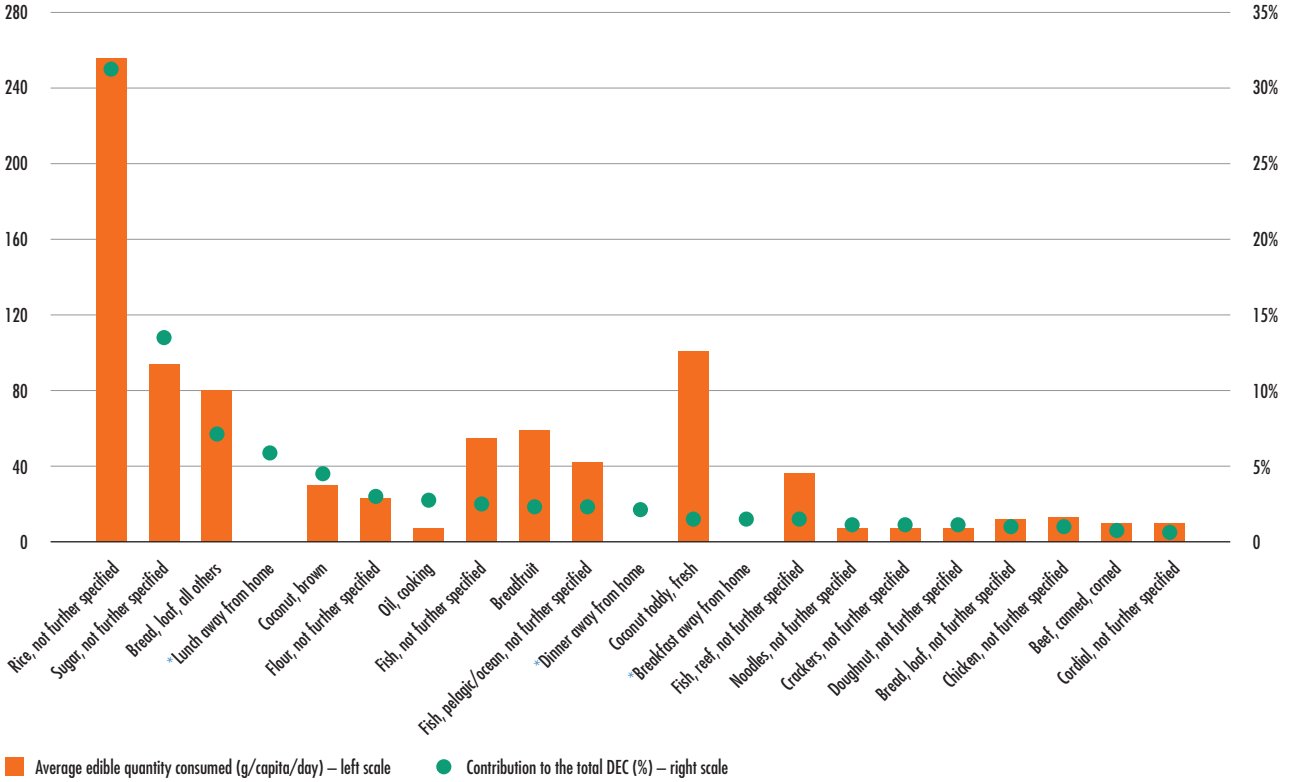
The percentage of households that reported having consumed the food during the previous seven days is a good indicator not only of consumer preference, but also of product availability and accessibility. As seen in Table 2, out of the 21 types of vegetables reported, none were consumed by more than 33 percent of the households. Conversely, even if the quantity of breadfruit consumed represents one third of that of rice, this local fruit is still consumed by 60 percent of the households. But less than 15 percent of households consume other locally grown fruits like pandanus or banana. Rice remains the most consumed and preferred food product, as 97 percent of households in Kiribati consume rice, followed by sugar and salt, which are consumed by around 90 percent of the households.

Almost three households in four consume cooking oil, and two households in three have at least one lunch away from home. More than one household in two consumes pelagic fish. Canned meat and canned fish are also among the main foods consumed by households, as almost one household in two consumes these products even if they are consumed in relatively small amounts, with an average of 10 grams per capita per day. Less than 30 percent of households consume fresh meat in the form of chicken, with an average edible quantity consumed of 13 grams/capita/day. Most of the milk consumed is in the form of powdered or condensed milk and is consumed by no more than one household in five, with an average quantity of less than 6 grams/capita/day (sum of both types of milk). The lack of access to fresh milk is not surprising, as the small size of the atoll and environmental constraints mean that only livestock of small size such as pigs, poultry or ducks[24] can be accommodated. Less than 10 percent of households consume eggs, considered as a very nutritious food, while, in contrast, 80 percent of the households consume tobacco, which is considered an unhealthy product.

[I] Edible quantity refers to the food after the non-edible portion (skin, bones, seeds, etc.) has been removed. More than half of the coconut and one fifth of breadfruit are not edible, while 100 percent of rice is edible. FAO and SPC. 2020. Pacific Nutrient Database User Guide. Noumea, New Caledonia. http://purl.org/spc/digilib/doc/zzejh

[II] See WHO, 2012. Guideline: sodium intake for adults and children, https://www.who.int/publications/i/item/9789241504836

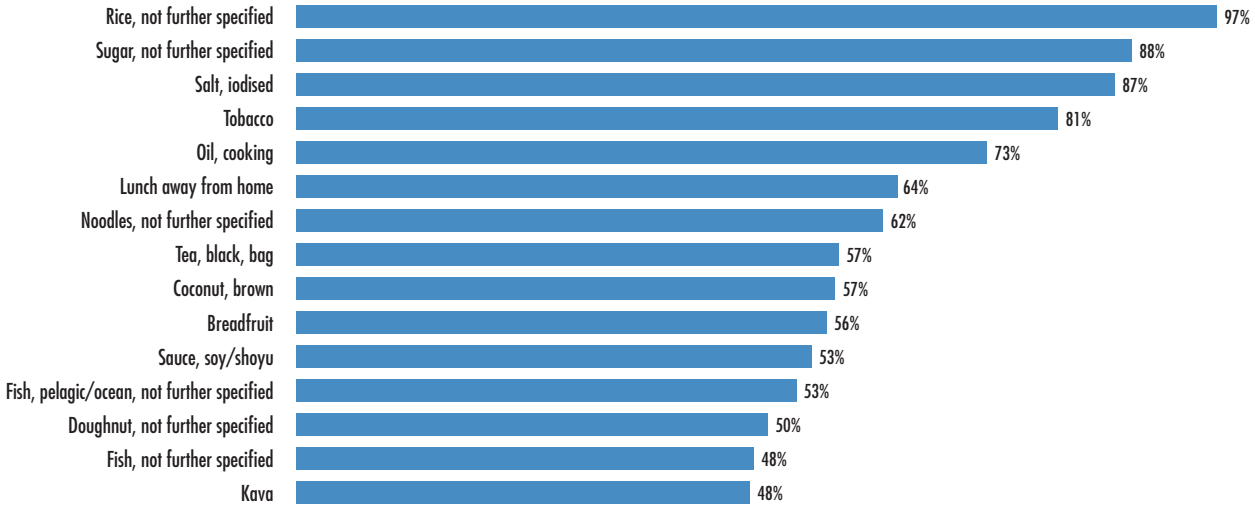
**FIGURE 9**
Average edible quantity consumed of the products contributing 90 percent of the average dietary energy consumption




* Only the number and value of meals consumed away from home were collected, with no quantities.

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 10**
Main products consumed by at least one household in two (percentage)




SOURCE: Kiribati 2019/20 HIES.

## 3.4 Sources of acquisition of the food products

Almost 90 percent of the dietary energy consumed from cereals, sweets and sugar is purchased. Even though around 50 percent of households have at least one household member involved in fishing activities, only one third of the fish consumed is own produced and one half is purchased, the rest is received for free or obtained through exchange. Almost 60 percent of fruits consumed are own produced and 24 percent are received as gifts or through exchange. More than half of the vegetables consumed are purchased and less than 30 percent are own produced. Almost 90 percent of the meat consumed is purchased; the rest is received as gift or through exchange.

**TABLE 3**
Products consumed by at least 30 percent of the households during the previous seven days and respective average quantities and dietary energy consumed

| Food product | Average quantity as purchased (g/capita/day) | Average edible quantity consumed (g/capita/day) | Average dietary energy consumption (kcal/cap./day) | Contribution to the total DEC (%) | Percentage of households reporting having consumed the food in the last 7 days |
|---|---|---|---|---|---|
| Rice, not further specified | 255 | 255 | 864 | 31.3 | 97 |
| Sugar, not further specified | 95 | 95 | 375 | 13.6 | 88 |
| Salt, iodized | 6 | 6 | 0 | 0.0 | 87 |
| Tobacco | 50 | 50 | 0 | 0.0 | 81 |
| Oil, cooking | 9 | 9 | 80 | 2.9 | 73 |
| Lunch away from home* | ... | ... | 163 | 5.9 | 64 |
| Noodles, not further specified | 8 | 8 | 33 | 1.2 | 62 |
| Tea, black, bag | 1 | 0 | 0 | 0.0 | 57 |
| Coconut, brown | 64 | 31 | 125 | 4.5 | 57 |
| Breadfruit | 77 | 60 | 65 | 2.4 | 56 |
| Sauce, soy/shoyu | 8 | 8 | 3 | 0.1 | 55 |
| Fish, pelagic/ocean | 71 | 43 | 64 | 2.3 | 53 |
| Doughnut | 8 | 8 | 33 | 1.2 | 50 |
| Fish, not further specified | 84 | 55 | 72 | 2.6 | 48 |
| Kava | 84 | 84 | 0 | 0.0 | 48 |
| Mackerel, canned | 11 | 10 | 17 | 0.6 | 48 |
| Bread, loaf, all others | 81 | 81 | 199 | 7.2 | 46 |
| Beef, canned, corned | 11 | 11 | 24 | 0.9 | 45 |
| Fish, reef, not further specified | 53 | 38 | 41 | 1.5 | 42 |
| Breakfast away from home* | ... | ... | 43 | 1.5 | 41 |
| Non-alcoholic drinks away from home* | ... | ... | 5 | 0.2 | 34 |
| Flour, not further specified | 24 | 24 | 84 | 3.1 | 33 |
| Hot drinks away from home | 12 | 12 | 4 | 0.1 | 33 |
| Dinner away from home* | ... | ... | 61 | 2.2 | 29 |
| Chicken, not further specified | 18 | 13 | 27 | 1.0 | 29 |

* Only the number and value of meals consumed away from home was collected, with no quantities.
SOURCE: Kiribati 2019/20 HIES.

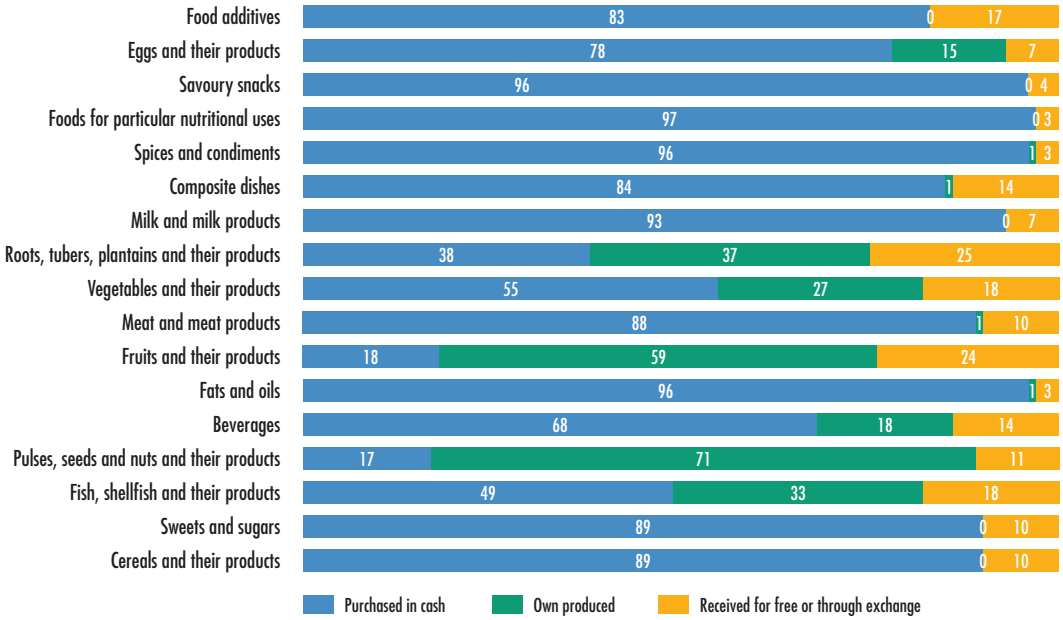
Almost half of the households that had a lunch away from home during the previous seven days consumed it for free. Of the 56 percent of households who consumed breadfruit in the previous seven days, almost 60 percent consumed it from their own production and 30 percent of the households received breadfruit as a gift. More than 40 percent of the households consuming reef fish or fish not further specified obtained it from their own fishing, while 70 percent of the households consuming pelagic fish purchased it in cash. Exchange is quite an important way of accessing rice, sugar or tea, as more than 10 percent of households that consumed these products access them through exchange. However, tobacco remains the most commonly exchanged product as one household in five that consumed tobacco accessed it through exchange.

## 3.5 Cost of food[1]

Of the 34 food products consumed by at least 20 percent of the households, brown coconut and fresh coconut toddy are the least expensive foods, with an average cost well below AUD 0.1 per 100 grams. However, compared with fresh coconut toddy, brown coconut remains the cheapest source of energy, as 1 000 kcal from coconut costs around AUD 0.1 compared with more than AUD 2 to get 1 000 kcal from fresh coconut toddy. Rice and sugar, which are the most consumed food products and highest source of energy, are also among the least expensive foods, as it costs AUD 0.11 and AUD 0.15 respectively to buy 100 grams of these products. Of the products consumed by at least one household in five, instant coffee is the most expensive, with an

[1] To account for the small dispersion observed in the price of some products, the values presented in this section refer to the median price.

**FIGURE 11**
Sources of acquisition of dietary energy by food group (percentage)




SOURCE: Kiribati 2019/20 HIES.

**TABLE 4**
Percentage of households consuming the food product in the previous seven days by source of consumption

| Food product | Percentage of households accessing the food | | | | |
|---|---|---|---|---|---|
| | Total | Cash | Home production | Gift | Exchange |
| Rice, not further specified | 97 | 86 | 0 | 2 | 11 |
| Sugar, not further specified | 88 | 87 | 0 | 2 | 11 |
| Salt, iodized | 87 | 91 | 0 | 2 | 7 |
| Tobacco | 81 | 68 | 5 | 7 | 20 |
| Oil, cooking | 73 | 95 | 1 | 2 | 2 |
| Lunch away from home | 64 | 51 | 0 | 49 | 0 |
| Noodles, not further specified | 62 | 89 | 0 | 2 | 9 |
| Tea, black, bag | 57 | 8 | 0 | 3 | 13 |
| Coconut, brown | 57 | 7 | 81 | 10 | 1 |
| Breadfruit | 56 | 10 | 59 | 31 | 0 |
| Sauce, soy/shoyu | 55 | 98 | 0 | 1 | 1 |
| Fish, pelagic/ocean | 53 | 70 | 7 | 22 | 1 |
| Doughnut, not further specified | 50 | 91 | 3 | 1 | 4 |
| Fish, not further specified | 48 | 34 | 45 | 20 | 1 |
| Kava | 48 | 72 | 0 | 21 | 6 |
| Mackerel, canned specified | 48 | 9 | 0 | 2 | 4 |
| Bread, loaf, all others | 46 | 92 | 1 | 2 | 4 |
| Beef, canned, corned | 45 | 94 | 0 | 3 | 3 |
| Fish, reef, not further specified | 42 | 39 | 41 | 18 | 1 |
| Breakfast away from home | 41 | 30 | 0 | 70 | 0 |
| Non-alcoholic drinks away from home | 34 | 67 | 0 | 33 | 0 |
| Flour, not further specified | 33 | 91 | 1 | 2 | 6 |
| Hot drinks away from home | 33 | 23 | 0 | 77 | 0 |
| Dinner away from home | 29 | 13 | 0 | 87 | 0 |
| Chicken, not further specified | 29 | 83 | 2 | 14 | 1 |

SOURCE: Kiribati 2019/20 HIES.

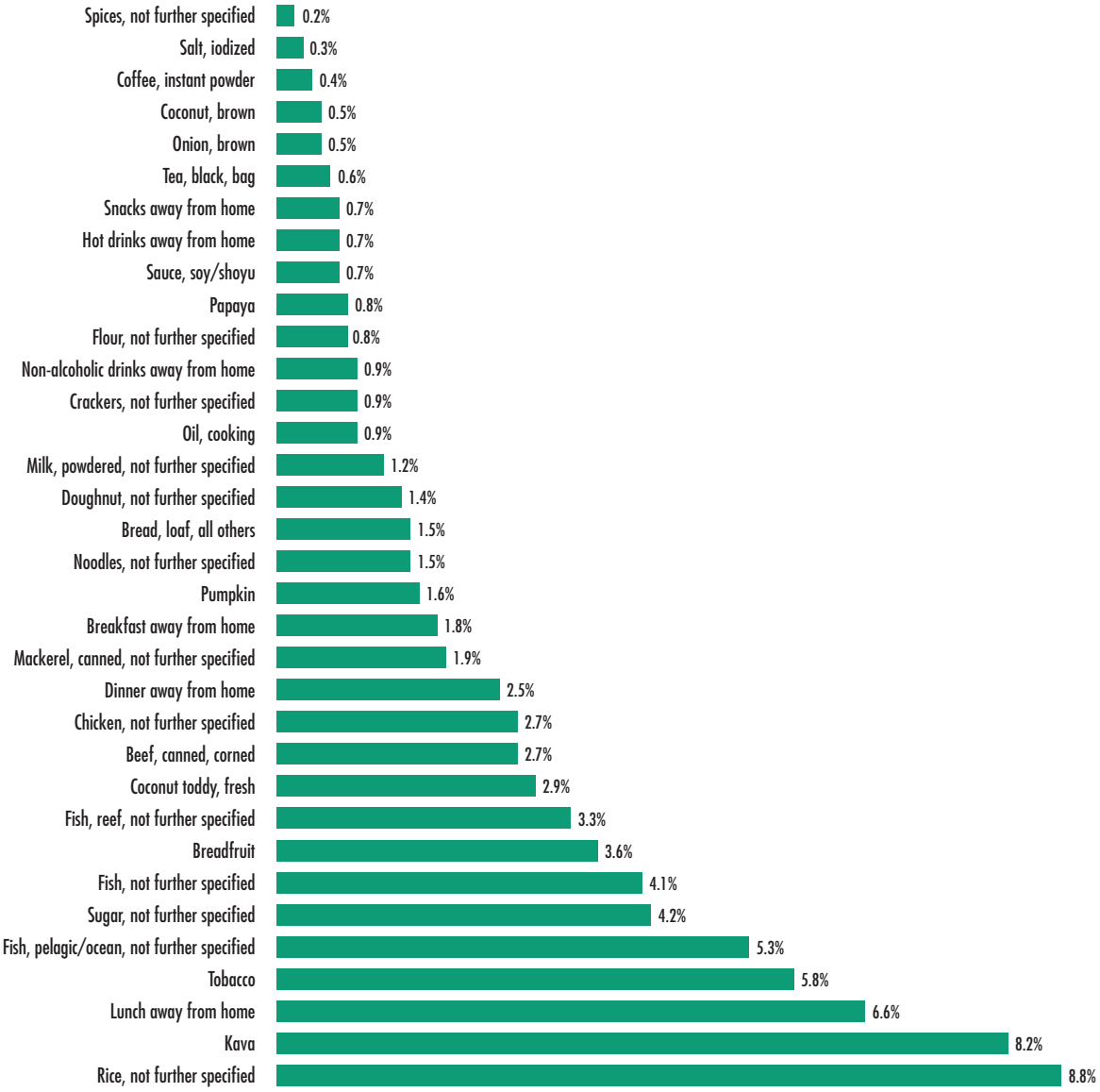
**TABLE 5**
Cost of 1 000 kcal and of 100 grams of the food products consumed by at least one household in five and contributing 90 percent of the average dietary energy consumption

| Food product | Average food consumption in monetary value (AUD/capita/day) | Median dietary energy unit value (AUD/1 000 kcal) | Median price (AUD/100g) | Contribution to total DEC (%) | Percentage of household that consumed the food in the last 7days (%) |
|---|---|---|---|---|---|
| Coconut, brown | 0.016 | 0.11 | 0.02 | 5 | 57 |
| Coconut toddy, fresh | 0.104 | 2.13 | 0.09 | 2 | 24 |
| Rice, not further specified | 0.312 | 0.34 | 0.11 | 31 | 97 |
| Salt, iodized | 0.011 | 0.00 | 0.13 | 0 | 87 |
| Flour, not further specified | 0.029 | 0.35 | 0.13 | 3 | 33 |
| Sugar, not further specified | 0.149 | 0.39 | 0.15 | 14 | 88 |
| Bread, loaf, all others | 0.052 | 0.67 | 0.17 | 7 | 46 |
| Fish, not further specified | 0.145 | 2.20 | 0.18 | 3 | 48 |
| Pumpkin | 0.057 | 5.96 | 0.19 | 1 | 24 |
| Papaya | 0.028 | 8.46 | 0.21 | 0 | 23 |
| Breadfruit | 0.127 | 2.54 | 0.22 | 2 | 56 |
| Fish, reef, not further specified | 0.117 | 2.87 | 0.22 | 1 | 42 |
| Fish, pelagic/ocean | 0.190 | 3.04 | 0.28 | 2 | 53 |
| Sauce, soy/shoyu | 0.025 | 8.62 | 0.30 | 0 | 55 |
| Kava | 0.290 | 0.00 | 0.33 | 0 | 48 |
| Tobacco | 0.205 | 0.00 | 0.36 | 0 | 81 |
| Non-alcoholic drinks away from home | 0.032 | 8.23 | 0.40 | 0 | 34 |
| Oil, cooking | 0.034 | 0.44 | 0.43 | 3 | 73 |
| Chicken, not further specified | 0.097 | 3.17 | 0.48 | 1 | 29 |
| Onion, brown | 0.017 | 22.86 | 0.50 | 0 | 25 |
| Hot drinks away from home | 0.023 | 6.11 | 0.50 | 0 | 33 |
| Crackers, not further specified | 0.033 | 1.13 | 0.51 | 1 | 25 |
| Snacks away from home | 0.023 | 0.42 | 0.55 | 2 | 28 |
| Mackerel, canned, not further specified | 0.067 | 3.8 | 0.59 | 1 | 48 |
| Noodles, not further specified | 0.055 | 1.6 | 0.67 | 1 | 62 |
| Doughnut, not further specified | 0.051 | 1.8 | 0.73 | 1 | 50 |
| Beef, canned, corned | 0.097 | 3.5 | 0.80 | 1 | 45 |
| Breakfast away from home* | 0.063 | 1.4 | 1.00 | 2 | 41 |
| Milk, powdered, not further specified | 0.042 | 4.1 | 1.63 | 0 | 22 |
| Lunch away from home* | 0.234 | 1.3 | 2.00 | 6 | 64 |
| Dinner away from home* | 0.088 | 1.40 | 2.00 | 2 | 29 |
| Tea, black, bag | 0.023 | 156.76 | 2.20 | 0 | 57 |
| Spices, not further specified | 0.008 | 7.12 | 2.50 | 0 | 28 |
| Coffee, instant, powder | 0.015 | 35.83 | 4.80 | 0 | 26 |

* Price per meal in case of breakfast, lunch and dinner consumed away from home.
SOURCE: Kiribati 2019/20 HIES.

average cost of around AUD 4.8 per 100 grams, which may also explain why only 26 percent of households consume coffee and more than 50 percent of households consume tea, which is half as expensive. It costs on average AUD 2 to get one lunch or dinner away from home and half that price for one breakfast away from home. Even if consumed by almost the same proportion of households, canned mackerel is less expensive than canned beef with respective costs of AUD 0.6 and AUD 0.8 per 100 grams, but is a more expensive source of energy, since to get 1 000 kcal from canned mackerel, households need to pay AUD 3.8 compared with AUD 3.5 to obtain 1 000 kcal from canned beef. Compared with rice, breadfruit is a more expensive product as it costs twice as much to get 100 grams of this product, and breadfruit is also a more expensive source of energy as it costs AUD 2.5 to get 1 000 kcal from breadfruit compared with

**FIGURE 12**
Contribution of the food product consumed to the total food expenditures (percentage)




SOURCE: Kiribati 2019/20 HIES.

AUD 0.34 for rice. The higher cost of this locally grown fruit compared to imported rice may also be a reason why only 56 percent of households consume breadfruit compared with 97 percent consuming rice. It costs on average AUD 1.6 to get 100 grams of milk powder and this can explain why only one household in five consumes this product; however, it can be seen that more than 80 percent of households are willing to spend four times this amount to get 100 grams of tobacco. Milk powder is a rich source of calcium, whereas tobacco does not have any nutritional value and can be considered as unhealthy.

An I-Kiribati spends on average AUD 3.5 per capita per day on food. With an average expenditure of AUD 0.3 per capita per day on rice, it is the leading contributor to the total expenditure, followed by lunches consumed away from home, with a contribution of 7 percent to the total amount spent on food.

Pelagic fish, reef fish and fish not further specified together contribute around 13 percent of food expenditure. Breadfruit and sugar each contribute 4 percent of the total amount spent on food, even if sugar is consumed by around 90 percent of households while breadfruit is consumed by only 56 percent of households. An I-Kiribati spends, on average, around AUD 0.5 per day to buy tobacco and kava; these products are not considered as food but if a household needs to compromise on more nutritious food to acquire these unhealthy products, then this can rapidly become a serious public health problem.

# CHAPTER 4
# CONSUMPTION PATTERN OF ESSENTIAL NUTRIENTS

Essential nutrients are composites that the body cannot produce or cannot produce in sufficient quantity to survive, grow and reproduce. While there are many essential nutrients, they can be broken into two categories: macronutrients and micronutrients.

Macronutrients (protein, carbohydrates, fibre and fats) are eaten in large amounts, include the primary building blocks of the diet, and provide the body with energy. Vitamins and minerals are micronutrients, and small doses are usually sufficient.

For a healthy diet, it is important to eat a variety of foods rich in these essential nutrients, and for a balanced diet it is important to eat quantities of each of these foods within acceptable limits.

## 4.1 Macronutrients contribution to the diet of an I-Kiribati

Proteins, fats and carbohydrates contribute 13 percent, 17 percent and 70 percent respectively to the average dietary energy consumed, and it can therefore be said that at the national level the diet is within the WHO/FAO/UNU norms for a balanced diet[25] (ADePT table 1.10).

**BOX 1**
### Essential macronutrients

**Carbohydrates** are critical to the function of the body. They are broken down into glucose, which is the primary source of fuel for the body and brain. Not only do they provide energy for the body, but they also help stabilize blood sugar levels and preserve muscle mass by preventing the breakdown of proteins for energy. Whole grains, fruits and vegetables are considered healthy carbohydrates.

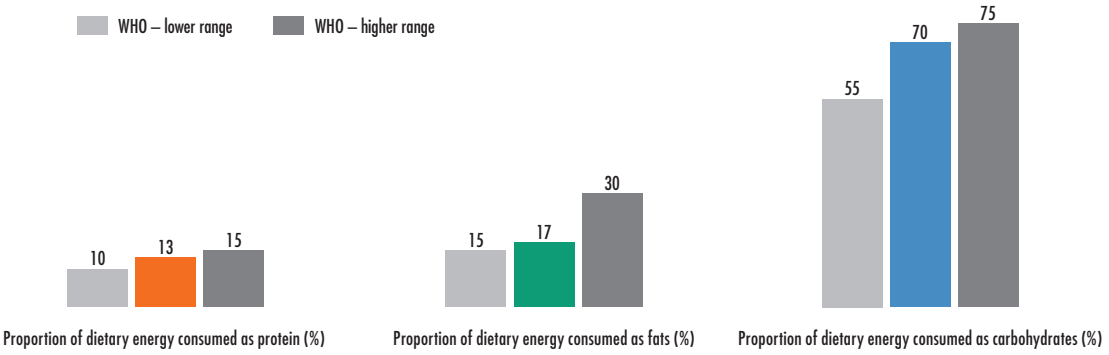
**Fibre** is an indigestible form of carbohydrate. It is not an essential nutrient and therefore an inadequate amount does not result in biochemical or clinical symptoms of a deficiency. However, diets high in fibre have shown decreased risk for obesity, high cholesterol and heart disease. Fruits, vegetables and whole grain products all contain high amounts of fibre.

**Proteins** are critical to good health. From forming muscle to creating new enzymes and hormones, getting enough protein in the diet is key. Proteins are made up of building blocks called amino acids. There are 20 types of amino acids, all of which are important. While animal proteins provide adequate amounts of all essential amino acids, plant-based proteins are typically lacking one or more. The best way to ensure adequate protein intake is to include a variety of protein foods in the diet, such as fish, meat, eggs, dairy, nuts and beans.

**Fat** is an essential nutrient that provides energy, boosts the absorption of certain vitamins and helps protect organs from damage. However, some types of fat are better than others. Saturated fats, for example, are a type of fat found in red meat, whole milk and other whole-milk-based dairy foods, coconut oil, and many commercially prepared baked goods and other foods. A diet rich in saturated fats can increase the risk of heart disease, and these should be limited to less than 10 percent of the calories per day. Unsaturated fats, on the other hand, can actually help protect the heart and aid in the prevention of heart disease. Healthy sources of fat include nuts, avocados, salmon, olive oil, flaxseed and nut butters.

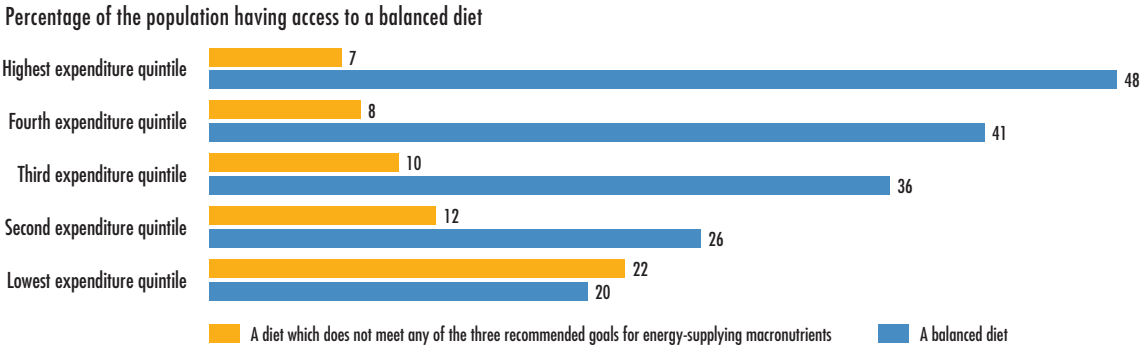
To reach a balanced diet, WHO recommends that, on average, proteins contribute 10 percent to 15 percent to total dietary energy consumed, fats contribute 15 percent to 30 percent and carbohydrates contribute 55 percent to 75 percent.

**FIGURE 13**
Overall diet is within WHO norms for a balanced diet




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 14**
Not all households have access to a balanced diet




SOURCE: Kiribati 2019/20 HIES.

However, not all households have access to this balanced diet at the national level, and less than one household in three in Kiribati experiences a contribution of proteins, fats and carbohydrates together within the WHO/FAO/UNU recommended norms for a balanced diet.

Disparities can be observed in the contribution of macronutrients to the average DEC, and the widest disparities are observed between the wealthiest and least wealthy households. In fact, 22 percent of the individuals living in households belonging to the lowest quintile of expenditure have a diet that does not meet any of the three recommended goals for energy supplying macronutrients, while 48 percent of individuals living in the highest expenditure quintile have a balanced diet, even if this diet is quite rich in fats, with around 20 percent of dietary energy consumed coming from fats.

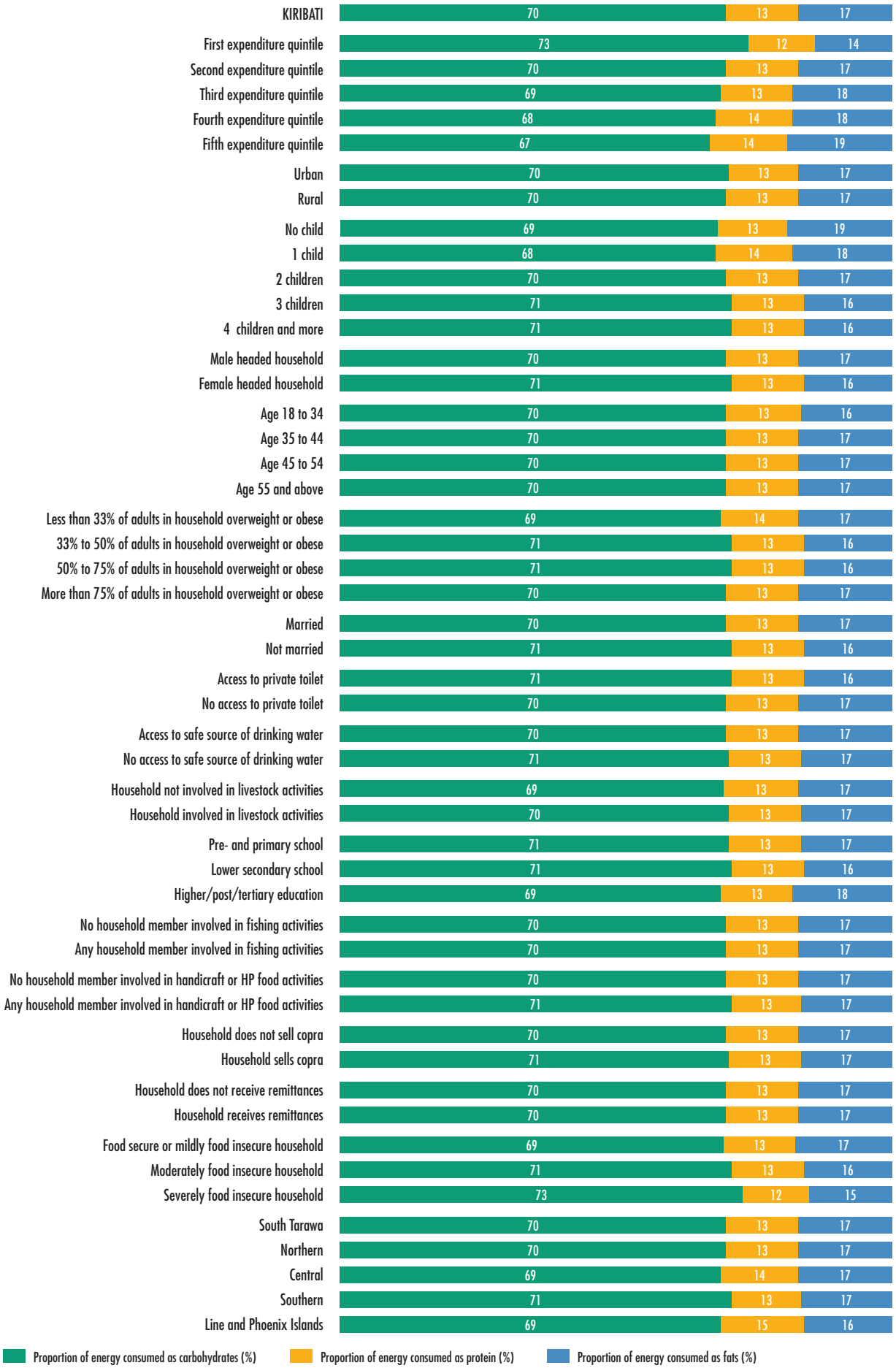
Not much difference can be observed in the contribution of macronutrients to the DEC of households living in rural areas compared with the DEC of households living in urban areas, but when the analysis is performed in terms of quantities of nutrient consumed, then differences are striking, as they also reflect the trend in the amount of energy consumed within these population groups.[I]

On average, an I-Kiribati consumes 90 grams of proteins per day, 52 grams of fats and 475 grams of carbohydrates, but this consumption of macronutrients is not equally distributed among the population. Households belonging to the highest quintile of expenditure consume, on average, twice the amounts of proteins, fats and carbohydrates consumed by households belonging to the lowest quintile of expenditures. Households with no children consume, on average, 40 grams/capita/day of fats and more than 30 grams/capita/day of proteins. The 500-kcal/capita/day difference that is observed between the average DEC of households with at least 75 percent of adults overweight or obese and the households with less than 25 percent of adults overweight or obese is mainly due to the difference of 100 grams/capita/day in carbohydrate consumption. Households with a higher concentration of adults overweight or obese also tend to consume higher quantities of fats.

[I] Macronutrients yield the energy consumed, with one gram of protein, fat, carbohydrate, fibre and alcohol bringing 4, 9, 4, 2 and 7 kcal respectively. Therefore, a low quantity of nutrients consumed translates to a low amount of dietary energy.

**FIGURE 15**

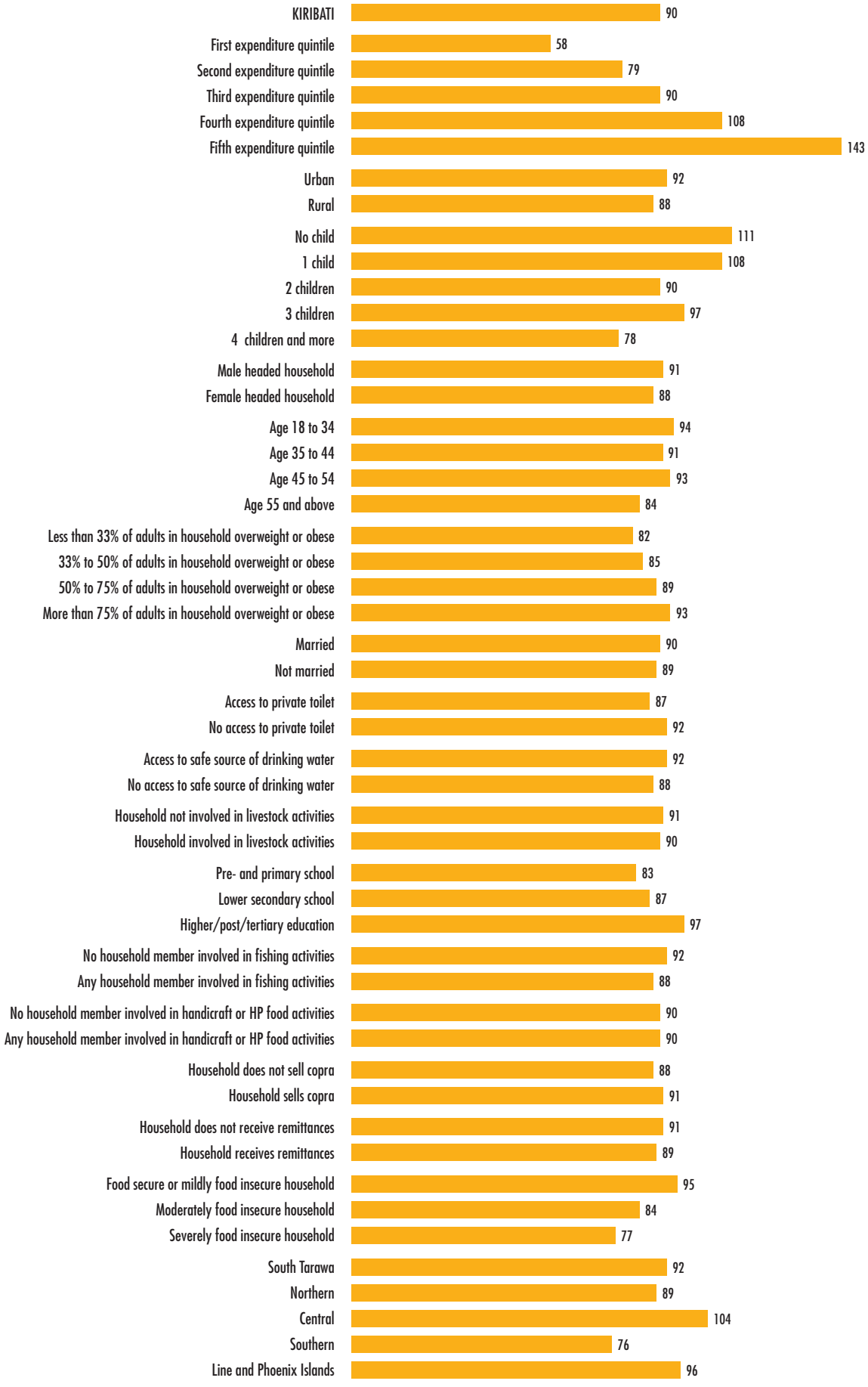
National disparities in the contribution of macronutrients to the average dietary energy consumption by population groups




SOURCE: Kiribati 2019/20 HIES.

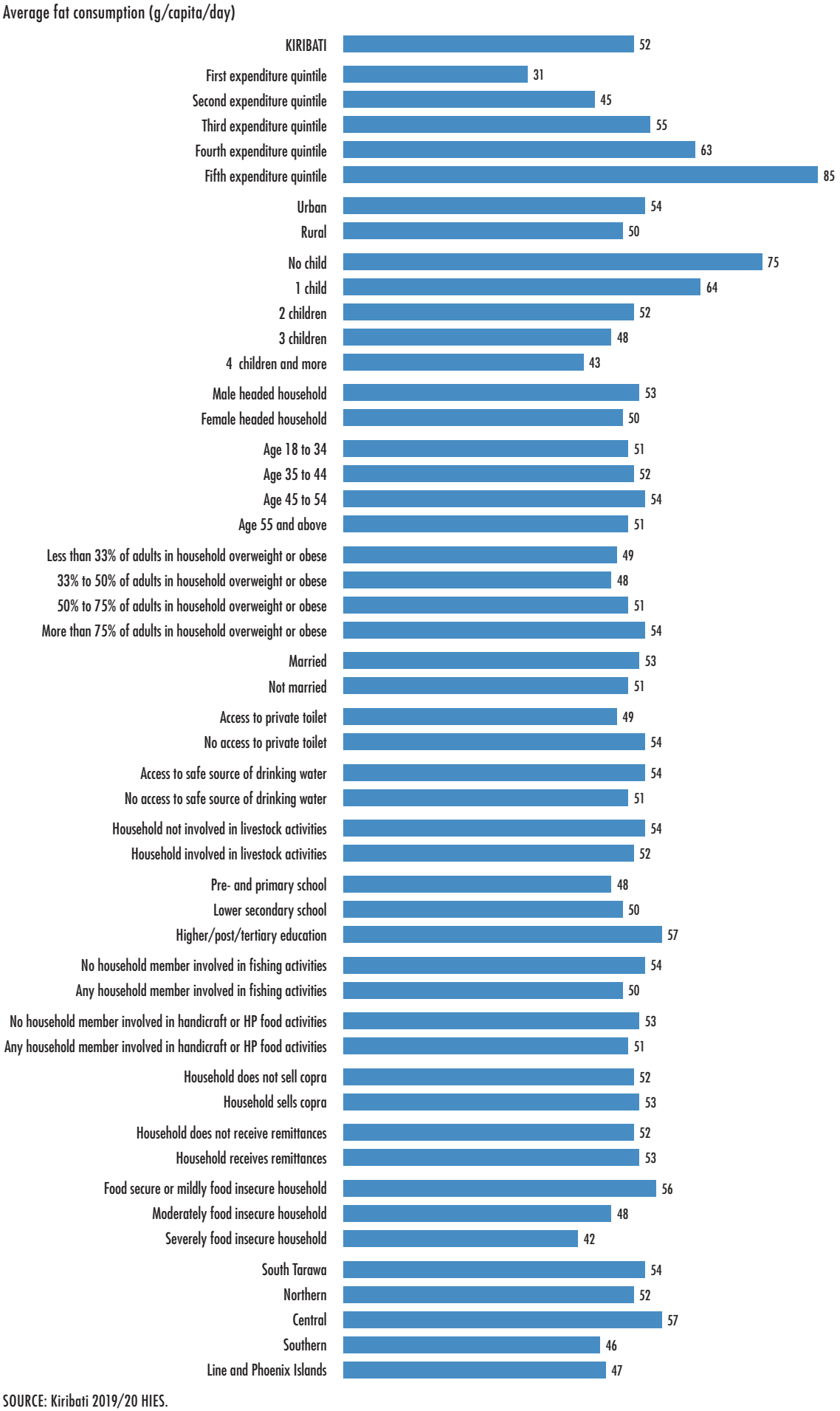
**FIGURE 16**
## Average quantity of macronutrients by population groups (g/capita/day)

Average protein consumption (g/capita/day)



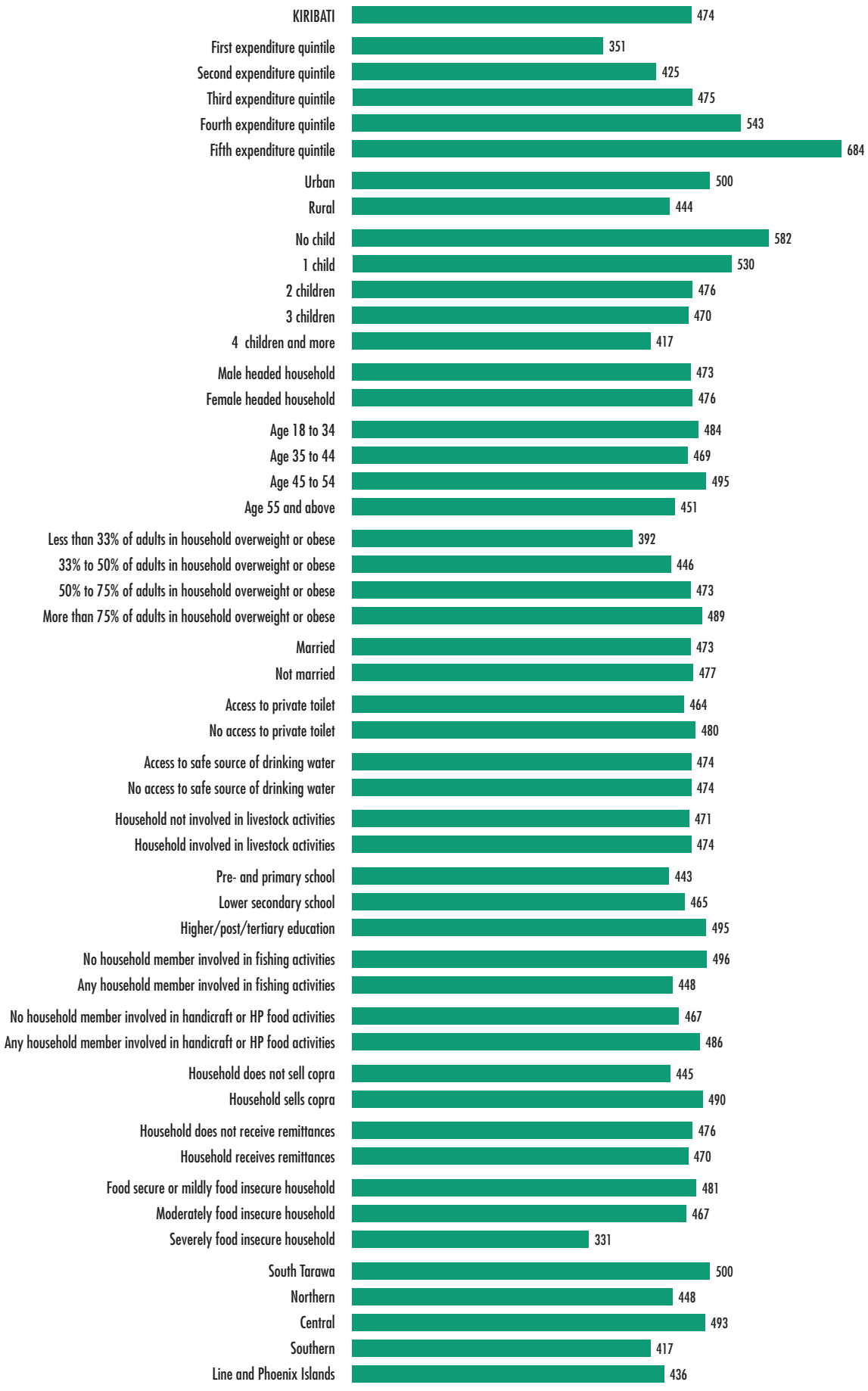

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 16**
Average quantity of macronutrients by population groups (g/capita/day) *(continued)*




SOURCE: Kiribati 2019/20 HIES.

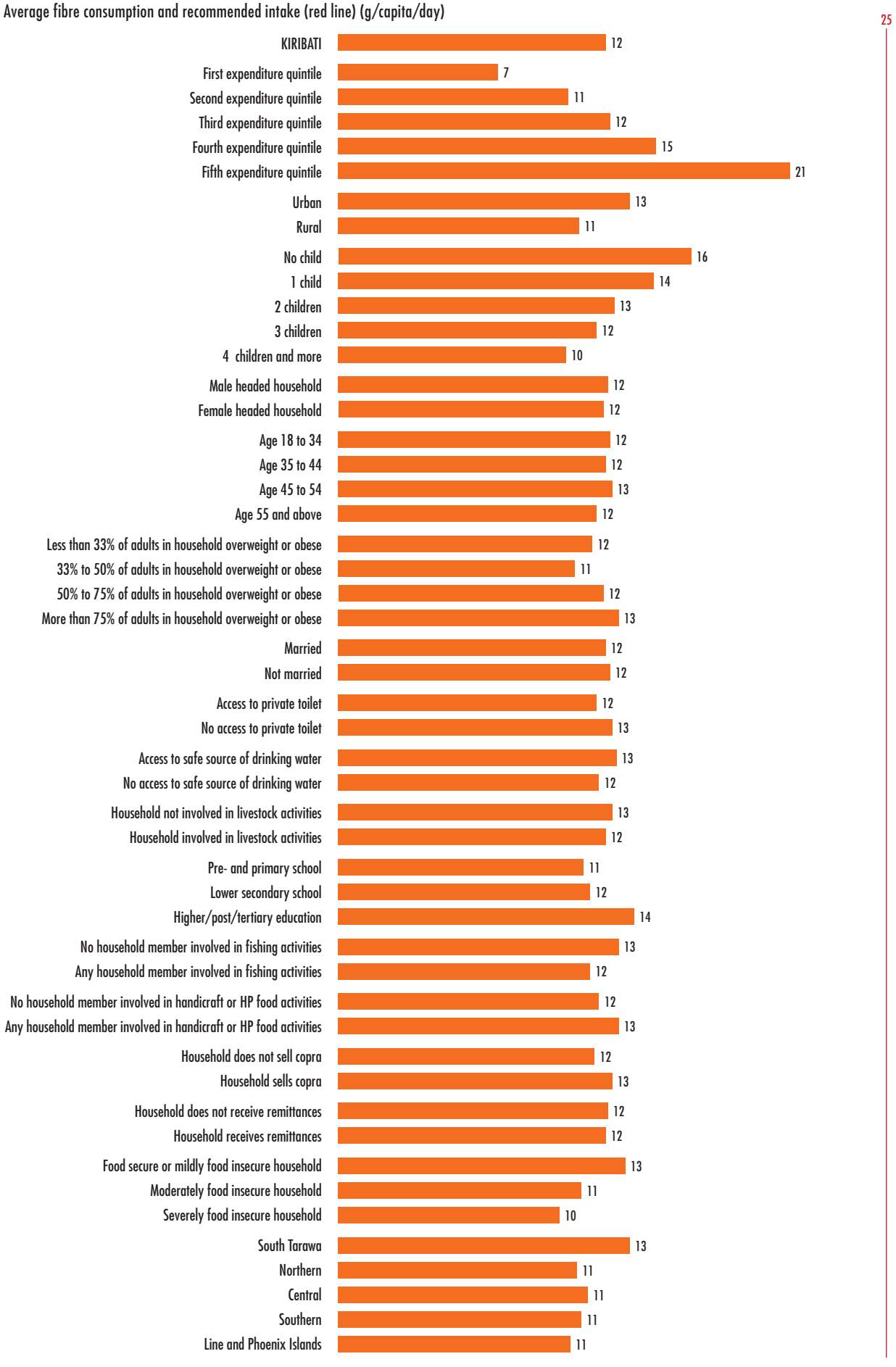
**FIGURE 16**
Average quantity of macronutrients by population groups (g/capita/day) *(continued)*




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 17**

## Average quantity of fibre consumption by population groups (g/capita/day)




SOURCE: Kiribati 2019/20 HIES.

Female headed households tend to consume less proteins and fats than male headed households and a little more carbohydrates. Important differences can also be noticed between food secure and food insecure households, but those will be further discussed in Section 5 of this report.

Proteins from animal origin (fish, meat, eggs and dairy products) contribute 45 percent of the proteins consumed (and fish and fish products contribute 37 percent) but contrary to expectations, protein consumption among households whose members are involved in fishing activities is much lower than that among households not involved in these activities (88 grams/capita/day versus 92 grams/capita/day). More than 50 percent of the carbohydrates consumed come from cereals, but sweets and sugar contribute around 23 percent of the total carbohydrates consumed, therefore producing a diet rich in added sugar[I] compared with natural sugars, and a diet also rich in saturated fats (meat, cooking oil and coconut), as unsaturated fats from cereals and fish contribute only 30 percent of the total fats consumed.

Even if dietary fibre is not an essential nutrient, a consumption of high fibre foods decreases constipation, lowers the risk of diabetes, heart disease and some forms of cancer. There is no determined average requirement for fibre, only population intake goals, or adequate intake set by most authoritative institutions,[II] of at least 25 grams per capita per day from foods (not supplements). When the mean consumption of fibre is higher than the adequate intake it can only be said that the risk of fibre inadequacy is low. Fibre consumption is very low in Kiribati, with an average of 12 grams/capita/day of fibre consumed, which is much lower than the 25 grams of dietary fibre per day recommended, making all population groups of interest at a high level of fibre inadequacy, as average fibre consumption in all the population group is lower than the recommended quantity.

## 4.2 Apparent consumption of vitamins[III, IV]

Vitamins help the body grow and function the way it should. They are five types of vitamins (A, B, C, D, E and K) and they have different jobs in the body, from helping resist infections to keeping nerves healthy and helping the body to get energy from food, or blood to clot properly. This report looks at vitamins A, B1, B2, B12 and C.

### 4.2.1 Vitamin A

**BOX 2**
**Vitamin A**

Vitamin A is essential for health, supporting cell growth, immune function, foetal development and vision. According to WHO, vitamin A deficiency is the leading cause of preventable blindness in children worldwide; it also increases the severity of, and risk of dying from, infections such as measles and diarrhoea; raises the risk of anaemia and death for pregnant women, and negatively impacts the foetus by slowing growth and development.

There are two forms of vitamin A found in food: beta-carotene (found in certain plant foods, and especially those that are orange, red and yellow, such as sweet potatoes) and retinol (found in certain animal foods like eggs yolks, salmon and organ meats).

For vitamin A, on average, around 340 mcg/capita/day (expressed in retinol equivalent) are available for consumption in Kiribati, which is slightly higher than the average requirement of 283 mcg/capita/day (ADePT table 5.1).[V]

If adequacy (as measured by the ratio of the vitamin available for consumption to the average requirement) is reached for Kiribati[VI] at the national level, this is not the case for all population groups. The groups more at risk of vitamin A inadequacy are the least wealthy households, severely food insecure households, households with more than four children and those living in Line and Phoenix Islands.

I Added sugars include sugars that are added during the processing of foods (such as sucrose or dextrose), foods packaged as sweeteners (such as table sugar), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices. They do not include naturally occurring sugars that are found in milk, fruits and vegetables. Definition from US Food and Drug Administration: https://www.fda.gov/food/new-nutrition-facts-label/added-sugars-new-nutrition-facts-label

II Such as the European Food Safety Authority (EFSA), United States Health and Medicine Division, World Cancer Research Fund International (WCRF).

III Here we refer to the quantity of vitamins available for consumption by the household. Note that the content and quality of the vitamin is affected by the way the food is stored, prepared, processed, cooked, held warm or reheated, and therefore there may be a considerable difference between the amount and quality of vitamins available for consumption and the amount and quality of vitamins ingested.

IV This analysis excludes the potential contribution of food consumed away from home to the total amount of vitamins available for consumption.

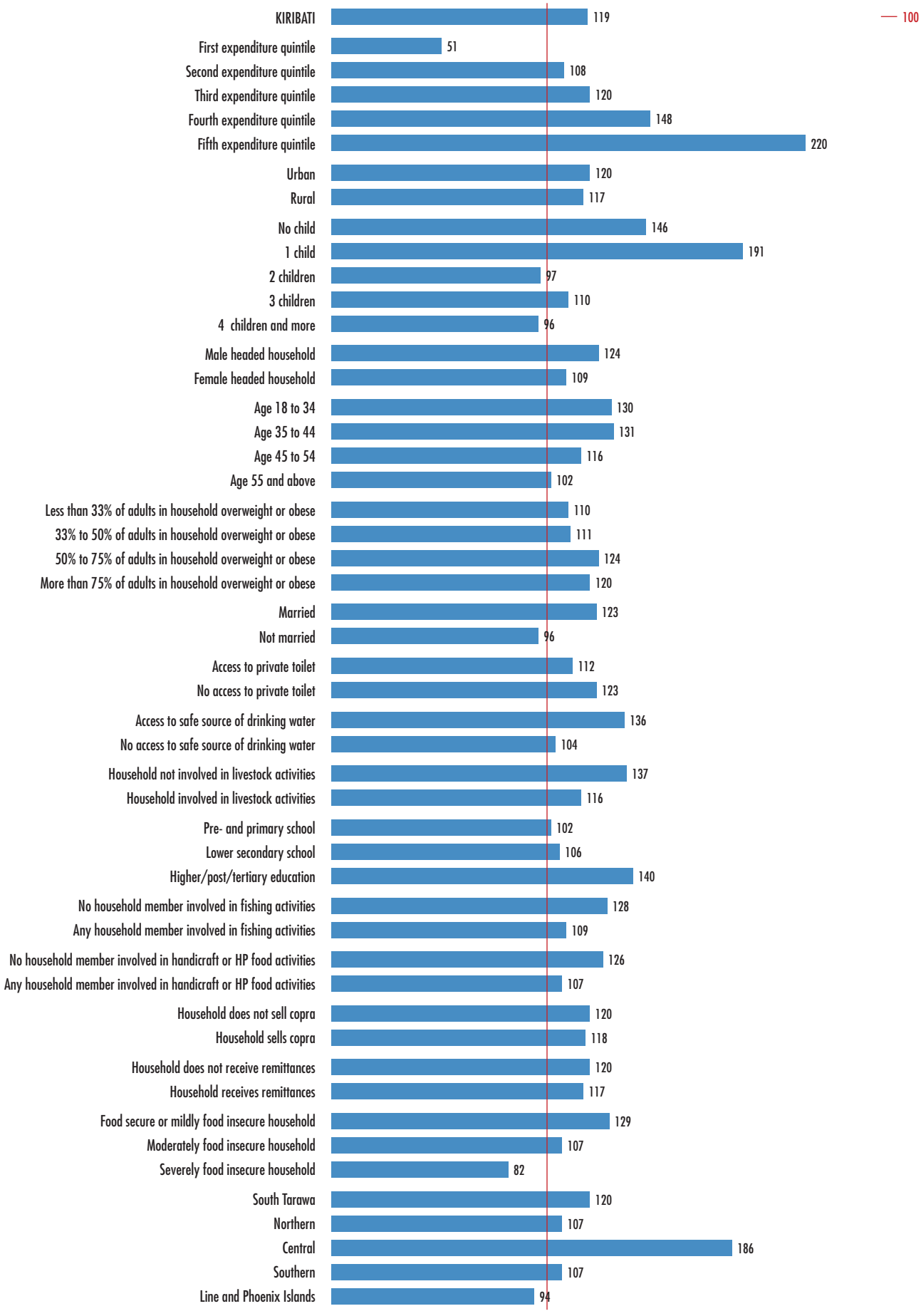
V The source of the estimated average requirement for vitamin A was the FAO/WHO expert consultation on human vitamin and mineral requirements in human nutrition. Second Edition (2004).

VI It is important to remember that the amount of the vitamin available for consumption may be enough to cover the requirements of a population group but this does not automatically imply that all households (or household members) belonging to this population group have equal access to this amount of the vitamin. This footnote holds for all the nutrients.

**FIGURE 18**

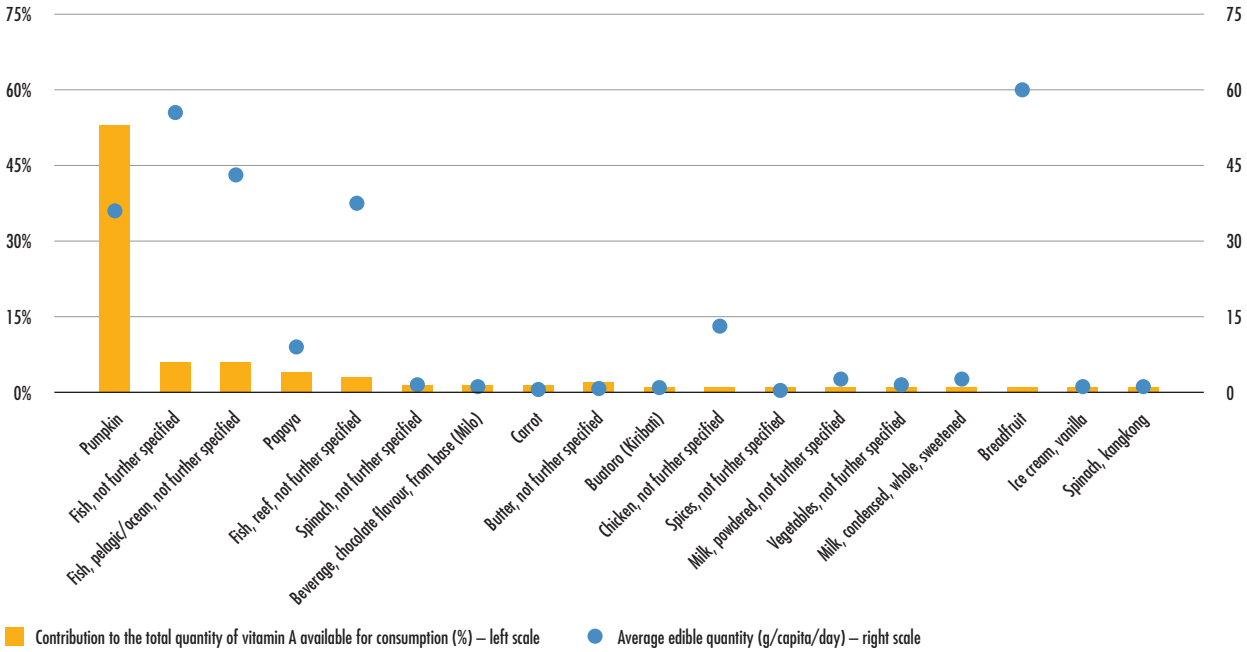
## National disparities in vitamin A available for consumption

Ratio of vitamin A available for consumption to the average requirements by population groups (%)




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 19**
Main sources of vitamin A




SOURCE: Kiribati 2019/20 HIES.

With an average edible quantity consumed of 36 grams per capita per day, pumpkin is the main source of vitamin A, contributing more than 53 percent of the vitamin A available for consumption at the national level. Fish and fish products are the second main source of vitamin A, contributing around 17 percent of total vitamin A available for consumption (ADePT table 6.1).

### 4.2.2 Vitamin B group

**BOX 3**
B vitamins

B vitamins are water-soluble and therefore do not stay long in the body. After the body uses these vitamins, amounts left over leave the body through the urine. B vitamins are important for the metabolism of proteins. Vitamins B1, B2 and B12 offer the following health benefits:

- Vitamin B1 (thiamine) helps to release energy from foods and is important in maintaining nervous system function.
- Vitamin B2 (riboflavin) helps to promote good vision and healthy skin and is also important in converting the amino acid tryptophan into niacin.
- Vitamin B12 helps in the formation of red blood cells and in the maintenance of the central nervous system.

Apart from vitamin B12, the body cannot store these vitamins for long periods, so they have to be replenished regularly through food. Foods rich in B vitamins are meat, poultry, seafood, eggs, dairy products and fortified cereals.

On average, the daily quantities of vitamins B1, B2 and B12 available for consumption are 0.79 mg, 0.76 mg and 5.64 mcg per capita respectively, compared with the average requirements[I] of 0.85 mg, 0.88 mg and 1.76 mcg per capita/day, respectively, showing that supply adequacy in Kiribati is met only for vitamin B12 (100 percent or more being the target) (ADePT table 5.2). However, this statement does not hold true for all population groups. Indeed, supply adequacy of vitamin B1 is reached in South Tarawa and for the wealthiest households, those not involved in fishing and

[I] The source of the estimated average requirement used for vitamins B1, B2 and B12 is the FAO/WHO expert consultation on human vitamin and mineral requirements in human nutrition. Second Edition (2004).

livestock activities, and those who do not sell copra. Vitamin B2 adequacy is reached only for the wealthiest households, while vitamin B12 adequacy is reached for all population groups, even if important disparities can be observed in access to vitamin B12 within the population. The average quantity of vitamin B12 available for consumption among the wealthiest households is twice that of the least wealthy households. Overall, vitamin B12 adequacy is higher in rural areas than in urban areas, with Line and Phoenix Islands exhibiting the highest quantities compared with the other regions due to the higher quantity of octopus and crabs reported in this region than in other regions.

In Kiribati, cereals in the form of rice, bread and flour represent the main sources of vitamins B1 and B2. With an average quantity consumed of 60 grams per capita per day, breadfruit is the third major source of vitamin B1 and it contributes 8 percent of the vitamin B1 available for consumption. An increase in the consumption of this locally grown product together with an increase in the consumption of breakfast cereals[I] or milk powder is recommended to increase the overall supply of thiamine and riboflavin in Kiribati and ensure all population groups receive adequate amounts of these vitamins. Most of the vitamin B12 available for consumption in Kiribati comes from fish and fish products, which contribute 85 percent of the total vitamin B12 availability.

### 4.2.3 Vitamin C

**BOX 4**
**Vitamin C**

Vitamin C, or ascorbic acid, is a water-soluble vitamin. It is central to iron absorption and synthesis of collagen. It aids in wound healing and bone formation while improving overall immune function; for instance, it is important for defence against infections such as the common cold. Basically, vitamin C stimulates the immune system, it is an anti-allergic and antioxidant, it helps in the formation of "cement" for connective tissues, maintains teeth and gum health, and is necessary for eye health.

The richest natural sources of vitamin C are fruits and vegetables.

With an average quantity available for consumption of around 60 mg/capita/day, vitamin C consumption is well above the average national requirement of 34 mg/capita/day[II] (ADePT table 5.3), which means that supply adequacy at the national level is reached. It is reached also for all population groups. However, both urban households, with an adequacy ratio of 130, and least wealthy households, with an adequacy ratio of 110, are close to the adequacy threshold, and present a high risk of not being able to access adequate amounts of vitamin C to reach the average requirements. Noticeable differences in vitamin C available for consumption can also be observed between male and female headed households. The latter are consuming 14 mg/capita/day less vitamin C than male headed households. Households where more than 75 percent of the adults are overweight or obese tend also to consume a much lower level of vitamin C when compared with households where less than 33 percent of adults are overweight or obese. Not surprisingly, households involved in selling copra consume 1.5 times the vitamin C of households not involved in this activity; these households have better access to coconut toddy, which is the main provider of vitamin C in Kiribati.

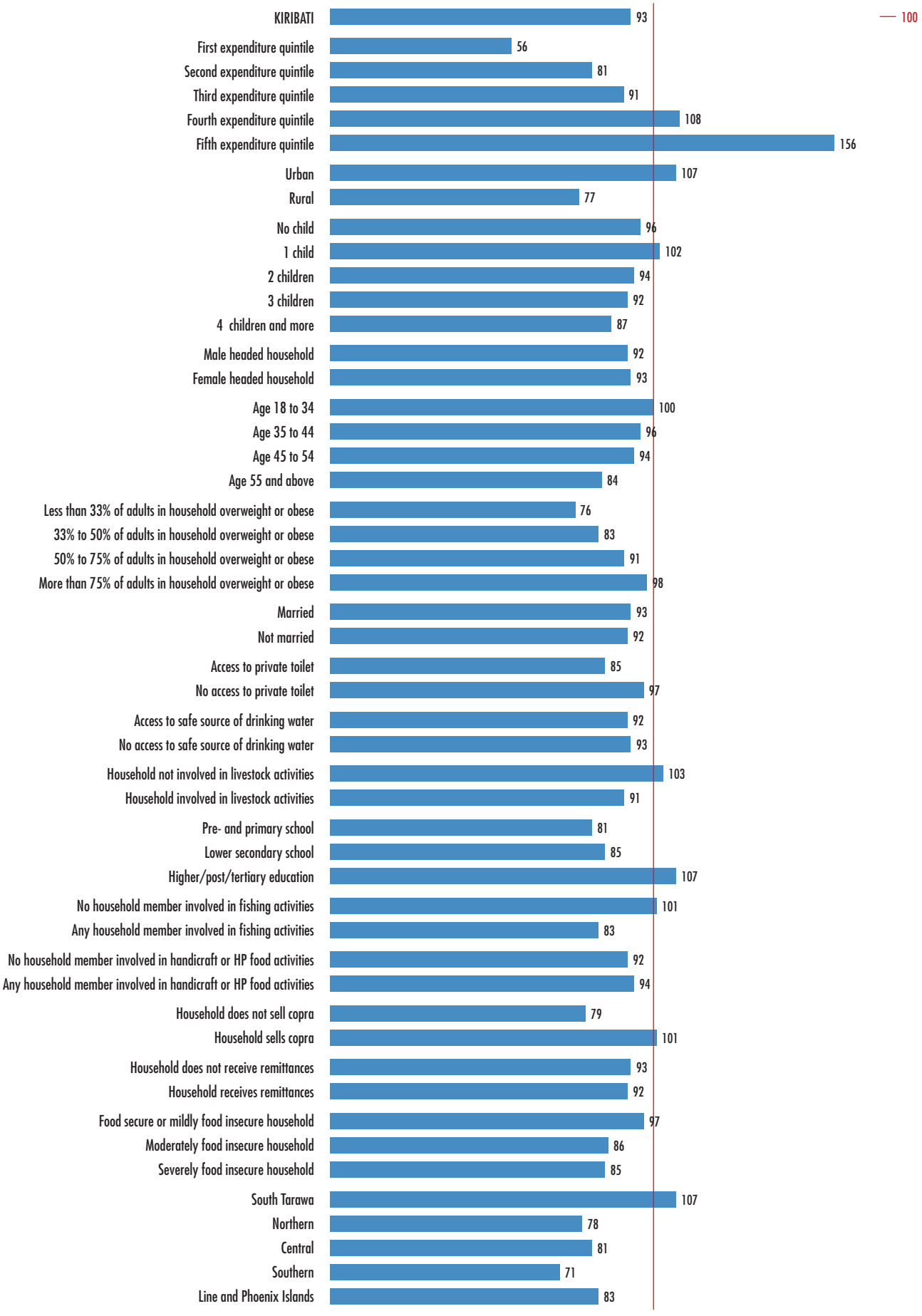
With an average consumption of 100 grams/capita/day, fresh coconut toddy contributes around one third of the vitamin C available for consumption in Kiribati. Breadfruit comes as the second source of vitamin C, followed by pumpkin and papaya, with consumptions of 60 grams/capita/day, 36 grams/capita/day and 9 grams/capita/day respectively. A slightly higher consumption of these products rich in vitamin C, together with higher consumption of green leafy vegetables, would ensure a higher level of adequacy and eventually adequate access to vitamin C for all.

[I] Breakfast cereals are good vehicles for fortification, and in the Pacific Nutrient Database (PNDB), breakfast cereals refer to food enriched in vitamins and essential minerals.

[II] The source of the estimated average requirement used for vitamin C is the FAO/WHO expert consultation on human vitamin and mineral requirements in human nutrition. Second Edition (2004).

**FIGURE 20**
## National disparities in adequacy of vitamin B

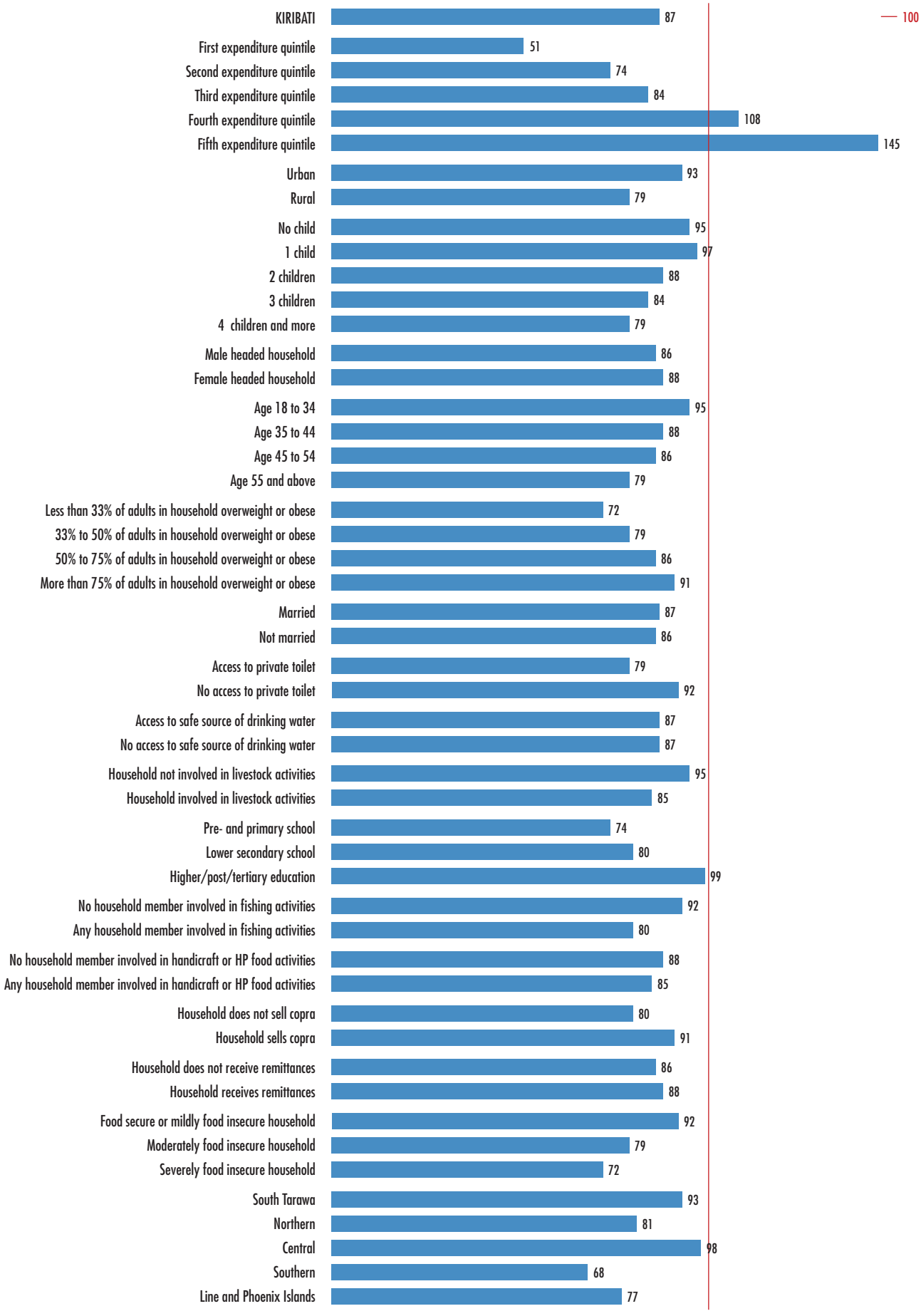
**Vitamin B1** adequacy as measured by the ratio of vitamin B1 available for consumption to the average requirements




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 20**
National disparities in adequacy of vitamin B *(continued)*

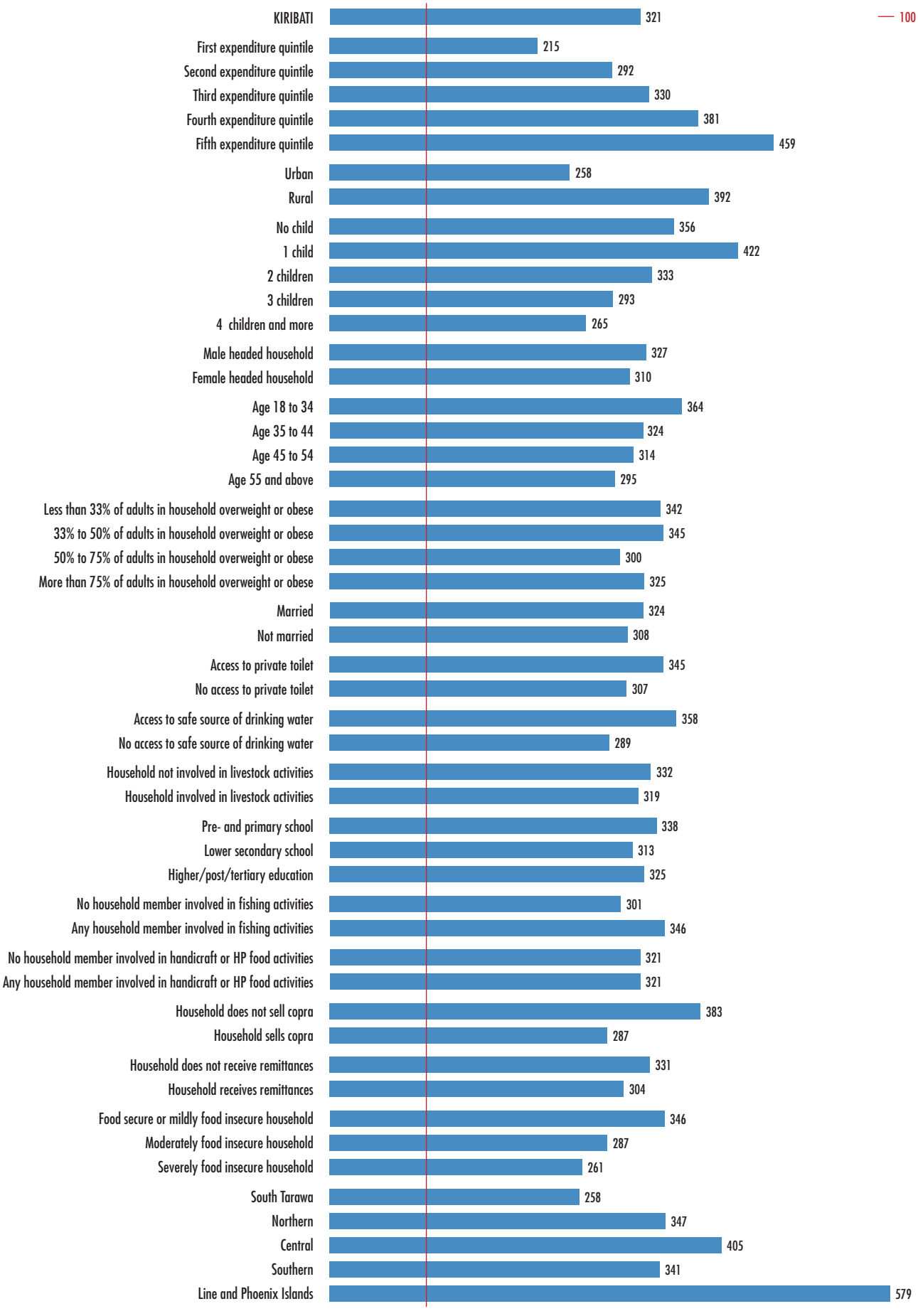
**Vitamin B2** adequacy as measured by the ratio of vitamin B2 available for consumption to the average requirements




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 20**
National disparities in adequacy of vitamin B *(continued)*

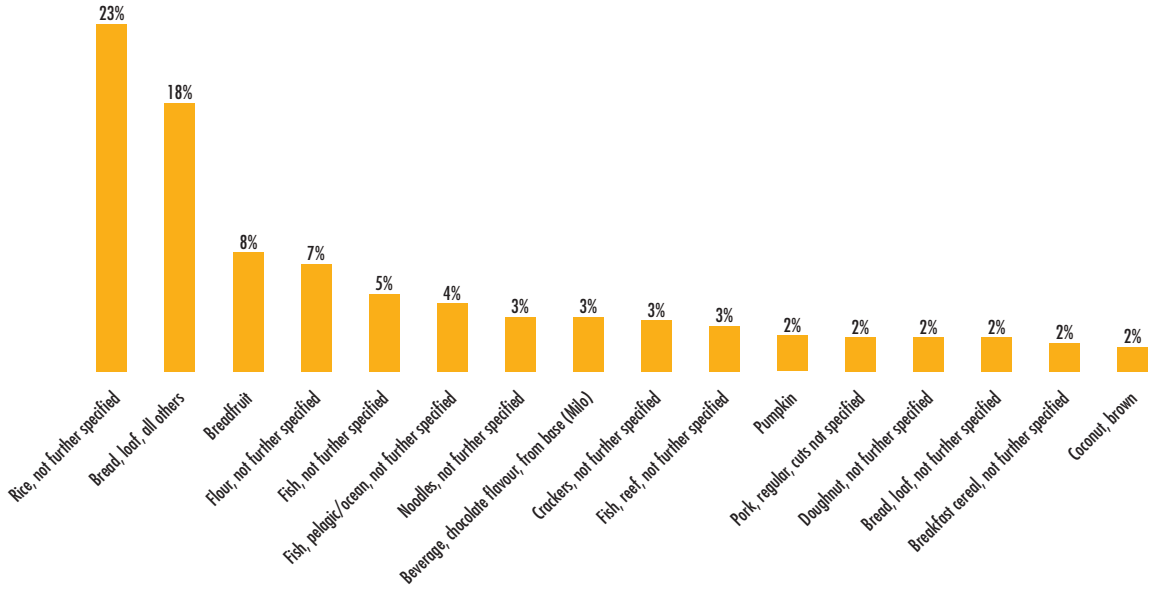
**Vitamin B12** adequacy as measured by the ratio of vitamin B12 available for consumption to the average requirements



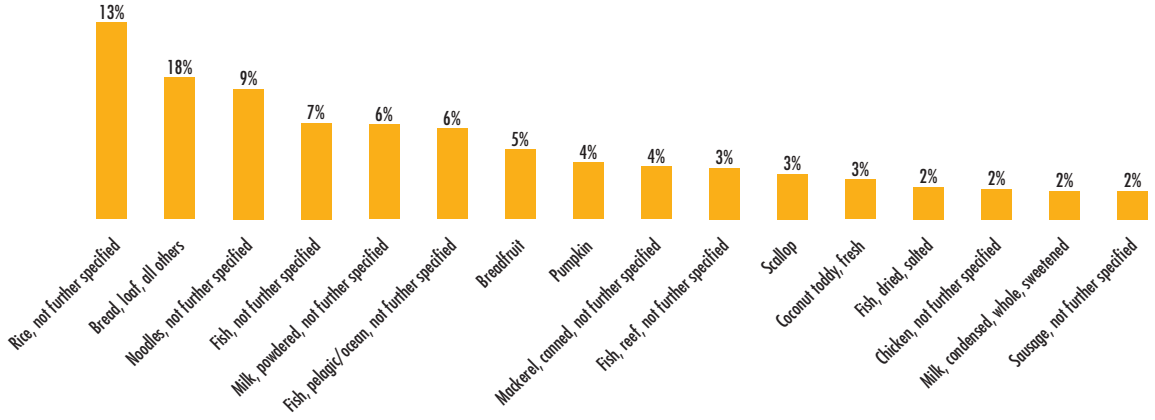

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 21**
## Main sources of vitamin B

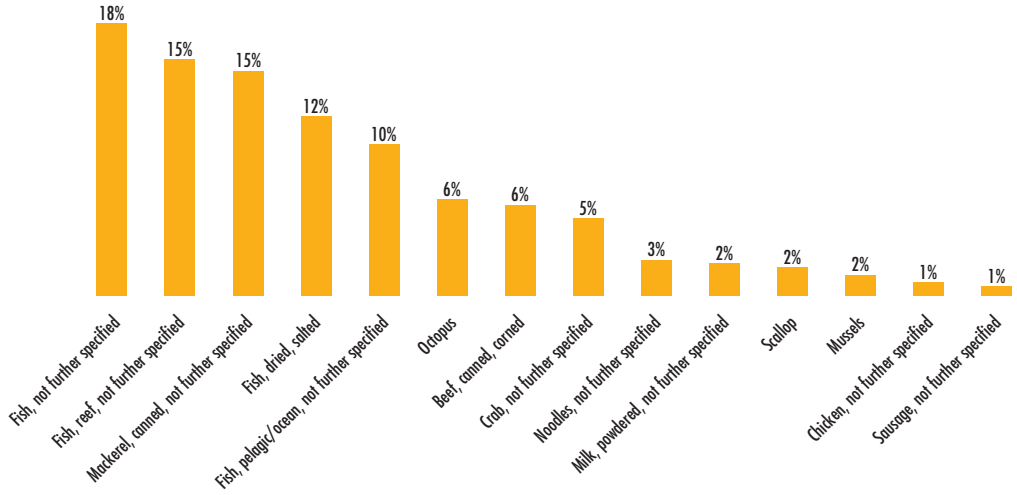
Contribution of the food products to the quantity of vitamin B1 available for consumption (%)




Contribution of the food products to the quantity of vitamin B2 available for consumption (%)




Contribution of the food products to the quantity of vitamin B12 available for consumption (%)

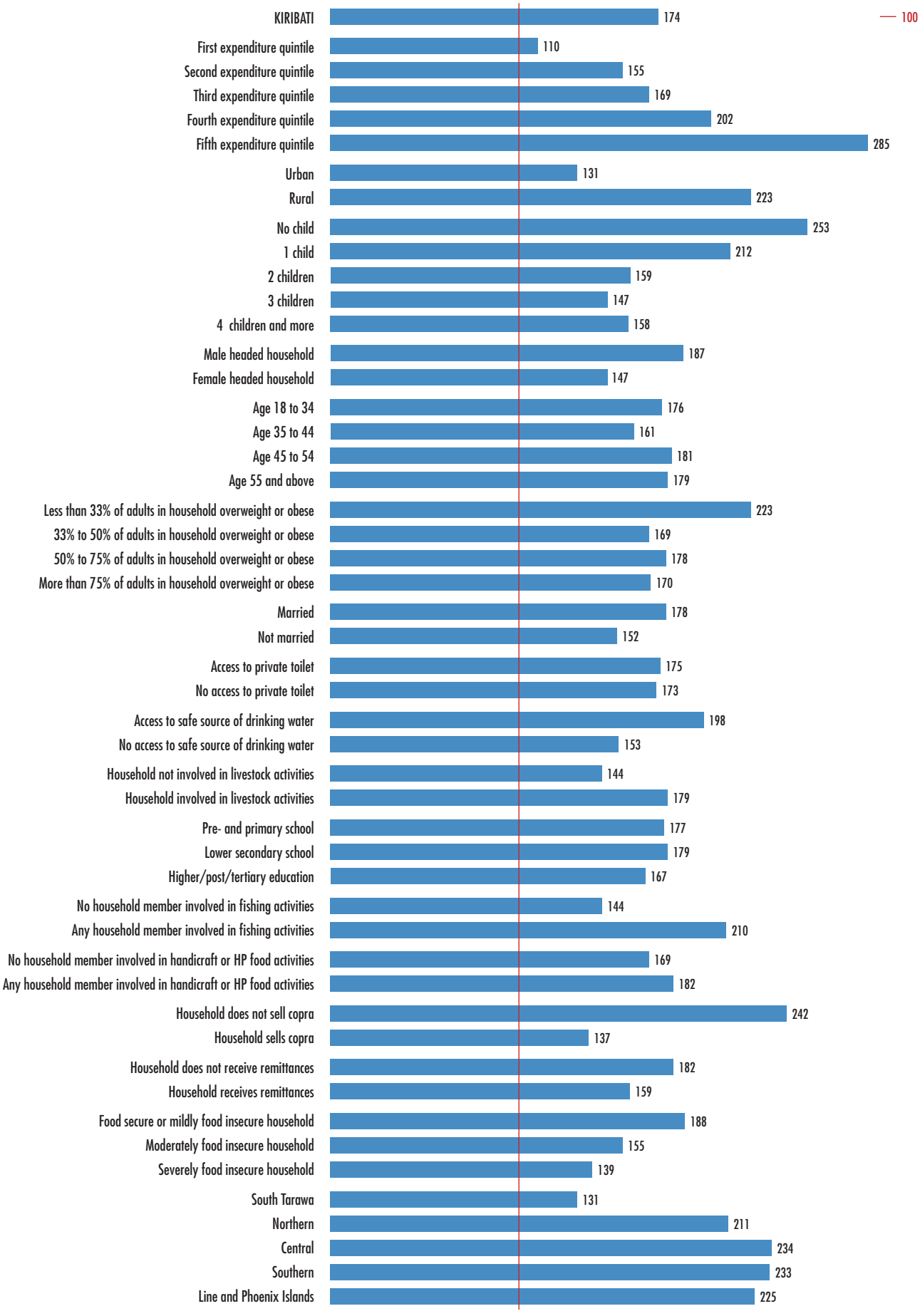



SOURCE: Kiribati 2019/20 HIES.

**FIGURE 22**

## Average consumption and average requirement of vitamin C by population groups

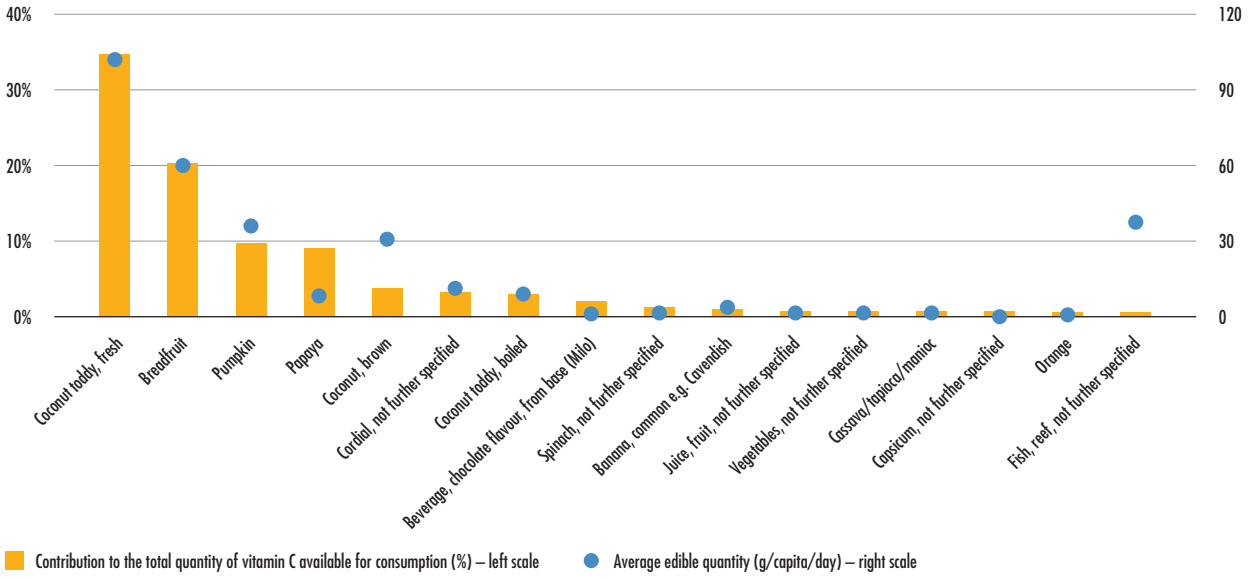
Vitamin C adequacy as measured by the ratio of vitamin C available for consumption to the average requirements




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 23**
Main sources of vitamin C

Average edible quantity and contribution of the main food products providing vitamin C




SOURCE: Kiribati 2019/20 HIES.

## 4.3 Apparent consumption of essential minerals

Minerals such as calcium and iron are essential nutrients found in many different types of plant- and animal-based foods. Calcium is a macro-mineral, which is required in greater amounts than trace minerals such as iron. Both types of minerals support a wide variety of bodily functions, ranging from building and maintaining healthy bones and teeth to keeping muscles, heart and brain working properly.

### 4.3.1 Calcium

**BOX 5**
Calcium

Most of the calcium in the body is found in the bones and its primary role is to ensure healthy bones and teeth. The main foods rich in calcium are dairy products such as milk, cheese and yoghurt. However, many non-dairy sources such as seafood, leafy greens, legumes, dried fruit and tofu are also high in calcium. Foods such as cereal and flour can also be fortified in calcium.

With an average consumption of around 330 mg/capita/day, calcium consumption in Kiribati is well below the average requirements of 840 mg/capita/day[I] (ADePT table 5.3). Calcium supply adequacy is far from being reached, all population groups considered.

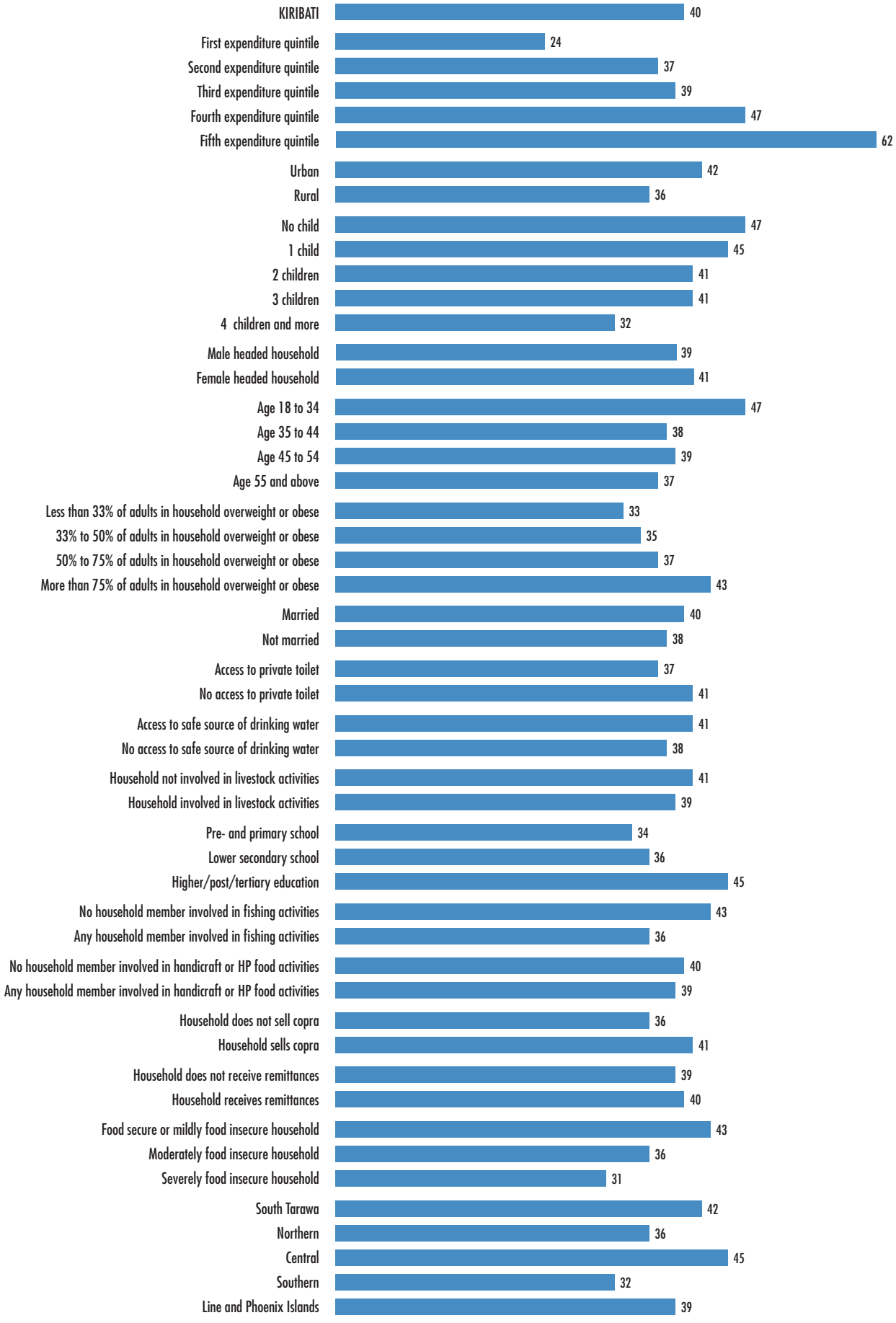
Sugar is not very dense in calcium[II] but through its high consumption, almost 100 grams/capita/day, this product represents the main source of calcium in Kiribati, contributing 20 percent of the total quantity of calcium available. Milk powder and mackerel in can, with contributions of 9 percent and 8 percent respectively, represent the second source of calcium (ADePT table 6.1), but this is mainly due to their very high density in calcium, as their average consumption in Kiribati is very low. As a matter of fact, dairy products (including condensed milk), with an average quantity consumed of round to 5.5 grams/capita/day, contribute only 11 percent of the total calcium available for consumption. To increase calcium consumption in Kiribati, an increased consumption of dairy products together with green leafy vegetables rich in calcium or further enriched foods, such as breakfast cereals or fruit juice, is recommended, but these products are usually also high in sugar and fat.

I The source of the estimated average requirement used for calcium was the Health and Medicine Division of the US National Academy of Sciences. Dietary Reference Intakes Tables and Application – Estimated Average Requirements and Adequate Intakes (as of 30 March 2016).

II 76 mg of calcium per 100 grams of sugar compared to 1 100 mg of calcium per 100 grams of milk powder.

**FIGURE 24**
## National disparities in calcium adequacy

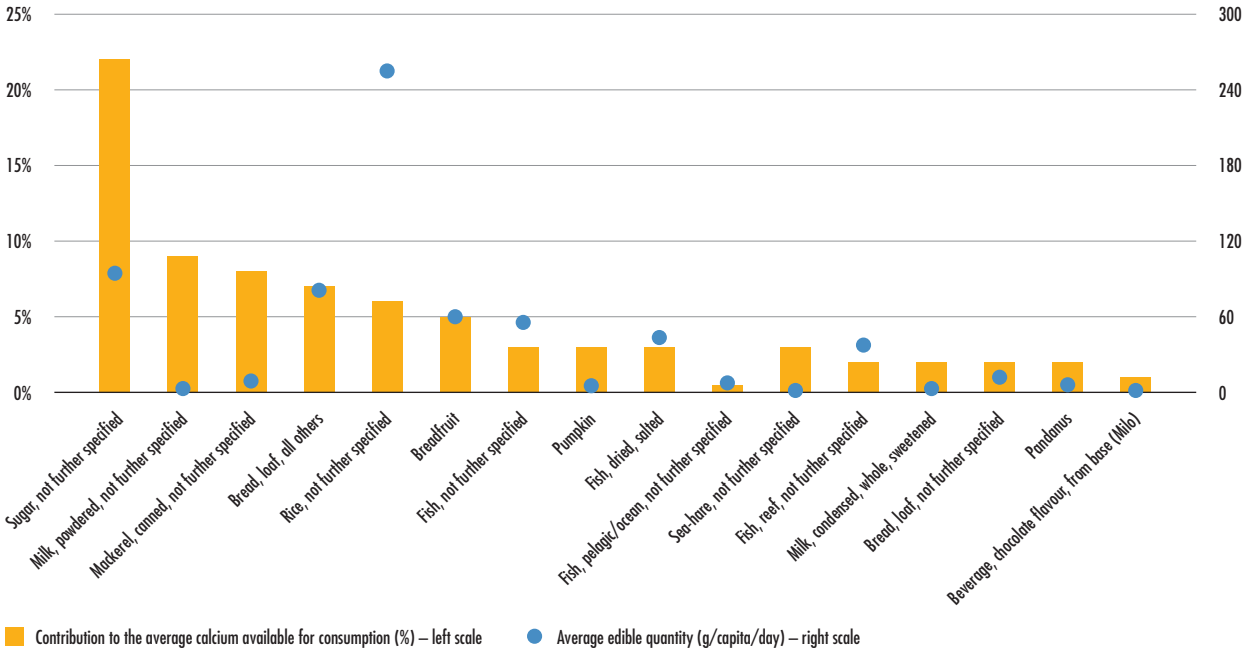
Calcium adequacy as measured by the ratio of calcium available for consumption to the average requirements (%)




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 25**
Main sources of calcium

Average edible quantity and contribution of the main food products providing calcium




SOURCE: Kiribati 2019/20 HIES.

### 4.3.2 Iron

Iron is one of the essential nutrients for proper growth and development of the human body. The body cannot produce iron on its own, so to maintain the required amount of iron in the body, iron-rich foods need to be consumed. Two different sources of iron are found:

i) non-haem sources of iron mostly refer to vegetables such as beans, turnips, leafy vegetables, pumpkins and so on, along with other products including legumes, lentils, dairy products and tofu; and

ii) haem sources of iron include lean meat, chicken liver, lamb, oysters, tuna fish and so on. The main difference between the two is that haem iron is absorbed faster than non-haem plant iron, but absorption of haem iron is not regulated by the body.[I]

Quantities of iron needed vary greatly and they depend on an individual's age and gender. Iron requirements are generally higher for women than for men. Children need on average 7 mg to 10 mg of iron per day, males aged from 19 to 99 years need 8 mg of iron per day, while a woman aged between 19 and 50 years need more than 18 mg of iron a day, while older women need 8 mg a day.[26]

With an average of 8 mg/capita/day, the average quantity of iron available for consumption in Kiribati is very low, and iron of animal origin contributes less than one third of the total iron available (ADePT table 5.4). Important inequalities in accessing iron can be observed among the population, with the largest difference being for the wealthiest households compared with the least wealthy households with a dispersion ratio of 3.[II] Households in which more than 75 percent of the adults are overweight or obese and those whose head has a high level of education have access to a higher quantity of iron than those with less than 33 percent of adults overweight or obese and those whose head has only achieved a primary school level of education.

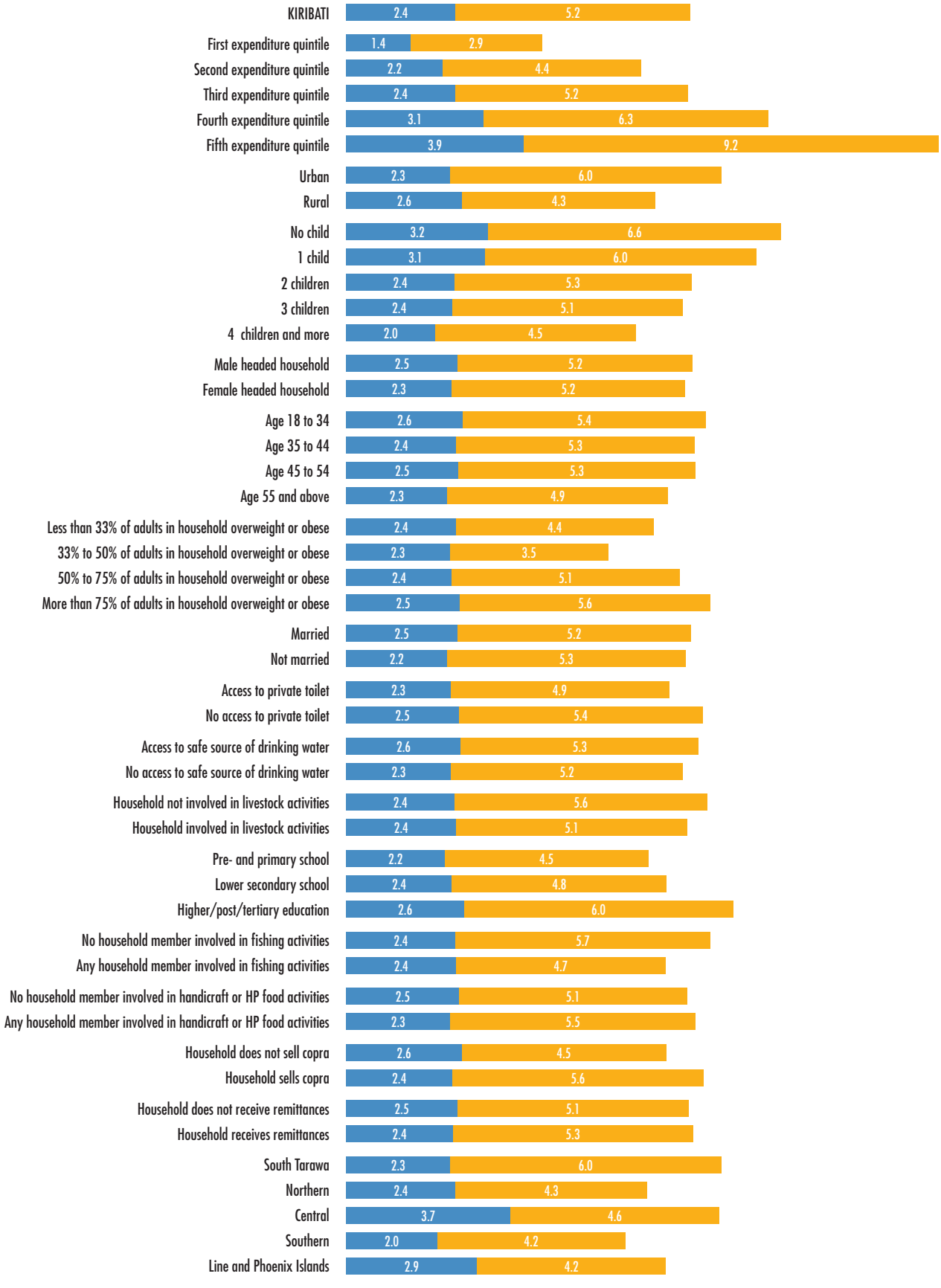
[I] If a body needs iron, it absorbs more from plants. If a body does not need more iron, it absorbs less plant iron but it will keep on absorbing haem iron, even reaching dangerous levels.

[II] The dispersion ratio is estimated as the ratio of the quantity of iron available for consumption for the wealthiest households to that for the least wealthy households.

**FIGURE 26**

## National disparities in the amount of iron available for consumption

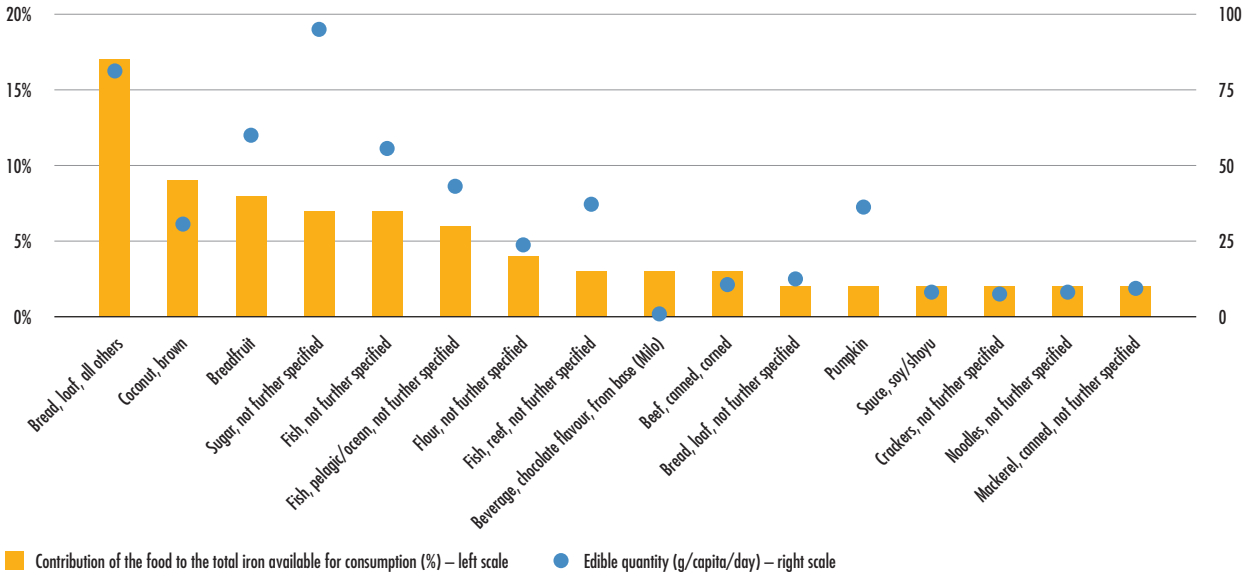
Iron consumption by population groups (mg/capita/day)




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 27**
Main sources of iron

Average edible quantity and contribution of the main food products providing iron




SOURCE: Kiribati 2019/20 HIES.

Regional differences can also be observed, with the region of South Tarawa presenting the highest amount of iron available for consumption while the Southern region has the lowest. No major difference can be observed between male headed and female headed households. In all population groups, except that of the wealthiest households, average iron consumption is well below the recommended level, which is reflected in the 26 percent prevalence of anaemia among women of reproductive age.[27]

Bread is the main source of iron in Kiribati, contributing 17 percent of the iron available for consumption, followed by fresh fish with an average contribution of 16 percent. To decrease the prevalence of anaemia, especially among women and children, it is recommended that the consumption of iron enriched cereals, such as breakfast cereals (provided the sugar and fat content added is low), green leafy vegetables, seafood or dried fruits is increased.

## 4.4 Healthy living pattern

As seen in sections 4.1, 4.2 and 4.3, it is important to eat a wide variety of foods to access all the essential nutrients. It is not only important to have a diverse diet but also to eat these foods in proportions that lead to a healthy diet. In 2018, the Public Health Division of the Pacific Community (SPC) published the Pacific guidelines for healthy living.[28] The main purpose of the guidelines is to provide background information and appropriate and effective guidance for healthy living. Following the recommendations from the guidelines, the food products collected in the 2019/20 KHIES were categorized into three groups (energy foods, protective foods and body building foods) recommended for a healthy diet. These groups were further disaggregated into three categories:

a. foods to choose,

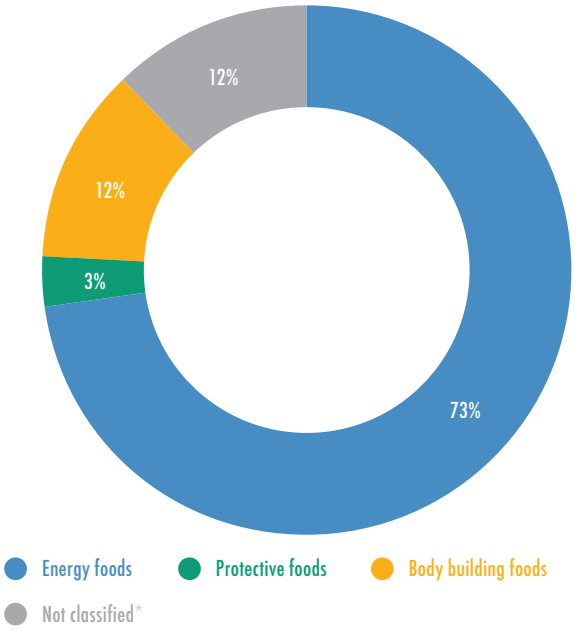
b. foods to limit, and

c. foods to avoid.

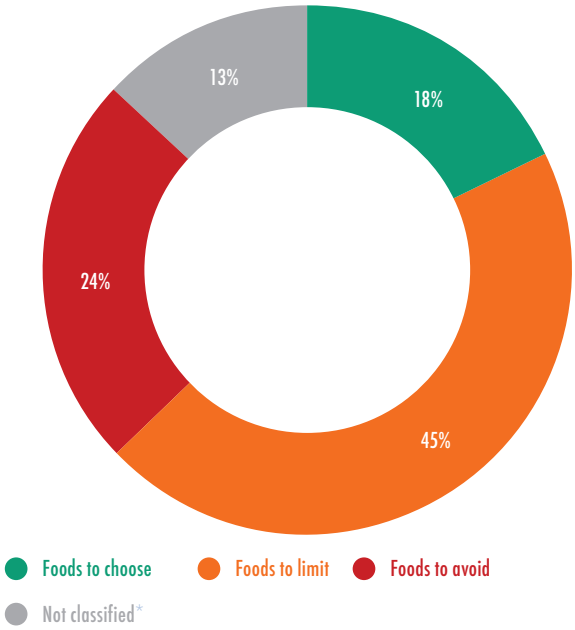
In addition to these groups, a fourth category was created to accommodate all the foods not classified according to the Pacific guidelines (see Box 6).

**FIGURE 28**
## Disaggregation of the average DEC according to the Pacific guidelines for healthy living

Disaggregation of the average dietary energy consumption into the three main groups for healthy diet




Disaggregation of the average dietary energy consumption in foods to choose, limit or avoid




* Food not classified corresponds to food like spices, alcoholic beverages, and meals consumed away from home.
SOURCE: Kiribati 2019/20 HIES.

**BOX 6**
### Group categories following the Pacific guidelines for healthy living

1. Energy-dense foods
   a. To choose: mainly local staple foods
   b. To limit: white rice, processed cereals, foods with low fat or low sugar
   c. To avoid: sugars, fats, foods processed from cereals with high fat or sugar content
2. Protective foods
   a. To choose: fresh fruits and vegetables
   b. To limit: dried fruits or processed fruits and vegetables with low sugar or salt content
   c. To avoid: processed fruits or vegetables with high sugar content
3. Body building foods
   a. To choose: lean meat, fish, nuts, beans, low fat dairy products
   b. To limit: medium fat meat, medium fat dairy products, low fat canned fish, etc.
   c. To avoid: high fat meat, high fat dairy products, processed meat
4. Unclassified foods
   i. Food consumed away from home
   ii. Spices/coffee/tea
   iii. Alcoholic beverages
   iv. Tobacco and kava*

* Not considered as food products

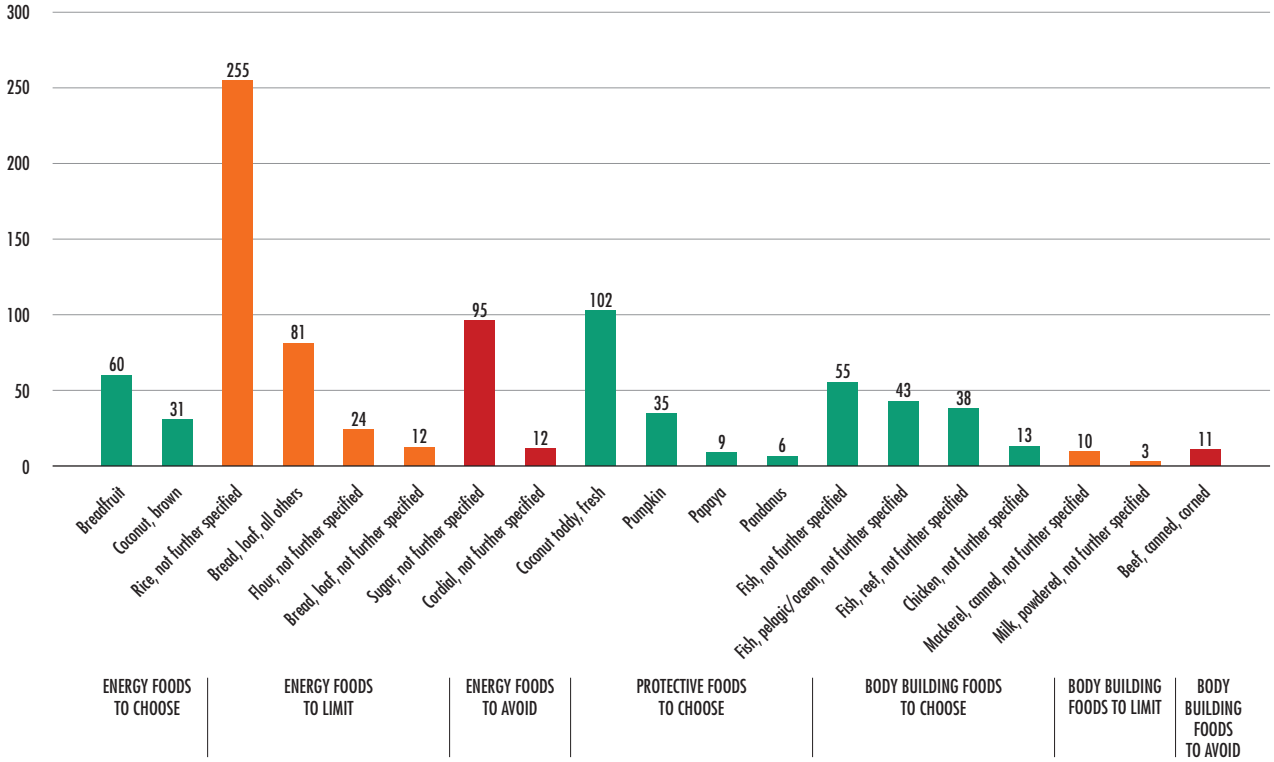
According to this food group classification, more than 70 percent of the average dietary energy consumed comes from energy dense foods like rice, brown coconut and breadfruit. Body building foods rich in protein, such as fish, meat or dairy products, contribute 12 percent of the dietary energy consumed. Protective foods rich in vitamins, such as fruits and vegetables, contribute less than 3 percent of the average dietary energy consumed.[I] Furthermore, looking at products to choose, limit or avoid, foods to limit or avoid contribute 70 percent of the dietary energy consumed. Less than 20 percent of the dietary energy consumed is composed of the nutritious foods that could be chosen. Except for coconut toddy boiled, which is classified as an energy food to avoid, other alcoholic beverages (as well as spices and food away from home) are within "not classified foods", but if they were classified, these products would undoubtedly increase the contribution of foods to avoid or limit.

[I] Looking at the contribution of each group to the total dietary energy consumed gives obviously more weight to the group composed of energy foods, and protective foods like fruits and vegetables have a lower contribution to average dietary energy consumption, but dietary energy is the only measure that allows comparisons between heterogeneous groups.

**FIGURE 29**

## Distribution of the quantities of the most consumed foods following the Pacific guidelines

Edible quantities of food products according to healthy guidelines classification (g/capita/day)




SOURCE: Kiribati 2019/20 HIES.

With an average daily edible quantity of 60 grams per capita, breadfruit is the main energy dense food to choose followed by brown coconut, with an average edible quantity of 30 grams/capita/day. Fresh coconut toddy, considered as a healthy and nutritious food rich in vitamin C, is the main protective food consumed, with an average daily consumption of 100 grams/capita/day, followed well behind by pumpkin, which is rich in vitamin A.

With an average consumption of 250 grams/capita/day, white rice is the main source of energy, but its consumption should be limited because of its poor nutrient qualities compared with brown rice.

Among energy-dense foods, sugar is the second most consumed product. Excess consumption of sugar leads to chronic diseases, obesity and dental decay, and therefore the consumption of this energy-dense product should be avoided, or at least not exceed 10 percent of the total dietary energy intake consumed.[I] In Kiribati, with an average of 95 grams per capita per day, table sugar alone contributes 14 percent of the average dietary energy consumed.

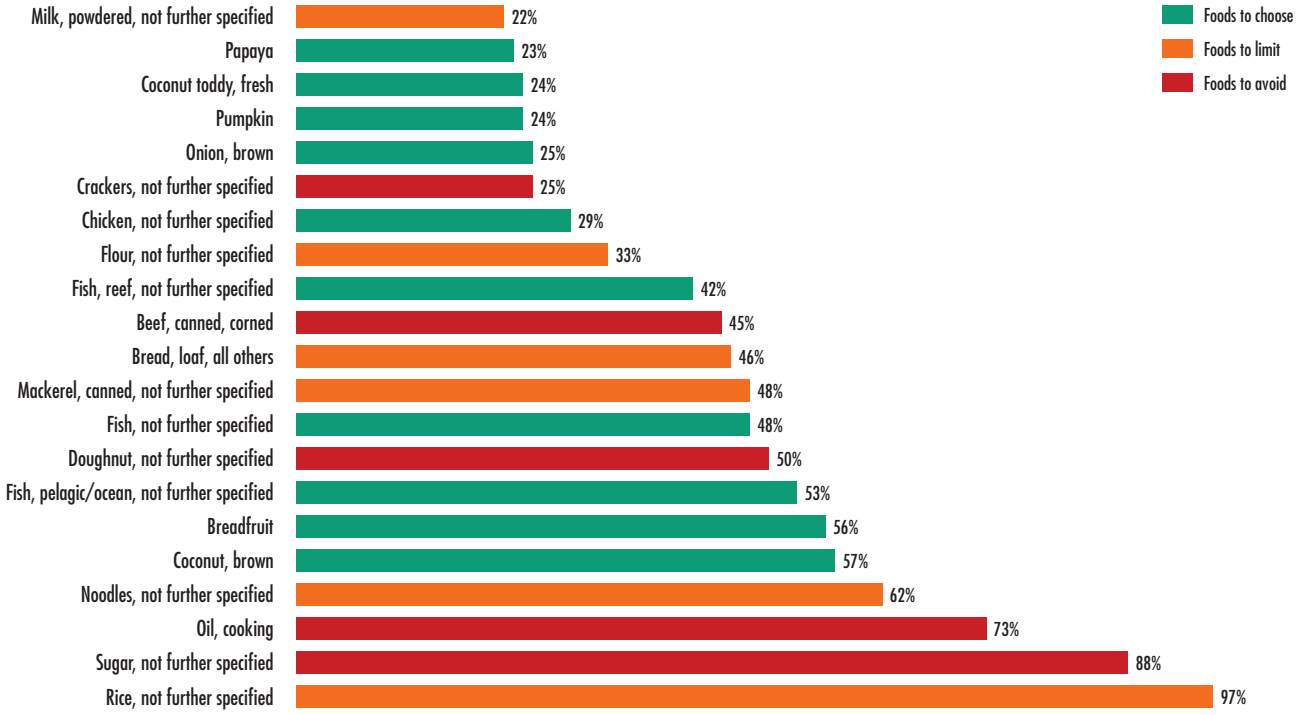
Fresh fish (reef, pelagic or not further specified) contribute around 60 percent of the average dietary energy coming from the range of body building foods, with an average daily edible quantity consumed of 140 grams/capita/day. Chicken consumption is limited, with an average of 13 grams/capita/day. Canned meat or fish are considered as body building foods, whose consumption should be limited or avoided, and indeed their consumption is relatively low in Kiribati, with less than 15 grams per capita of canned meat or fish consumed daily on average.

Among the energy-dense foods, the preferences of households tend to be towards foods to limit or avoid, as less than 60 percent of the households consume breadfruit, a traditional local fruit whose consumption is recommended, whereas 97 percent of households consume rice, for which consumption is recommended to be limited, and 88 percent of households consume sugar, which should be avoided.

Less than one household in four consumes protective foods such as onion, pumpkin or papaya. Pelagic fish are the most consumed body building foods that are recommended to be chosen, but are consumed by only one household in two.

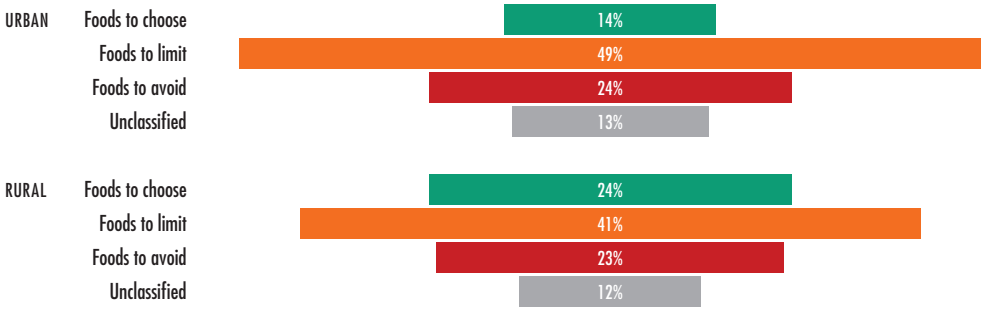
[I] See WHO 2015 guidelines: sugars intake for adults and children: https://www.who.int/publications/i/item/9789241549028

**FIGURE 30**
Percentage of households consuming the food products to choose, limit or avoid




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 31**
Differences in the dietary pattern between rural and urban areas (as percentage of DEC in each group)




SOURCE: Kiribati 2019/20 HIES.

A further look at the classification of foods according to the Pacific guidelines in urban and rural areas shows a pattern relatively similar for foods to avoid and the not classified foods, but the respective contributions of foods to choose and foods to limit to the total dietary energy consumed show important differences.

In rural areas, foods to choose contribute 24 percent of the average DEC and food to limit amounts to 41 percent compared with contributions of 14 percent and 49 percent respectively in urban areas. The trend among foods to choose is mainly due to a higher consumption of breadfruits and brown coconut in rural areas (respectively 90 grams/capita/day and 40 grams/capita/day) and fresh fish (around 160 edible grams/capita/day) compared with urban areas (34 grams/capita/day, 22 grams/capita/day and 110 grams/capita/day respectively). The lower quantities of bread consumption in rural areas than in urban areas (24 grams/capita/day versus 130 grams/capita/day) mainly explain the difference in contribution of foods to limit in the average DEC in urban and rural areas. But not all households consume these foods. In fact, fresh fish is consumed by 30 percent to 60 percent of rural households compared with 35 percent to 80 percent of urban households, while around 50 percent of households consume breadfruit in urban areas compared with 60 percent in rural areas. Other significant differences in dietary patterns between urban and rural households can be observed. If urban households are consuming less fish, they consume, in turn, more chicken. One household in two in urban areas

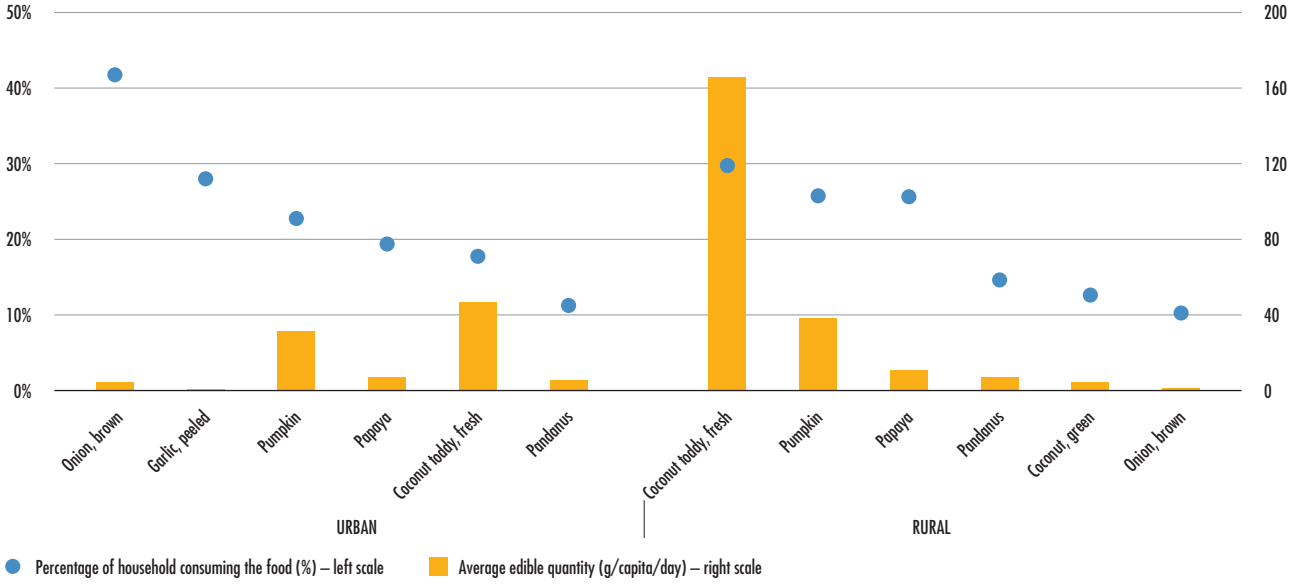
**TABLE 6**
Quantity and percentage of households consuming the foods grouped according to the Pacific guidelines and by area

| | | | Average quantity as purchased (g/capita/day) | Average edible quantity (g/capita/day) | Average dietary energy consumption (kcal/capita/day) | Percentage of households consuming the food (%) |
|---|---|---|---|---|---|---|
| Energy foods – to choose | Breadfruit | Rural | 115 | 90 | 98 | 59 |
| | | Urban | 43 | 34 | 37 | 52 |
| | Coconut, brown | Rural | 85 | 41 | 166 | 64 |
| | | Urban | 46 | 22 | 89 | 49 |
| Energy foods – to limit | Bread, loaf, all others | Rural | 24 | 24 | 59 | 42 |
| | | Urban | 132 | 132 | 322 | 50 |
| | Flour, not further specified | Rural | 20 | 20 | 72 | 28 |
| | | Urban | 27 | 27 | 96 | 39 |
| | Noodles, not further specified | Rural | 6 | 6 | 25 | 53 |
| | | Urban | 10 | 10 | 40 | 72 |
| | Rice, not further specified | Rural | 262 | 262 | 886 | 96 |
| | | Urban | 250 | 250 | 845 | 99 |
| Energy foods – to avoid | Crackers, not further specified | Rural | 6 | 6 | 25 | 20 |
| | | Urban | 9 | 9 | 40 | 30 |
| | Doughnut, not further specified | Rural | 5 | 5 | 19 | 38 |
| | | Urban | 11 | 11 | 45 | 64 |
| | Oil, cooking | Rural | 8 | 8 | 70 | 61 |
| | | Urban | 10 | 10 | 89 | 87 |
| | Sugar, not further specified | Rural | 102 | 102 | 402 | 86 |
| | | Urban | 89 | 89 | 351 | 91 |
| Protective foods – to choose | Coconut toddy, fresh | Rural | 166 | 166 | 71 | 30 |
| | | Urban | 47 | 47 | 20 | 18 |
| | Onion, brown | Rural | 1 | 1 | 0 | 10 |
| | | Urban | 6 | 5 | 1 | 42 |
| | Papaya | Rural | 15 | 11 | 4 | 26 |
| | | Urban | 10 | 7 | 2 | 19 |
| | Pumpkin | Rural | 48 | 38 | 15 | 26 |
| | | Urban | 43 | 34 | 14 | 23 |
| Body building foods – to choose | Chicken, not further specified | Rural | 6 | 5 | 10 | 11 |
| | | Urban | 28 | 21 | 43 | 50 |
| | Fish, not further specified | Rural | 138 | 92 | 118 | 60 |
| | | Urban | 36 | 24 | 31 | 34 |
| | Fish, pelagic/ocean, not further specified | Rural | 41 | 25 | 38 | 30 |
| | | Urban | 96 | 59 | 88 | 80 |
| | Fish, reef, not further specified | Rural | 69 | 50 | 54 | 42 |
| | | Urban | 38 | 27 | 30 | 41 |
| Body building foods – to limit | Mackerel, canned, not further specified | Rural | 10 | 9 | 16 | 42 |
| | | Urban | 13 | 10 | 19 | 55 |
| | Milk, powdered, not further specified | Rural | 2 | 2 | 8 | 13 |
| | | Urban | 3 | 3 | 14 | 33 |
| Body building foods – to avoid | Beef, canned, corned | Rural | 8 | 8 | 19 | 37 |
| | | Urban | 13 | 13 | 29 | 54 |
| | Milk, condensed, whole, sweetened | Urban | 4 | 4 | 12 | 24 |
| | Sausage, not further specified | Urban | 9 | 9 | 19 | 29 |

Foods to choose  Foods to limit  Foods to avoid

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 32**
Percentage of households and quantity consumed of protective foods in urban and rural areas




SOURCE: Kiribati 2019/20 HIES.

consumes chicken at an average edible quantity of 20 grams/capita/day compared with a bit more than one household in ten in rural areas (around 5 grams/capita/day).

Protective foods are consumed by less than 30 percent of the households in rural areas, and fresh coconut toddy is the main protective food product consumed, with around 160 grams consumed daily per capita, followed by a little less than 40 grams/capita/day of pumpkin, which is consumed by 26 percent of rural households. In urban areas, more than 40 percent of households consume onion, but in very small amounts, with an average daily quantity of around 5 grams per capita. Fresh coconut toddy is the main protective food consumed in urban areas in quantity, with an average of around 50 grams/capita/day, but it is consumed by only 18 percent of households, followed by pumpkin, which is consumed by 23 percent of the households, with an average quantity consumed of 30 grams/capita/day.

In terms of foods not classified according to the Pacific guidelines, salt is the most common product consumed by households in both urban and rural areas. Three urban households in four have at least one of their members consuming a lunch away from home compared with one in two rural households. Another interesting finding is the importance of consumption of tobacco in both areas, with an average quantity of 50 grams/capita/day consumed by at least 80 percent of the households. Consumption of kava is higher in urban areas than in rural areas in terms of average quantity consumed, with around 100 grams/capita/day and 70 grams/capita/day respectively, but the percentages of households consuming kava are very close, with around one household in two consuming kava in both urban and rural areas. Instant coffee is mainly consumed in urban areas, while a larger proportion of 61 percent of households consume tea in rural areas compared to 54 percent in urban areas.

It is interesting to note that most of the dietary energy consumed from energy-dense foods and protective foods in the to choose category comes from own production, and most of the dietary energy coming from foods to limit or avoid comes from cash purchases. Among the not classified foods, most of the dietary energy comes from foods consumed away from home. Notably, one kcal in five from foods to choose is received for free or through exchange.

**TABLE 7**

## Quantity and contribution to the average dietary energy consumption of the foods not classified consumed by at least one household in three

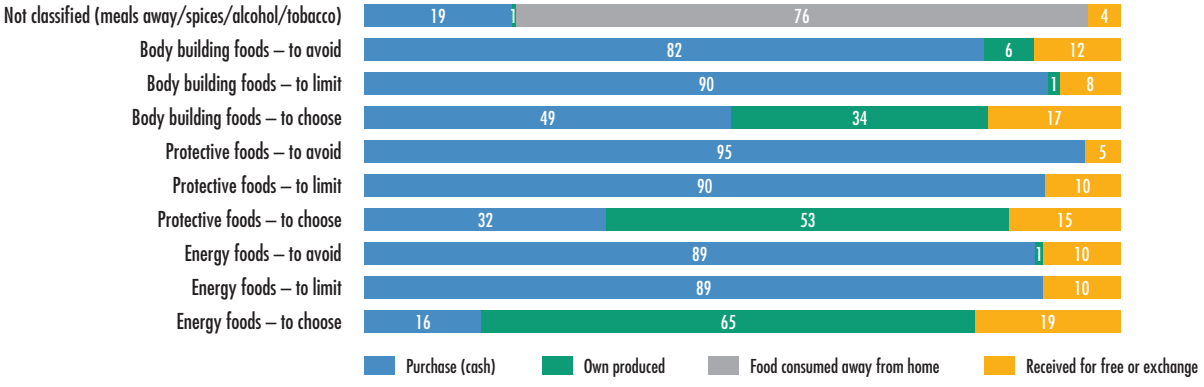
| | | Average edible quantity (g/capita/day) | Average dietary energy consumption (kcal/capita/day) | Percentage of household consuming the food (%) |
|---|---|---|---|---|
| Breakfast away from home | Rural | … | 44 | 38 |
| | Urban | … | 42 | 45 |
| Coffee, instant, powder | Urban | 1 | 1 | 35 |
| Hot drinks away from home | Rural | 14 | 5 | 35 |
| | Urban | 10 | 3 | 31 |
| Kava | Rural | 69 | 0 | 49 |
| | Urban | 98 | 0 | 47 |
| Lunch away from home | Rural | … | 138 | 56 |
| | Urban | … | 185 | 73 |
| Salt, iodized | Rural | 8 | 0 | 84 |
| | Urban | 5 | 0 | 90 |
| Sauce, soy/shoyu | Rural | 6 | 2 | 35 |
| | Urban | 10 | 3 | 78 |
| Snacks away from home | Urban | … | 79 | 37 |
| Spices, not further specified | Urban | 0 | 1 | 35 |
| Tea, black, bag | Rural | 0 | 0 | 61 |
| | Urban | 0 | 0 | 54 |
| Tobacco | Rural | 49 | 0 | 80 |
| | Urban | 52 | 0 | 81 |

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 33**

## Dietary energy consumption split by main sources of acquisition and Pacific guidelines

Contribution of the source of acquisition to the DEC by the Pacific guidelines classification



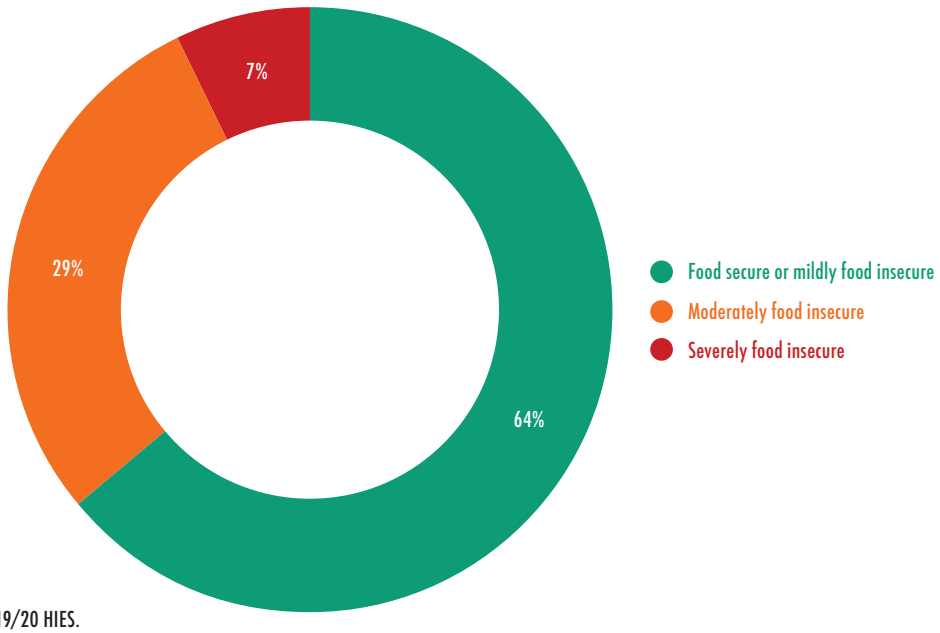

SOURCE: Kiribati 2019/20 HIES.

# CHAPTER 5
# ANALYSIS OF THE DIETARY PATTERNS OF THE FOOD INSECURE

The inclusion of the Food Insecurity Experience Scale (FIES) module in the 2019/20 KHIES presents a good opportunity to better understand the food consumption pattern of the food insecure in Kiribati. First, in combining information on the socioeconomic and demographic characteristics of the households, it is possible to derive a profile for the food insecure, and second, in cross-analysing the food consumption and the FIES data collected in the 2019/20 KHIES, it is possible to derive food consumption indicators by severity levels of food insecurity.

As further described in the methodological note, the scale passed all the statistical validity tests, and the number of affirmative answers to the eight questions of the scale (raw score) can be considered as an ordinal measure of food insecurity.[I] Based on these findings, a level of food insecurity was assigned to each household. A household is classified as "food secure or mildly food insecure" when the raw score is less than or equal to 3; a household is considered as "moderately food insecure" when the raw score is higher than or equal to 4 but less than 7; and a household is considered "severely food insecure" when the raw score is equal to 7.[II] Following this categorization, it was found that 29 percent of households in Kiribati are moderately food insecure, which means that around 5 800 households are having difficulty in accessing safe and nutritious foods, and 7 percent of households are severely food insecure, which means around 1 300 households do not have enough access to food, to the point of experiencing hunger.

**FIGURE 34**
Percentage of food secure and food insecure households




SOURCE: Kiribati 2019/20 HIES.

I The higher the raw score, the higher the probability that the level of food insecurity is severe. For more detail see Methodologcal Annex 1.2, and refer to the Voices of the Hungry website: http://www.fao.org/in-action/voices-of-the-hungry/en/

II See footnote 30

## 5.1 Profile of the food insecure

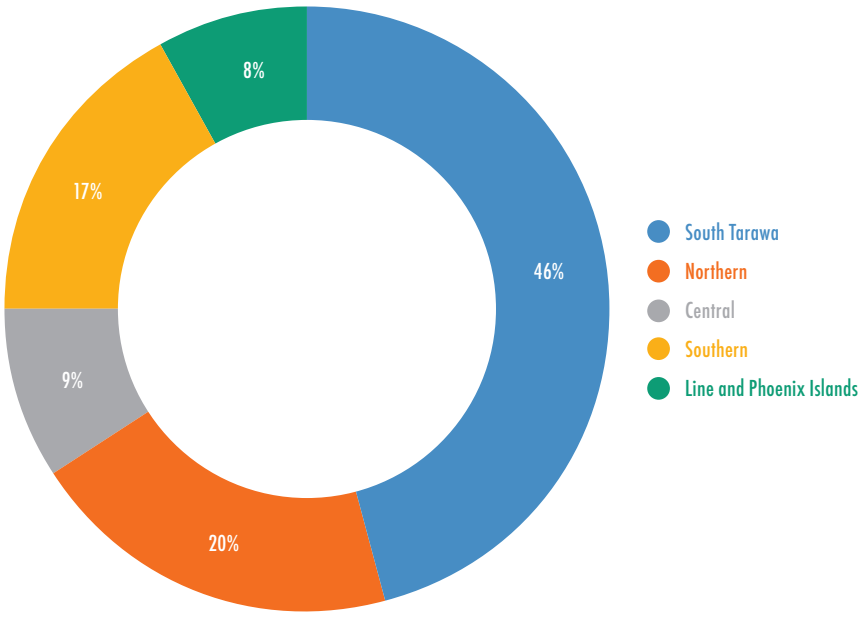
To adopt the best policies intended to reduce food insecurity and all forms of malnutrition, it is important to have a better understanding of the profile and dietary pattern of food insecure households.

The Northern region and South Tarawa have the highest proportion of food insecure households, with 9 percent of the households living in these regions being severely food insecure, and 36 percent in the Northern region and 32 percent in South Tarawa being moderately food insecure. The region of Line and Phoenix Islands, which has less than 8 percent of the population, is the region where food insecurity is the lowest, with less than one household in five experiencing moderate or severe levels of food insecurity.

A larger proportion of food insecure households is found among the least wealthy households, with one household in two belonging to the first expenditure quintile being food insecure, of which 11 percent are severely food insecure compared with 77 percent of food secure households being among the wealthiest households. With income and education being positively correlated, it is not surprising to find a higher proportion of food insecurity among households with low levels of education. Of the households that have a head with a low level of education, 45 percent are experiencing moderate or severe levels of food insecurity compared with 27 percent of households that have a head with a high level of education. The probability of being food insecure does not seem to depend on the gender of the head of the household, but it does depend on the marital status, the age of the head of the household and the number of children. In effect, the prevalence of moderate or severe food insecurity is higher in households that have a head who is older than age 35 years, or not married, or with more than 4 children than in households with no children or in which the head of the household is younger than age 35 years or is married.

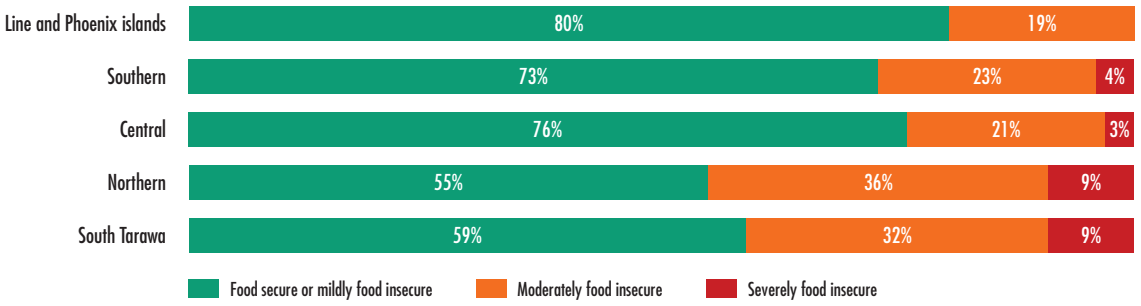
Around 42 percent of households with no private toilet experience moderate or severe levels of food insecurity compared with 32 percent of households with access to private toilets. But contrary to what we would expect, the prevalence of food insecurity is higher among households with access to a safe source of drinking water than among households with no access to a safe source of drinking water. This result is unexpected, as access to a safe source of water is fundamental to preventing contamination of foods. This unexpected trend can be explained because in Kiribati regional localization is a higher impediment than income for access to a safe source of drinking water. In fact, in urban areas two households in three have access to a safe source of drinking water, but urban areas also have the highest prevalence of the food insecure. The concentration of food insecure households is higher among households involved in handicraft or fishing activities than among households not involved in these activities. Conversely, the prevalence of food security

**FIGURE 35**
Regional distribution of the population




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 36**
Regional distribution of food secure and food insecure households




SOURCE: Kiribati 2019/20 HIES.

is much higher among households that sell copra than among those households not selling copra, with a prevalence of 69 percent against 60 percent respectively. There is a higher probability of finding food insecure households among households that have a percentage of overweight or obese adults of less than 33 percent than among households that have a percentage of overweight or obese adults higher than 75 percent, but this is not enough to make inferences about the nutritional status of the food insecure households.

To confirm all the trends discussed, a simple ordered logistic regression was performed linking the three classes of food insecurity to all the demographic and socioeconomic characteristics of the households (see Annex 5 for more detail). The model, as a whole, is statistically significant with a *p* value = 0.000, compared to the null model with no predictors. To ease the interpretation, only the sign and the statistical significance of the log odds[I] are discussed. The value of the log odds and their significance level are presented in Annex 6. The model confirms that total expenditure is an important determinant of food insecurity and, as income increases, the probability of being in a higher class of food insecurity decreases, given that all of the other variables in the model are held constant. The gender of the head of the household is not a determinant of food insecurity, and neither is the age of the head of the household, or the involvement of the household in livestock activities, or access to private toilets.

The odds of belonging to a higher class of food insecurity (i.e. being more food insecure) is lower for households located in rural areas, and those have a head of household who is married and who has a high level of education, and if the household is selling copra.[II] Conversely, households with more than four children and households involved in fishing and handicraft activities have a higher probability of being food insecure than households with no children or not involved in fishing and handicraft activities.[III] The probability of belonging to a higher class of food insecurity seems to be slightly higher among households receiving remittances, but the statistical significance is low (*p* value = 0.17).

The model also confirms that going from no access to access to a safe source of drinking water increases the probability of belonging to a higher class of food insecurity, given all of the other variables in the model are held constant. In other words, food insecurity is higher among households with access to a safe source of drinking water, but the statistical significance of the log odds is low (*p* value = 0.08). Finally, the percentage of adults overweight or obese in the households is not statistically significant, which means the probability of being in a higher class of food insecurity does not depend on the nutritional status of the household; conversely, being food insecure does not seem to have a significant impact on the nutritional status of the household (even if the sign of the log odds of households with more than 75 percent of adults overweight or obese is negative, pointing towards a lower incidence of severe food insecurity among these households, which is what we would expect).

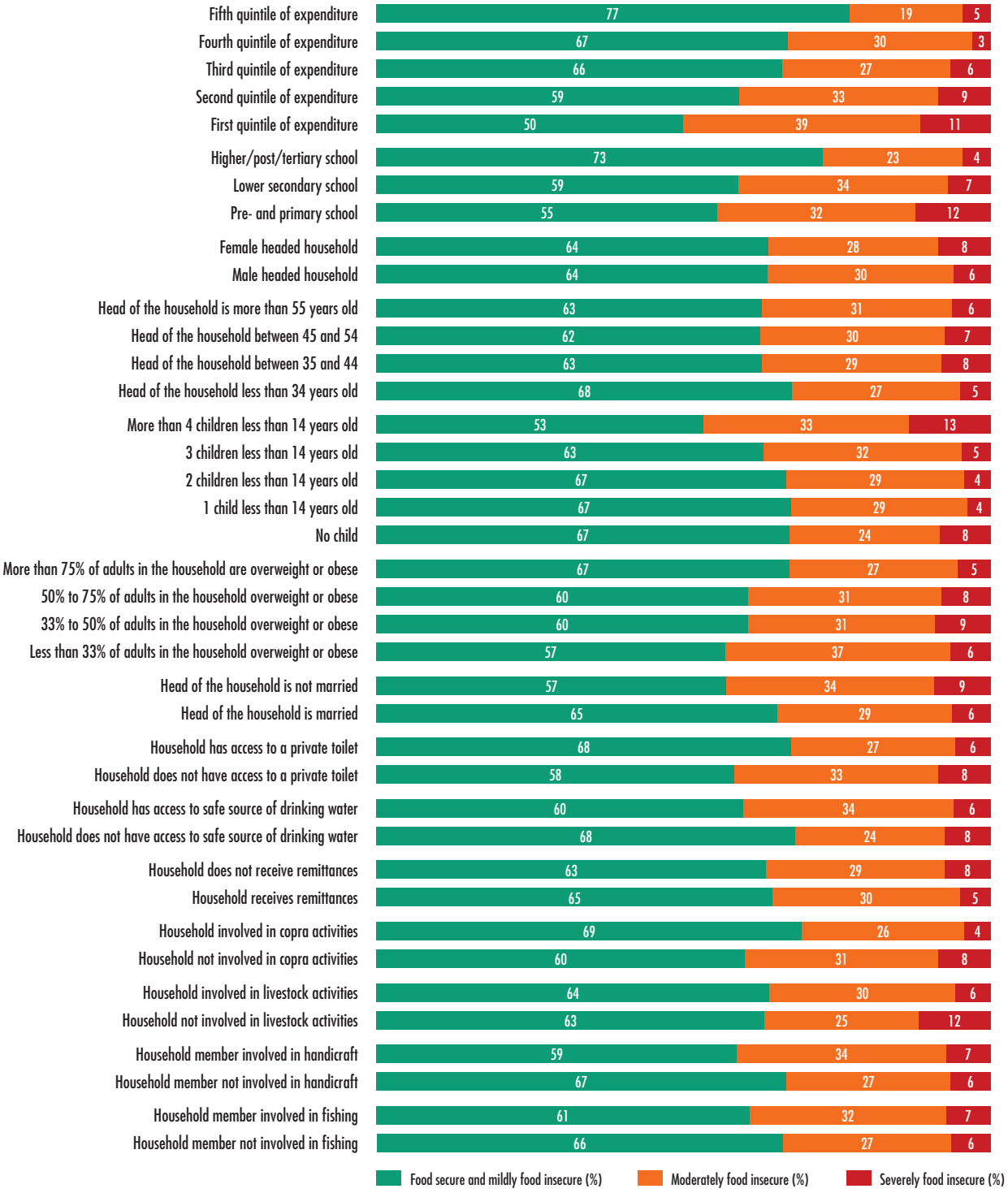
[I] The odds correspond to the probability that the household belongs to the highest class of food insecurity against the probability it belongs to the two lowest classes of food insecurity. In other words, it is the probability that the household is food secure versus the probability it is food insecure. The log odds is the logarithm of the odds.

[II] The respective values of the log odds are −0.60, −0.36, −0.82 and −0.52.

[III] The respective values of the log odds are 0.96, 0.22 and 0.38.

**FIGURE 37**
## Profile of food secure and food insecure households

Socioeconomic and demographic characteristics of food secure and food insecure households




SOURCE: Kiribati 2019/20 HIES.

## 5.2 Overall pattern of food consumption of the food insecure and food secure households

Households experiencing moderate levels of food insecurity, that is households that have insufficient access to safe and nutritious foods, are consuming on average 200 kcal/capita/day less than food secure or mildly food insecure households. Severely food insecure households, meaning households that do not have access to enough quantity of food and that had household members who went a whole day without eating at least once in the previous twelve months, consume 200 kcal/capita/day less than moderately food insecure households.[I] The difference in the average amount of dietary energy consumed combined with the high prevalence of food insecurity confirms that inadequate access to foods in both quantity and quality is a real source of concern for many households in Kiribati.

Severely food insecure households spend on average AUD 3.2/capita/day to acquire food, which represents 64 percent of their total expenditure compared with food secure households, who spend AUD 3.7/capita/day on food, which is 59 percent of their overall budget. Further analysis of the cost of dietary energy shows that food insecure households spend, on average, 10 cents less to acquire 1 000 kcal than food secure households.[II] The lower cost of energy points towards households having access to dietary energy of slightly lower quality than food secure households.

The fact that there is very little difference in the cost to acquire 1 000 kcal between moderately and severely food insecure households further confirms that, because of a lack of resources or other means, households have first compromised the quality of the food they are accessing and then they start to compromise the quantity of foods they are accessing to the point of experiencing hunger.

Around 70 percent of the dietary energy consumed by the severely food insecure is purchased, less than 9 percent comes from their own production and 11 percent is received for free or through exchange of other foods. There is therefore a strong reliance on the cash economy and higher vulnerability to price shocks and/or income reduction for food insecure households in Kiribati.

## 5.3 Main food products consumed by food insecure and food secure households

On average, food secure and food insecure households consume around 19 food products. But the variety and diversity of food products from which they choose differ by level of severity of food insecurity. The total number of products reported by food secure households is 168 compared with 156 reported by households experiencing moderate levels of food insecurity and 120 reported by households experiencing severe levels of food insecurity. Therefore, the variety of foods accessed by food insecure households is much lower than the variety of foods accessed by food secure households (even if not all food secure households are consuming all of the 168 food products reported). Even though a broad number of food products are available at the national level, they are not accessible for some I-Kiribati.

The breakdown by food groups of the total food products consumed by food secure and food insecure households shows that the groups of meat, fruits, vegetables, and milk and milk products are those for which the difference in the number of products consumed by food secure versus food insecure households is the highest.

If the number of products consumed differs by level of food insecurity, the quantity of the main products consumed by food groups is also different. Overall, the average quantities of food products consumed by food group are lower for food insecure households than for food secure households. The main differences in the quantity are observed for the groups of fish, fruits and cereals, with the average quantities consumed by severely food insecure households being 45 grams/capita/day, 35 grams/capita/day and 25 grams/capita/day respectively lower than those of food secure households.

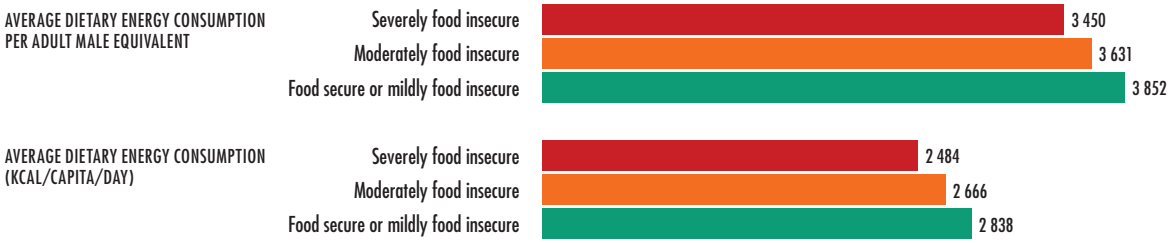
The quantities of tobacco and kava consumed by moderately or severely food insecure households are higher than those consumed by food secure or mildly food insecure households. The excessive consumption of these products is further exposing food insecure households to a higher risk of health problems.

[I] Food insecure households are usually composed of more children less than age 14 years, and to account for the composition of the household, we also looked at the average DEC in adult male equivalent, and the difference in the DEC between food secure and food insecure households is the same when expressed in per capita or per adult male equivalent.

[II] We further grouped households experiencing moderate levels of food insecurity with those experiencing severe levels of food insecurity. The average cost of 1 000 kcal for food secure households is AUD 1.36 compared with AUD 1.26 for food insecure households. The difference in the cost of 1 000 kcal is significant at 95% (t = 4.53, *p* value = 0.00 and df = 2180).

**FIGURE 38**
## Distribution of dietary energy consumption by level of food insecurity

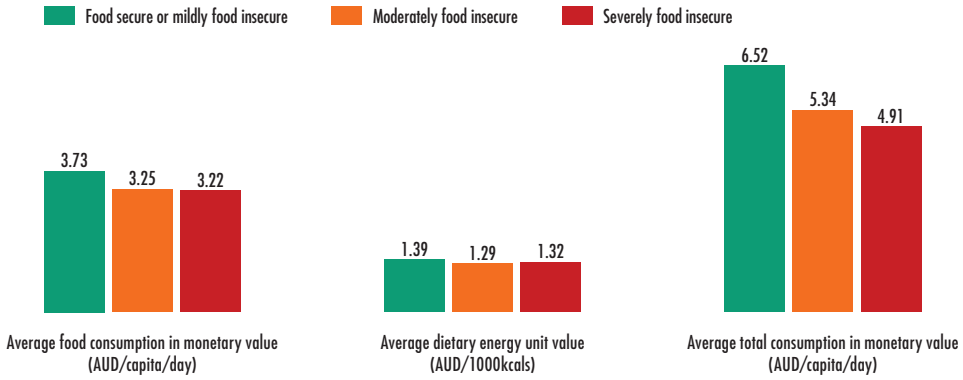
Average dietary energy consumption by level of severity of food insecurity (kcal/day)




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 39**
## Distribution of the cost of food by level of food insecurity

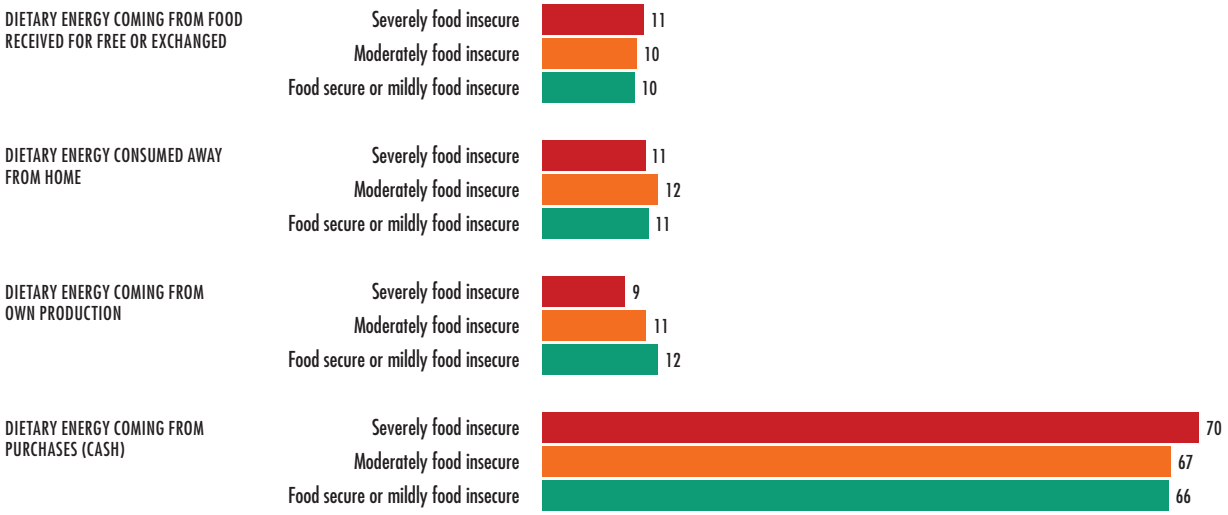
Difference in the amount spent on food between food secure and food insecure households




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 40**
## Main sources of acquisition of dietary energy consumption by level of food insecurity

Contribution of the main source of consumption of the average DEC (%)




SOURCE: Kiribati 2019/20 HIES.

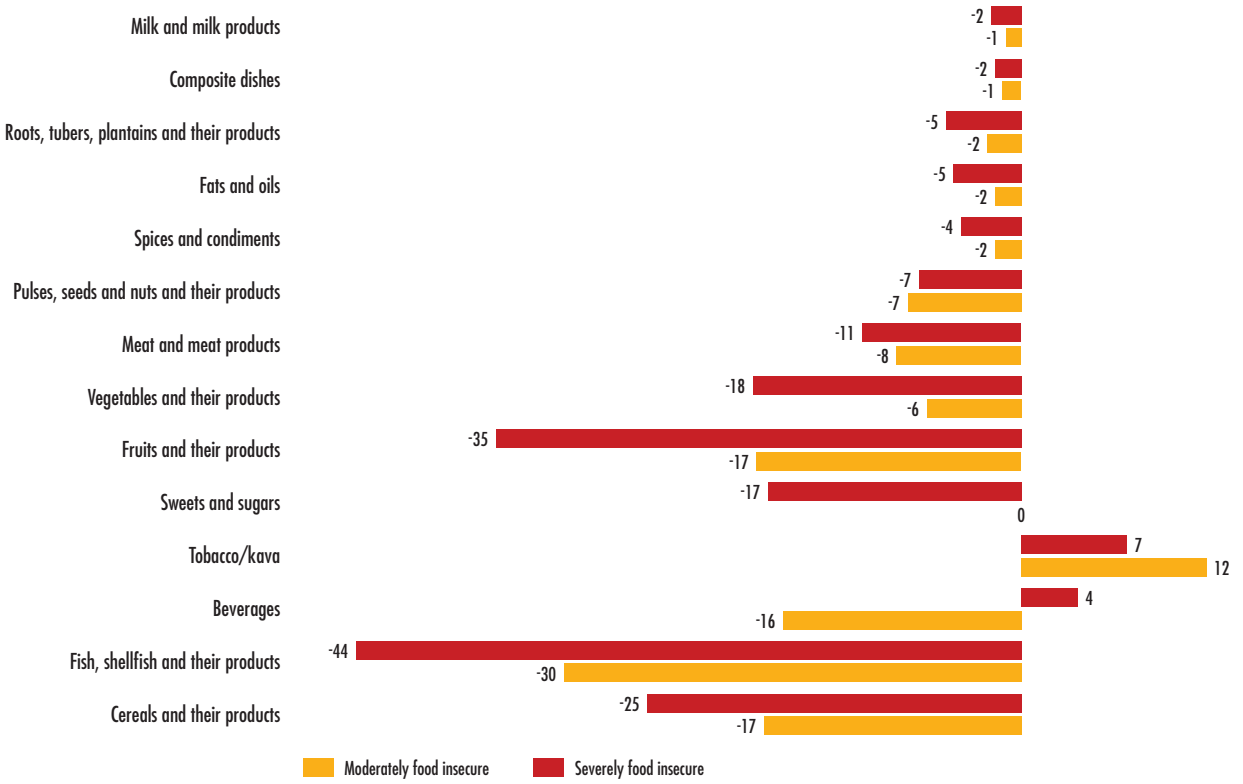
**TABLE 8**
Number of products reported by food groups and severity of food insecurity

| Food product | Classes of level of severity of food insecurity | Number of products reported |
|---|---|---|
| Cereals and their products | Food secure or midly food insecure | 6 |
| | Moderate food insecure | 6 |
| | Severe food insecure | 6 |
| Roots, tubers, plantains and their products | Food secure or midly food insecure | 7 |
| | Moderate food insecure | 7 |
| | Severe food insecure | 7 |
| Pulses, seeds and nuts and their products | Food secure or midly food insecure | 5 |
| | Moderate food insecure | 4 |
| | Severe food insecure | 4 |
| Milk and milk products | Food secure or midly food insecure | 4 |
| | Moderate food insecure | 4 |
| | Severe food insecure | 1 |
| Eggs and their products | Food secure or midly food insecure | 1 |
| | Moderate food insecure | 1 |
| | Severe food insecure | 1 |
| Fish, shellfish and their products | Food secure or midly food insecure | 17 |
| | Moderate food insecure | 18 |
| | Severe food insecure | 15 |
| Meat and meat products | Food secure or midly food insecure | 12 |
| | Moderate food insecure | 9 |
| | Severe food insecure | 6 |
| Vegetables and their products | Food secure or midly food insecure | 21 |
| | Moderate food insecure | 18 |
| | Severe food insecure | 13 |
| Fruits and their products | Food secure or midly food insecure | 16 |
| | Moderate food insecure | 16 |
| | Severe food insecure | 9 |
| Fats and oils | Food secure or midly food insecure | 6 |
| | Moderate food insecure | 4 |
| | Severe food insecure | 4 |
| Sweets and sugars | Food secure or midly food insecure | 19 |
| | Moderate food insecure | 19 |
| | Severe food insecure | 15 |
| Spices and condiments | Food secure or midly food insecure | 8 |
| | Moderate food insecure | 8 |
| | Severe food insecure | 8 |
| Beverages | Food secure or midly food insecure | 19 |
| | Moderate food insecure | 17 |
| | Severe food insecure | 15 |
| Food not classified | Food secure or midly food insecure | 7 |
| | Moderate food insecure | 7 |
| | Severe food insecure | 7 |
| Composite dishes | Food secure or midly food insecure | 14 |
| | Moderate food insecure | 14 |
| | Severe food insecure | 5 |

SOURCE: Kiribati 2019/20 HIES.

**FIGURE 41**
Differences in quantities of the main products consumed by moderately food insecure and severely food insecure households

Difference between the quantity of food products consumed by food insecure and food secure households (using quantities of food consumed by food secure as reference) (g/capita/day)*




* a positive value refers to higher quantity consumed by moderate or severe food insecure compared to the quantity consumed by food secure and a negative value refers to a lower quantity consumed by moderate or severe food insecure compared to the quantity consumed by food secure.

SOURCE: Kiribati 2019/20 HIES.

## 5.4 Nutrient consumption of food insecure versus food secure households

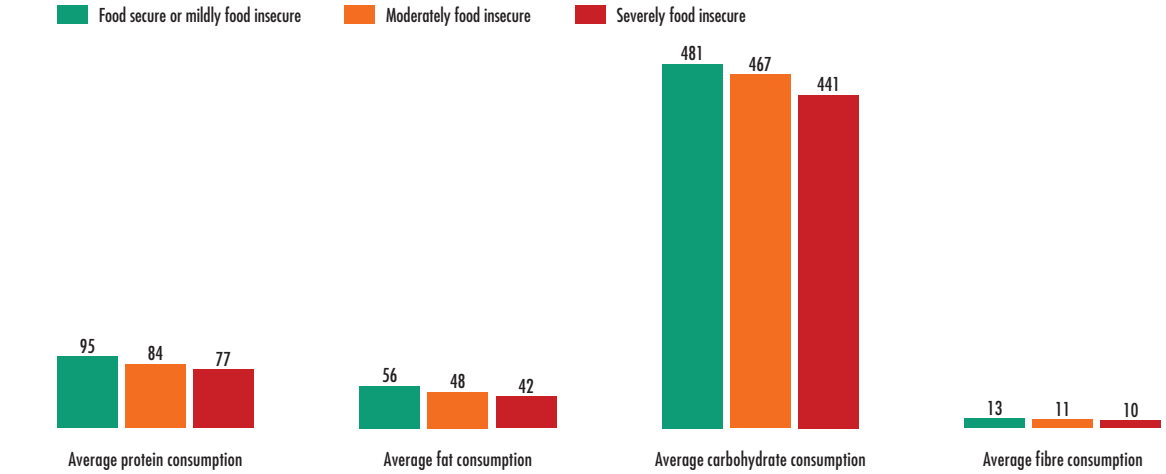
The lower consumption of foods rich in animal proteins, such as meat, fish and dairy products, of food insecure households compared with food secure households translates to an average quantity of proteins consumed by moderately food insecure households of around 10 g per capita per day less than for food secure households, and another 10 g of protein less for severely food insecure households. The lower quantities of fruits and vegetables consumed by food insecure households translates into lower fibre consumption, putting food insecure households at higher risk of developing colon cancer, presenting unhealthy cholesterol levels, and diverticulosis (noting that the overall low fibre consumption in Kiribati is putting the entire population at risk). Despite the lower quantity of carbohydrates consumed by food insecure households, the contribution of carbohydrates to the average DEC of severely food insecure households is close to the maximum limit of the WHO recommended norm for a balanced diet, with 73 percent of the dietary energy consumed by the severely food insecure coming from carbohydrates. Conversely, the higher quantity of fat consumed by food secure households than for food insecure households is exposing food secure households to a higher risk of non-communicable diseases.

On average, the quantity available for consumption of all essential micronutrients and minerals is lower for food insecure households than for food secure households. Vitamin B12 and vitamin C adequacy is reached for food secure and food insecure households due to the high consumption of fish rich in vitamin B12, and fresh coconut toddy rich in vitamin C. Vitamin A adequacy is reached only for food secure households and is at the margin for moderately food insecure households due to the lower quantity of pumpkin and papaya consumed, which are rich in vitamin A (the total edible quantity of both pumpkin and papaya consumed by the food secure, and moderately and severely food insecure households is 48 g/capita/day, 37 g/capita/day and 27 g/capita/day respectively).

**FIGURE 42**

## Average macronutrient consumption by level of food insecurity

Average macronutrient consumption by level of food insecurity (g/capita/day)

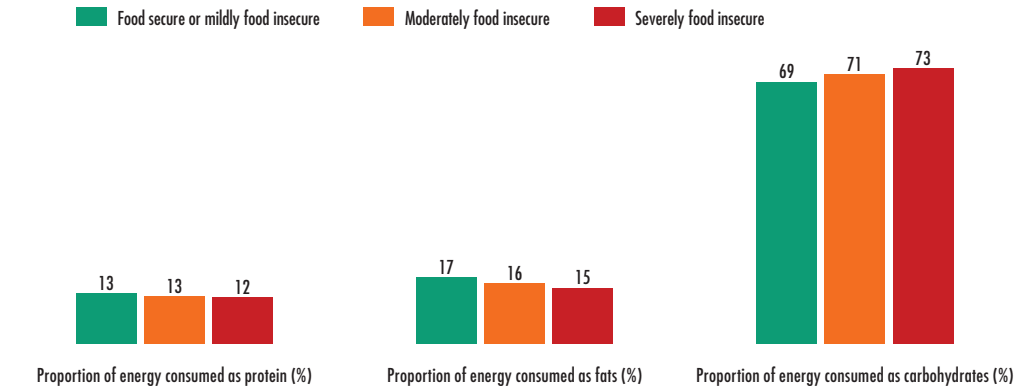



SOURCE: Kiribati 2019/20 HIES.

**FIGURE 43**

## Contribution of macronutrients to the diet of food secure and food insecure households

Contribution of macronutrients to the diet of food secure and food insecure households

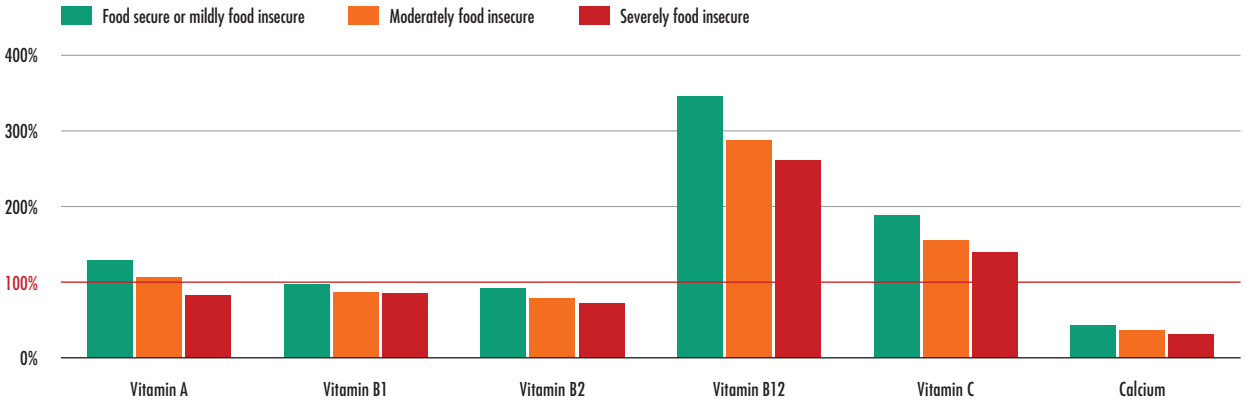



SOURCE: Kiribati 2019/20 HIES.

**FIGURE 44**

## Nutrient adequacy of the food secure vs food insecure (percentage)

Nutrient adequacy as measured by the ratio of available nutrient consumption to the average requirements by level of severity of food insecurity (%)

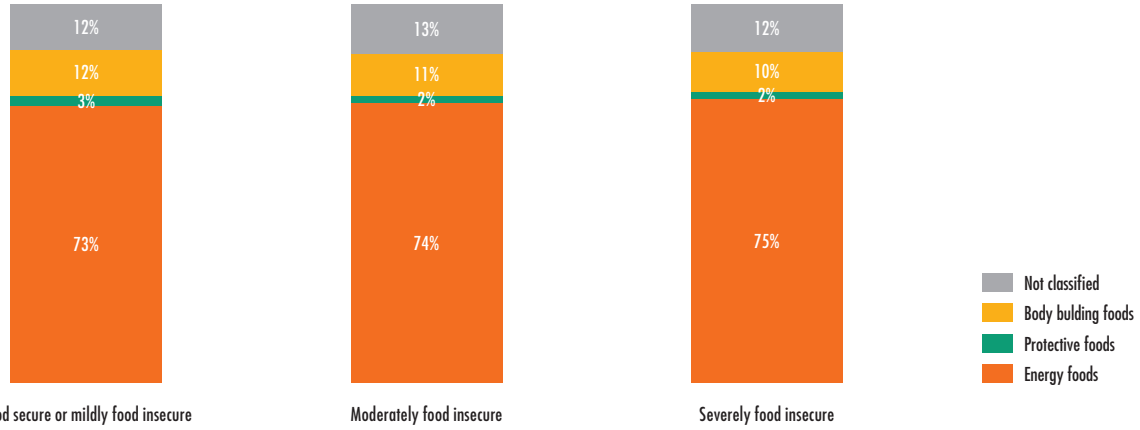



SOURCE: Kiribati 2019/20 HIES.

**FIGURE 45**

## Contribution of energy, body building and protective foods by level of severity of food insecurity

Contribution of energy, body building and protective foods to the average DEC of the food secure and food insecure households




SOURCE: Kiribati 2019/20 HIES.

**FIGURE 46**

## Contribution of foods to choose, limit or avoid by level of severity of food insecurity

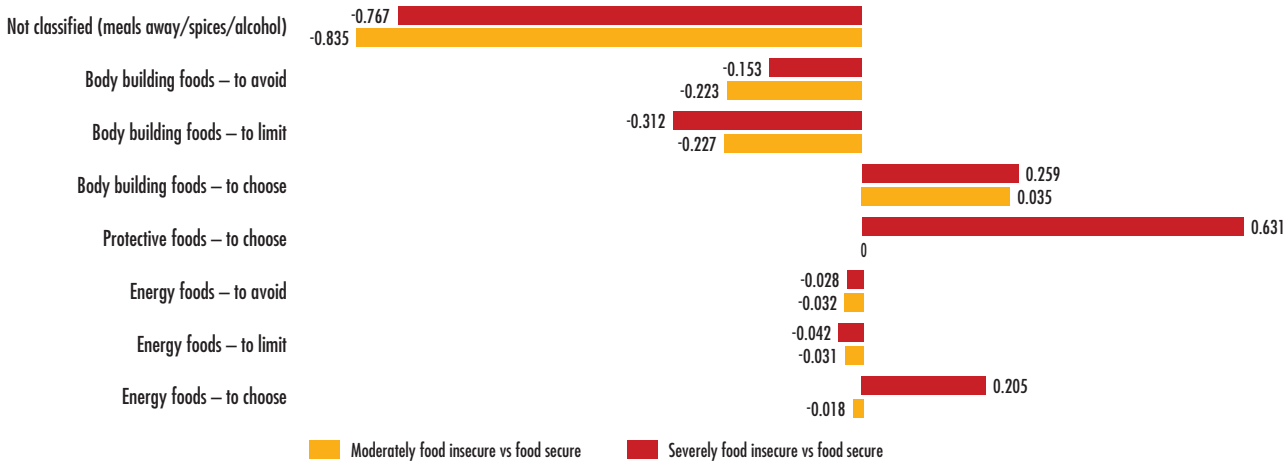
Contribution of foods to choose, limit or avoid to the average DEC of the food secure and food insecure


SOURCE: Kiribati 2019/20 HIES.

**FIGURE 47**

## Difference in the cost of 1 000 kcal for food secure and food insecure households

Difference in the cost of 1 000 kcal for food insecure households compared with food secure households (AUD/1 000kcal)




SOURCE: Kiribati 2019/20 HIES.

**TABLE 9**
Products consumed by at least 25 percent of food secure and food insecure households during the previous seven days

| | | Food secure (% of households) | Moderately food insecure (% of households) | Severely food insecure (% of households) |
|---|---|---|---|---|
| Energy foods – to choose | Breadfruit | 57 | 56 | 43 |
| | Coconut, brown | 56 | 59 | 52 |
| Energy foods – to limit | Rice, not further specified | 97 | 97 | 99 |
| | Noodles, not further specified | 62 | 62 | 64 |
| | Bread, loaf, all others | 48 | 42 | 45 |
| | Flour, not further specified | 33 | 33 | 36 |
| | Crackers, not further specified | <25 | <25 | 26 |
| Energy foods – to avoid | Sugar, not further specified | 90 | 86 | 83 |
| | Oil, cooking | 74 | 74 | 64 |
| | Doughnut, not further specified | 47 | 55 | 58 |
| Body building foods – to choose | Fish, pelagic/ocean, not further specified | 52 | 54 | 54 |
| | Fish, not further specified | 48 | 50 | 46 |
| | Fish, reef, not further specified | 43 | 39 | 42 |
| | Chicken, not further specified | 30 | 28 | <25 |
| Body building foods – to limit | Mackerel, canned, not further specified | 47 | 50 | 46 |
| | Milk, powdered, not further specified | 25 | <25 | <25 |
| Body building foods – to avoid | Beef, canned, corned | 47 | 42 | 41 |
| Protective foods – to choose | Pumpkin | 26 | <25 | <25 |
| | Onion, brown | 26 | <25 | <25 |
| | Coconut toddy, fresh | <25 | 25 | <25 |
| Not classified (spices/alcohol/tobacco) | Salt, iodized | 85 | 89 | 93 |
| | Tobacco | 78 | 85 | 88 |
| | Lunch away from home | 61 | 68 | 66 |
| | Tea, black, bag | 57 | 59 | 53 |
| | Sauce, soy/shoyu | 56 | 52 | 46 |
| | Kava | 46 | 51 | 52 |
| | Breakfast away from home | 38 | 47 | 43 |
| | Non-alcoholic drinks away from home | 34 | 34 | 38 |
| | Hot drinks away from home | 33 | 34 | 28 |
| | Spices, not further specified | 29 | <25 | 35 |
| | Dinner away from home | 29 | 31 | <25 |
| | Snacks away from home | 27 | 29 | 29 |
| | Coffee, instant, powder | 26 | <25 | 32 |

SOURCE: Kiribati 2019/20 HIES.

Vitamin B1 and B2 adequacy is reached only for food secure households due to higher consumption of cereals. Adequacy of calcium is far from being reached no matter the severity of food insecurity of the households, with an average quantity of 360 and 260 mg/capita/day available for consumption by food secure and severely food insecure households respectively.

## 5.5 Healthy living pattern

When the foods consumed are categorized according to the Pacific guidelines for healthy living, it can be seen that the contribution of energy foods to the average dietary energy consumed is slightly higher for food insecure households than for food secure households. Conversely, the contribution of body building or protective foods is much lower. Furthermore, looking at the distribution of dietary energy from foods to choose from or to limit or avoid, only 17 percent and 16 percent of the dietary energy

consumed by moderately and severely food insecure households respectively is coming from foods to choose compared with 19 percent for food secure households. Conversely, the contribution of foods to limit is higher for moderately or severely food insecure households than for food secure households, with respective contributions of 46 percent, 49 percent and 45 percent.
The contribution of foods to avoid is highest for moderately food insecure households. All these trends tend to confirm that even though, as a whole, the diet of Kiribati is not as nutritious and healthy as it should be, the overall diet of food insecure households is even more compromised.

This difference in the quality of the diet is further reflected in the difference in the cost of the dietary energy consumed. In general, food insecure households pay more to acquire 1 000 kcal from foods from which to choose and they pay less for foods to avoid or limit. This tends to confirm that moderately or severely food insecure households are accessing foods of lower nutritional quality than food secure households.

In terms of the main foods consumed, we looked at the percentage of food secure, moderately or severely food insecure households that consumed any of the 168 food products reported in the survey in the previous seven days. As expected, except for fresh fish, a lower percentage of moderately and severely food insecure households consumed foods to choose than did food secure households. Conversely, a larger percentage of food insecure households consumed energy foods to limit or avoid in the form of rice, noodles, crackers or doughnuts. Less than one severely food insecure household in four consumed pumpkin, onion or fresh coconut toddy, which are protective foods from which to choose. It is interesting to note that more severely food insecure households are consuming tobacco, kava and stimulants, such as instant coffee, than other households; these may be consumed to soothe the sensation of hunger, or it is possible that the expenditure allocated to narcotics reduces the budget available for food.

# CONCLUSIONS

Target 2.1 of the Sustainable Development Goals (SDGs) aims to end hunger and to ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round, by 2030.

In Kiribati, access to enough food in quantity and quality is still a struggle for around 41 percent of individuals. Reaching SDG Target 2.1 by 2030 is out of reach if appropriate policies aiming to improve food security and nutrition are not developed and adopted in the coming years.

To inform such policies, the food and Food Insecurity Experience Scale (FIES) data collected in the 2019/20 Kiribati Household Income and Expenditure Survey were analysed to provide a broad overview of the food consumption patterns of I-Kiribati.

The analysis reveals that the diet is not sufficiently diversified, with almost one kcal in four consumed coming from energy-dense foods that are rich in fat and sugar, and locally produced foods or foods rich in protein contribute only 18 percent of the dietary energy consumed. This is the result of important inequalities in accessing dietary energy, with undernourishment coexisting with obesity. Consumer preferences for imported foods rather than locally grown produce also compound the problem. It is also the result of a country where soil salinization and water scarcity hinder agriculture and livestock policies aimed at increasing domestic production.

All these are among the challenges to be addressed by policies to eradicate hunger and to ensure food security for all in Kiribati by 2030. It is hoped that this report will help in designing such policies.

## Further uses of this report

This report is the first of its kind in Kiribati. The information assembled in the report should be a catalyst for the further development and implementation of food and food system policies and interventions. The report may be used, for example, to:

- communicate to all stakeholders on the status of food security and nutrition in Kiribati;
- assess the data gaps and needs in terms of food consumption and nutrition information, and to further develop nutrition assessment tools and surveys;
- form recommendations aiming at improving the overall diet of I-Kiribati and reducing risks associated with bad eating habits and/or access to unhealthy diets;
- develop policies aiming to increase access to more traditional and healthy local foods;
- identify those who are food insecure, and further develop policies targeting the most vulnerable populations;
- report on SDG Target 2.1 indicators;
- further assess the impact of COVID-19 on food security and food systems by providing a baseline for future evaluations;
- serve as a baseline to assess the changes over time in food security and food consumption patterns in Kiribati;
- bring the discussion on food security and food consumption at a regional level towards sharing experiences and providing evidence; and
- complement further analysis such as that on welfare and hardship in Kiribati.

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# ANNEX 1
# Methodological Annex related to SDG Target 2.1 estimates

## ANNEX 1.1 SDG Indicator 2.1.1 – The prevalence of undernourishment

**Definition:** Undernourishment is defined as the condition of an individual whose habitual food consumption is insufficient to provide, on average, the amount of dietary energy required to maintain a normal, active, and healthy life.

**How it is reported:** The SDG Indicator 2.1.1 is reported as a prevalence and is denominated as "prevalence of undernourishment" (PoU), which is an estimate of the percentage of individuals in the total population that are in a condition of undernourishment.

**Methodology:** To compute an estimate of the prevalence of undernourishment in a population, the probability distribution of habitual dietary energy intake levels (expressed in kcal per person per day) for the average individual is modelled as a parametric probability density function (pdf), *f(x)*. The indicator is obtained as the cumulative probability that the habitual dietary energy intake (*x*) is below the minimum dietary energy requirements (MDER) (i.e. the lowest limit of the range of energy requirements for the population's representative average individual), as in the formula below:

$$\text{PoU} = \int x < \text{MDER}\ f(x|\theta)dx$$

where θ is a vector of parameters that characterize the pdf. The distribution is assumed to be lognormal, and thus fully characterized by only two parameters: the mean dietary energy consumption (DEC), and its coefficient of variation (CV).

| | PoU (%) | Average DEC (kcal/capita/day) | Minimum dietary energy requirement (kcal/capita/day) | CV (%) |
|---|---|---|---|---|
| Kiribati | 8 | 2 758 | 1 789 | 29 |
| Urban | 7 | 2 889 | 1 781 | 30 |
| Rural | 8 | 2 608 | 1 798 | 25 |

**Data sources:** the main sources used to estimate the three parameters for Kiribati are given below.

- Minimum dietary energy requirement (MDER): Human energy requirements for an individual in a given sex/age class are determined on the basis of normative requirements for basic metabolic rate (BMR) per kilogram of body mass, multiplied by the ideal weight that a healthy person of that class may have, given their height, and then multiplied by a coefficient of physical activity level (PAL) to take this into account. Given that both healthy BMIs and PALs vary among active and healthy individuals of the same sex and age, a *range* of energy requirements applies to each sex and age group of the population. The MDER for the average individual in the population, that is the threshold used in the PoU formula, is obtained as the weighted average of the lower bounds of the energy requirement ranges for each sex and age group, using the shares of the population in each sex and age group as weights.
- Information on the median height and on the population structure by sex and age is extracted from the anthropometric and demographic information on height, age and gender collected in the 2019/20 KHIES.
- Dietary energy consumption (DEC) and coefficient of variation (CV) were extracted from the food data collected in the 2019/20 KHIES, which collects the quantities of products consumed by the household and number of meals consumed outside the house during the previous seven days. The quantities were converted into grams using conversion factors provided by the market survey and ad hoc conversions from KNSO and further converted into nutrient values using the Pacific Nutrient Database developed jointly by SPC, FAO and the University of Wollongong, and based on the Food Composition Table of the Pacific. The dietary energy provided by the food consumed away from home is estimated by applying the median cost of one calorie consumed in the house to the amount spent to consume away from home. From the distribution of average

daily dietary energy consumption in the population it is possible then to estimate the average DEC and CV that describe the distribution. However, because of excess variability[I] observed in the distribution of daily energy, additional data treatment[II] was needed to get a reliable estimate of the CV. The treatment of excess variability leads to a CV of around 30 percent.

**Challenges and limitations:** Formally, the state of being undernourished or not is a condition that applies to individuals. However, given that the data is usually available only on a large scale it is impossible to reliably identify which individuals in a certain group are actually undernourished. Through the statistical model described above, the indicator can only be computed with reference to a population or a group of individuals for which a representative sample is available; therefore only the prevalence at the national level and for urban and rural areas are provided. Due to the probabilistic nature of the inference and the margins of uncertainty associated with estimates of each of the parameters in the model, the precision of the PoU estimates is generally low, with margins of error around PoU estimates that can be expected to probably be 2.5 percentage points above or below the point estimate in most cases. As can be seen from the table below that shows the values of PoU associated with different values of DEC and CV or MDER, PoU is very sensitive to a change in any of these parameters, which is why it is important to frequently update the parameters used to report on SDG 2.1.1.[III]

| | Average dietary energy consumption (kcal/capita/day) | Full CV of DEC | Minimum dietary energy requirements (kcal/capita/day) | Prevalence of undernourishment in Kiribati (%) |
|---|---|---|---|---|
| Kiribati – using survey data | 2 758 | 0.29 | 1 789 | **8.3** |
| Kiribati – using dietary energy supply from food balance sheets and CV and MDER from KHIES | 2 990 | 0.29 | 1 789 | **4.8** |
| Kiribati – using dietary energy supply from food balance sheets and SOFI CV and MDER from KHIES | 2 990 | 0.27 | 1 789 | **3.6** |
| Kiribati – SOFI 2020[IV] | 2 990 | 0.27 | 1 718 | **2.5** |

## References

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I Excess variability is due to survey design (the 2019 HIES of Kiribati was not designed to measure individual food consumption), field work, data entry or other measurement errors.

II The coefficient of variation that measures inequality in accessing dietary energy is estimated as the sum of inequality in accessing energy due to socioeconomic differences (CV of income) and inequality in accessing energy due to differences in energy requirements (CV of requirements). See http://www.fao.org/3/a-i4046e.pdf for more details about the estimation of the CV and treatment for excess variability. In the case of Kiribati we used expenditure distribution as a welfare indicator to measure inequality in access to food.

III FAO webpage on SDG: http://www.fao.org/sustainable-development-goals/indicators/211/en/

IV FAO webpage on SDG: http://www.fao.org/sustainable-development-goals/indicators/211/en/

# ANNEX 1.2 SDG Indicator 2.1.2 – The prevalence of moderate or severe food insecurity based on the FIES

**Definition:** Food insecurity as measured by this indicator refers to limited *access to food*, at the level of individuals or households, due to lack of money or other resources. The severity of food insecurity is measured using data collected with the *Food Insecurity Experience Scale survey module* (FIES-SM), a set of eight questions asking individuals or households to self-report conditions and experiences typically associated with limited access to food because of a lack of money or other resources during the previous 12 months. In the case of Kiribati, the head of the household was asked questions to report on behalf of the household. The eight questions of the FIES are:

| | |
|---|---|
| Q1. | Were you worried you would run out of food because of a lack of money or other resources? |
| Q2. | Were you unable to eat healthy and nutritious food because of a lack of money or other resources? |
| Q3. | Did you eat only a few kinds of food because of a lack of money or other resources? |
| Q4. | Did you have to skip a meal because there was not enough money or other resources to get food? |
| Q5. | Did you eat less than you thought you should because of a lack of money or other resources? |
| Q6. | Did your household run out of food because of a lack of money or other resources? |
| Q7. | Were you hungry but did not eat because there was not enough money or other resources? |
| Q8. | Did you go without eating for a whole day because of a lack of money or other resources? |

This indicator is particularly relevant for countries where severe food deprivation may no longer be of concern, but where sizeable pockets of food insecurity still remain. In this sense, it is an indicator that is fully aligned with the universality principles of the 2030 Agenda. Of note is the reference to the 12-month period to ensure that the indicator reflects chronic food insecurity. To that extent, the SDG Indicator 2.1.2 is also aligned to SDG Indicator 2.1.1, as both are a measure of chronic food insecurity.

**How the indicator is reported:** The estimates correspond to the prevalence (percentage) of individuals in the population living in households where *at least one adult was found to be food insecure*.

**Data source:** The eight questions of the FIES-FM were introduced for the first time in Kiribati through the 2019/20 Kiribati Household Income and Expenditure Survey.

**Methodology:** The data were validated and used to construct a scale of food insecurity severity using the Rasch model, which postulates that the probability of observing an affirmative answer by respondent *i* to question *j* is a logistic function of the distance, on an underlying scale of severity, between the position of the respondent, *ai*, and that of the item, *bj*.

$$Prob\ (Xi, j = \text{Yes}) = \exp(ai - bj) / (1 + \exp(ai - bj))$$

By applying the Rasch model to the FIES data, it is possible to estimate the probability of being food insecure ($pi, L$) at each level of severity of food insecurity $L$ (moderate or severe, or severe), for each respondent $i$, with $0 < pi, L < 1$.

**The prevalence of food insecurity** at each level of severity (*FIL*) in the population is computed as the weighted sum of the probability of being severely food insecure for all respondents ($i$) in a sample:

$$FIL = \Sigma pi, Lwi$$

where $wi$ are post-stratification weights that indicate the proportion of individuals or households in the national population represented by each record in the sample.

**Challenges:** to produce comparable measures over time and across different populations, a common scale was established as a reference (exactly as converting measures of temperature across different measuring scales – such as Celsius and Fahrenheit). The national scale of severity of food insecurity in Kiribati was then equated to the global standard to obtain an SDG 2.1.2 estimate, which can be further compared to global, regional or country level of severe food insecurity based on the FIES. The scale performs relatively well in Kiribati.[I] All the questions seem to have been properly interpreted by enumerators and understood by respondents. Given the results of the statistical validation, the raw score can be considered a reliable, ordinal indicator of food security severity. The two thresholds proposed for international monitoring on the global FIES scale are calibrated on the scale produced by the FIES application in Kiribati.[II] The results reveal that, after appropriate scaling of the severity values, the item HUNGRY corresponding to the question "*Were you hungry but did not eat because there was not enough money or other resources?*" was unique, and the correlation between the remaining seven items of the Kiribati scale with the global standard is 98.6 percent.[III]

## References

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[I] In the Central region, the items WORRIED and HUNGRY were problematic, and in Line and Phoenix Islands, the item SKIPPED presented a high infit. The analysis was performed independently on these two regions excluding the problematic items, and the prevalence of moderate or severe food insecurity were close to those obtained with the full model with a margin of error around the estimate of 10 percent in the Central region and 9 percent in Line and Phoenix Islands.

[II] The global adjusted FIES threshold value of −0.72 is used for moderate food insecurity and the value of 3.27 is used for severe food insecurity, calibrated on the Kiribati scale excluding the item HUNGRY. Without equating to the global scale, the national threshold is −0.62 for moderate or severe and 3.71 for severe, which would give a percentage of individuals who were moderately or severely food insecure of 39.7 percent (±4.2 percent) and of 6.4 percent (±2.1 percent) for severe.

[III] The correlation could have been further increased to 98 percent in dropping the item WORRIED but the trend is to try to keep as many common items as possible when equating to the global scale if it does not significantly increase the correlation.

# ANNEX 2
# Description of the groups

## ANNEX 2.1 Population groups

| Population group | Number of sampled households | Percentage |
|---|---|---|
| **Geographic characteristics** | | |
| Area of residence | | |
| Urban | 598 | 27.4 |
| Rural | 1 584 | 72.6 |
| Region | | |
| South Tarawa | 598 | 27.4 |
| Northern | 396 | 18.2 |
| Central | 300 | 13.8 |
| Southern | 480 | 22.0 |
| Line and Phoenix Islands | 408 | 18.7 |
| **Demographic characteristics of the household** | | |
| Gender of the head of the household | | |
| Male | 1 537 | 70.4 |
| Female | 645 | 29.6 |
| Class of age for the head of the household (in years) | | |
| Age 18 to 34 | 547 | 25.1 |
| Age 35 to 44 | 558 | 25.6 |
| Age 45 to 54 | 540 | 24.7 |
| Age 55 and above | 537 | 24.6 |
| Categories for the number of children less than 14 years old | | |
| No child | 392 | 17.9 |
| 1 child | 476 | 21.8 |
| 2 children | 489 | 22.4 |
| 3 children | 406 | 18.6 |
| 4 children and more | 418 | 19.2 |
| Marital status of the head of the household | | |
| Married | 1 813 | 83.1 |
| Not married | 369 | 16.9 |
| **Health and sanitation** | | |
| Percentage of adults older than 15 years in the household overweight or obese | | |
| Less than 33% | 110 | 5.0 |
| 33% to 50% | 415 | 19.0 |
| 50% to 75% | 490 | 22.5 |
| More than 75% | 1 167 | 53.5 |
| Access to safe water and sanitation | | |
| Yes | 1 039 | 47.6 |
| No | 1 143 | 52.4 |
| Access to private toilets | | |
| Yes | 1 232 | 56.5 |
| No | 950 | 43.6 |

SOURCE: Kiribati 2019/20 HIES.

| Population group | Number of sampled households | Percentage |
|---|---|---|
| **Socioeconomic characteristics of the head of the household** | | |
| Education level of the head of the household | | |
| Pre- and primary school | 345 | 15.8 |
| Lower secondary school | 1 045 | 47.9 |
| Higher/post/tertiary education | 792 | 36.3 |
| Any household member involved in fishing activities | | |
| Yes | 1 018 | 46.6 |
| No | 1 164 | 53.4 |
| Any household member involved in handicraft or home food processing | | |
| Yes | 758 | 34.8 |
| No | 1 424 | 65.2 |
| Household involved in the sale of copra | | |
| Yes | 1 154 | 52.9 |
| No | 1 028 | 47.1 |
| Head of the household involved in livestock activities | | |
| No | 302 | 13.8 |
| Yes | 1 880 | 86.2 |
| Head of the household involved in aquaculture | | |
| No | 2 158 | 99.0 |
| Yes | 21 | 1.0 |
| Household receives remittances | | |
| No | 1 528 | 70.0 |
| Yes | 654 | 30.0 |
| Level of severity of food insecurity | | |
| Food secure or mildly food insecure | 1 483 | 68.0 |
| Moderately food insecure | 581 | 26.6 |
| Severely food insecure | 118 | 5.4 |
| **Total** | **2 182** | |

SOURCE: Kiribati 2019/20 HIES.

# ANNEX 2.2 Classification of the food products collected in the 2019 KHIES according to GIFT and Pacific guidelines

| Food product reported in the 2019/20 KHIES | GIFT classification | Pacific guidelines classification | Percentage of households that consumed the food (%) |
|---|---|---|---|
| Rice, not further specified | Cereals and their products | Energy foods – to limit | 97 |
| Noodles, not further specified | Cereals and their products | Energy foods – to limit | 62 |
| Bread, loaf, all others | Cereals and their products | Energy foods – to limit | 46 |
| Flour, not further specified | Cereals and their products | Energy foods – to limit | 33 |
| Breakfast cereal, not further specified | Cereals and their products | Energy foods – to limit | 6 |
| Bread, loaf, not further specified | Cereals and their products | Energy foods – to limit | 5 |
| Potato, not further specified | Roots, tubers, plantains | Energy foods – to choose | 4 |
| Cassava/tapioca/manioc | Roots, tubers, plantains | Energy foods – to choose | 4 |
| Taro, not further specified | Roots, tubers, plantains | Energy foods – to choose | 4 |
| Flour, cassava | Roots, tubers, plantains | Energy foods – to choose | 4 |
| Kumara/sweet potato | Roots, tubers, plantains | Energy foods – to choose | 3 |
| Banana, cooking, raw | Roots, tubers, plantains | Energy foods – to choose | 3 |
| Yam, not further specified | Roots, tubers, plantains | Energy foods – to choose | 0 |
| Taro, common | Roots, tubers, plantains | Energy foods – to choose | 0 |
| Coconut, brown | Pulses, seeds and nuts | Energy foods – to choose | 57 |
| Coconut cream, canned/UHT | Pulses, seeds and nuts | Energy foods – to avoid | 19 |
| Peanut butter, not further specified | Pulses, seeds and nuts | Energy foods – to avoid | 7 |
| Mixed dried fruit, not further specified | Pulses, seeds and nuts | Body building foods – to limit | 1 |
| Beans, legumes canned e.g. red kidney | Pulses, seeds and nuts | Protective foods – to choose | 0 |
| Milk, powdered, not further specified | Milk and milk products | Body building foods – to limit | 22 |
| Milk, fresh, not further specified | Milk and milk products | Body building foods – to choose | 1 |
| Creamer, powdered | Milk and milk products | Body building foods – to avoid | 1 |
| Cheese, block e.g. Cheddar, Edam | Milk and milk products | Body building foods – to limit | 0 |
| Egg, chicken, fresh | Eggs and their products | Body building foods – to choose | 9 |
| Fish, pelagic/ocean, not further spec. | Fish, shellfish and products | Body building foods – to choose | 53 |
| Fish, not further specified | Fish, shellfish and products | Body building foods – to choose | 48 |
| Mackerel, canned, not further specified | Fish, shellfish and products | Body building foods – to limit | 48 |
| Fish, reef, not further specified | Fish, shellfish and products | Body building foods – to choose | 42 |
| Fish, dried, salted | Fish, shellfish and products | Body building foods – to avoid | 16 |
| Crab, not further specified | Fish, shellfish and products | Body building foods – to choose | 12 |
| Scallop | Fish, shellfish and products | Body building foods – to choose | 9 |
| Shark | Fish, shellfish and products | Body building foods – to choose | 4 |
| Tuna canned, not further specified | Fish, shellfish and products | Body building foods – to limit | 4 |
| Trochus | Fish, shellfish and products | Body building foods – to choose | 3 |
| Crayfish/lobster, not further specified | Fish, shellfish and products | Body building foods – to choose | 2 |
| Mussels | Fish, shellfish and products | Body building foods – to choose | 2 |
| Snapper | Fish, shellfish and products | Body building foods – to choose | 1 |
| Octopus | Fish, shellfish and products | Body building foods – to choose | 1 |
| Stingray | Fish, shellfish and products | Body building foods – to choose | 0 |
| Crab, coconut | Fish, shellfish and products | Body building foods – to choose | 0 |
| Squid, not further specified | Fish, shellfish and products | Body building foods – to choose | 0 |
| Sea-hare, not further specified | Fish, shellfish and products | Body building foods – to choose | 0 |
| Seaweed | Fish, shellfish and products | Body building foods – to choose | 0 |

SOURCE: Kiribati 2019/20 HIES.

| Food product reported in the 2019/20 KHIES | GIFT classification | Pacific guidelines classification | Percentage of households that consumed the food (%) |
|---|---|---|---|
| Beef, canned, corned | Meat and meat products | Body building foods – to avoid | 45 |
| Chicken, not further specified | Meat and meat products | Body building foods – to choose | 29 |
| Sausage, not further specified | Meat and meat products | Body building foods – to avoid | 16 |
| Pork, regular, cuts not specified | Meat and meat products | Body building foods – to limit | 6 |
| Beef, canned, not further specified | Meat and meat products | Body building foods – to avoid | 5 |
| Beef, regular, cut not specified | Meat and meat products | Body building foods – to limit | 1 |
| Beef, offal, not further specified | Meat and meat products | Body building foods – to avoid | 1 |
| Pork, not further specified | Meat and meat products | Body building foods – to limit | 0 |
| Lamb and mutton, regular, cuts not sp. | Meat and meat products | Body building foods – to limit | 0 |
| Chicken, whole | Meat and meat products | Body building foods – to choose | 0 |
| Goose, not further specified | Meat and meat products | Body building foods – to choose | 0 |
| Bird, all others, e.g. pigeon, noddy bird | Meat and meat products | Body building foods – to choose | 0 |
| Canned meat, not further specified | Meat and meat products | Body building foods – to avoid | 0 |
| Onion, brown | Vegetables and products | Protective foods – to choose | 25 |
| Pumpkin | Vegetables and products | Protective foods – to choose | 24 |
| Garlic, peeled | Vegetables and products | Protective foods – to choose | 16 |
| Vegetables, not further specified | Vegetables and products | Protective foods – to choose | 8 |
| Cabbage, Chinese | Vegetables and products | Protective foods – to choose | 3 |
| Cabbage, European, white | Vegetables and products | Protective foods – to choose | 2 |
| Spinach, not further specified | Vegetables and products | Protective foods – to choose | 2 |
| Cucumber, unpeeled | Vegetables and products | Protective foods – to choose | 2 |
| Carrot | Vegetables and products | Protective foods – to choose | 2 |
| Spinach, kangkong | Vegetables and products | Protective foods – to choose | 1 |
| Leaves, tips, pumpkin | Vegetables and products | Protective foods – to choose | 1 |
| Eggplant | Vegetables and products | Protective foods – to choose | 1 |
| Beans, long | Vegetables and products | Protective foods – to choose | 1 |
| Lettuce, not further specified | Vegetables and products | Protective foods – to choose | 0 |
| Leaves, taro | Vegetables and products | Protective foods – to choose | 0 |
| Chilli | Vegetables and products | Protective foods – to choose | 0 |
| Tomato, common | Vegetables and products | Protective foods – to choose | 0 |
| Capsicum, not further specified | Vegetables and products | Protective foods – to choose | 0 |
| Beans, green | Vegetables and products | Protective foods – to choose | 0 |
| Corn, cob, not further specified | Vegetables and products | Protective foods – to choose | 0 |
| Mushrooms, canned | Vegetables and products | Protective foods – to choose | 0 |
| Breadfruit | Fruits and their products | Energy foods – to choose | 56 |
| Papaya | Fruits and their products | Protective foods – to choose | 23 |
| Banana, common e.g. Cavendish | Fruits and their products | Energy foods – to choose | 14 |
| Pandanus | Fruits and their products | Protective foods – to choose | 13 |
| Coconut, green | Fruits and their products | Protective foods – to choose | 11 |
| Orange | Fruits and their products | Protective foods – to choose | 4 |
| Mango | Fruits and their products | Protective foods – to choose | 1 |
| Lime | Fruits and their products | Protective foods – to choose | 1 |
| Apple, not further specified | Fruits and their products | Protective foods – to choose | 1 |
| Watermelon | Fruits and their products | Protective foods – to choose | 1 |
| Fruit, not further specified | Fruits and their products | Protective foods – to choose | 1 |
| Fruit, canned, not further specified | Fruits and their products | Protective foods – to limit | 1 |
| Pineapple | Fruits and their products | Protective foods – to choose | 0 |

SOURCE: Kiribati 2019/20 HIES.

| Food product reported in the 2019/20 KHIES | GIFT classification | Pacific guidelines classification | Percentage of households that consumed the food (%) |
|---|---|---|---|
| Pear, Packham's | Fruits and their products | Protective foods – to choose | 0 |
| Strawberry | Fruits and their products | Protective foods – to choose | 0 |
| Banana, cooked | Fruits and their products | Protective foods – to choose | 0 |
| Breadfruit, cooked | Fruits and their products | Energy foods – to choose | 0 |
| Oil, cooking | Fats and oils | Energy foods – to avoid | 73 |
| Butter, not further specified | Fats and oils | Energy foods – to avoid | 13 |
| Bacon, not further specified | Fats and oils | Body -building foods – to avoid | 2 |
| Margarine, not further specified | Fats and oils | Energy foods – to avoid | 1 |
| Oil, coconut | Fats and oils | Energy foods – to avoid | 0 |
| Oil, not further specified | Fats and oils | Energy foods – to avoid | 0 |
| Dripping, beef | Fats and oils | Body building foods – to avoid | 0 |
| Sugar, not further specified | Sweets and sugars | Energy foods – to avoid | 88 |
| Doughnut, not further specified | Sweets and sugars | Energy foods – to avoid | 50 |
| Crackers, not further specified | Sweets and sugars | Energy foods – to avoid | 25 |
| Ice blocks, flavoured ice, popsicles | Sweets and sugars | Energy foods – to avoid | 17 |
| Milk, condensed, whole, sweetened | Sweets and sugars | Body building foods – to avoid | 16 |
| Chewing gum, bubble gum | Sweets and sugars | Energy foods – to avoid | 15 |
| Sweets, jelly lollies | Sweets and sugars | Energy foods – to avoid | 13 |
| Ice cream, vanilla | Sweets and sugars | Energy foods – to limit | 4 |
| Biscuits, sweet, all others | Sweets and sugars | Energy foods – to avoid | 3 |
| Pancake mix | Sweets and sugars | Energy foods – to avoid | 3 |
| Bun/roll, not further specified | Sweets and sugars | Energy foods – to avoid | 2 |
| Cake, not further specified | Sweets and sugars | Energy foods – to avoid | 2 |
| Sweets, boiled, hard | Sweets and sugars | Energy foods – to avoid | 2 |
| Pudding (dairy based) | Sweets and sugars | Energy foods – to avoid | 1 |
| Syrup, sweet pouring, not specified | Sweets and sugars | Energy foods – to avoid | 1 |
| Jam | Sweets and sugars | Energy foods – to avoid | 1 |
| Chocolate, not further specified | Sweets and sugars | Energy foods – to avoid | 1 |
| Nutella, or other chocolate spread | Sweets and sugars | Energy foods – to avoid | 1 |
| Ice cream, cone or bar | Sweets and sugars | Energy foods – to avoid | 1 |
| Salt, iodized | Spices and condiments | Not classified | 87 |
| Sauce, soy/shoyu | Spices and condiments | Not classified | 55 |
| Spices, not further specified | Spices and condiments | Not classified | 28 |
| Sauce, tomato, ketchup | Spices and condiments | Not classified | 6 |
| Vinegar, not further specified | Spices and condiments | Not classified | 5 |
| Sauce, chilli, Asian, commercial | Spices and condiments | Not classified | 3 |
| Dressing, salad, not further specified | Spices and condiments | Not classified | 1 |
| Ginger root, fresh | Spices and condiments | Not classified | 1 |
| Tea, black, bag | Beverages | Not classified | 57 |
| Coffee, instant, powder | Beverages | Not classified | 26 |
| Coconut toddy, fresh | Beverages | Protective foods – to choose | 24 |
| Cordial, not further specified | Beverages | Energy foods – to avoid | 17 |
| Lemonade, soft drink, e.g. Sprite, 7 Up | Beverages | Energy foods – to avoid | 15 |
| Beverage, chocolate flavour, from base | Beverages | Energy foods – to avoid | 12 |
| Beer, homebrew | Beverages | Not classified | 12 |
| Beer, not further specified | Beverages | Not classified | 11 |
| Coconut toddy, boiled | Beverages | Energy foods – to avoid | 10 |

SOURCE: Kiribati 2019/20 HIES.

| Food product reported in the 2019/20 KHIES | GIFT classification | Pacific guidelines classification | Percentage of households that consumed the food (%) |
|---|---|---|---|
| Juice, fruit, not further specified | Beverages | Protective foods – to avoid | 5 |
| Mineral water, natural, unflavoured | Beverages | Not classified | 5 |
| Cola flavour soft drink cola/Pepsi | Beverages | Energy foods – to avoid | 2 |
| Whiskey | Beverages | Not classified | 2 |
| Cocoa, cocoa powder | Beverages | Energy foods – to limit | 1 |
| Milk, soy | Beverages | Body building foods – to choose | 0 |
| Coconut, water only | Beverages | Protective foods – to choose | 0 |
| Coffee, ground | Beverages | Not classified | 0 |
| Wine, not further specified | Beverages | Not classified | 0 |
| Tea, black, brewed, no milk | Beverages | Not classified | 0 |
| Infant formula, not further specified | Foods nutritional use | Not classified | 3 |
| Breakfast away from home | Food not classified | Not classified | 41 |
| Lunch away from home | Food not classified | Not classified | 64 |
| Non-alcoholic drinks away from home | Food not classified | Not classified | 34 |
| Hot drinks away from home | Food not classified | Not classified | 33 |
| Dinner away from home | Food not classified | Not classified | 29 |
| Snacks away from home | Food not classified | Not classified | 28 |
| Bottled water away from home | Food not classified | Not classified | 15 |
| Baking powder | Food additives | Not classified | 0 |
| Yeast spread, e.g. Vegemite | Food additives | Not classified | 0 |
| Takeaway, pizza, not further specified | Composite dishes | Body building foods – to avoid | 7 |
| Takeaway, chicken, fried | Composite dishes | Body building foods – to avoid | 4 |
| Buatoro (Kiribati) | Composite dishes | Energy foods – to avoid | 4 |
| Pizza, frozen, commercial, not further specified | Composite dishes | Energy foods – to avoid | 3 |
| Takeaway, Chinese, noodle dish | Composite dishes | Energy foods – to avoid | 1 |
| Takeaway, fish, fried, barbequed | Composite dishes | Body building foods – to avoid | 1 |
| Beef, cooked, not further specified | Composite dishes | Body building foods – to avoid | 0 |
| Pork, cooked, not further specified | Composite dishes | Body building foods – to avoid | 0 |
| Crab, cooked, not further specified | Composite dishes | Body building foods – to avoid | 0 |
| Leaves, winged beans, cooked | Composite dishes | Protective foods – to avoid | 0 |
| Taro, not further specified, cooked | Composite dishes | Energy foods – to avoid | 0 |
| Soup, chicken | Composite dishes | Body building foods – to avoid | 0 |
| Soup, vegetable | Composite dishes | Protective foods – to choose | 0 |
| Rice, not further specified, fried | Composite dishes | Energy foods – to avoid | 0 |
| Soup, vegetable from café or restaurant | Composite dishes | Protective foods – to avoid | 0 |
| Takeaway, barbequed spare ribs, beef ribs | Composite dishes | Body building foods – to avoid | 0 |
| Takeaway, hamburger, bread roll, patty | Composite dishes | Body building foods – to avoid | 0 |
| Takeaway, salad, mixed vegetables | Composite dishes | Body building foods – to avoid | 0 |
| Savoury snacks, chips e.g. Twisties | Savoury snacks | Energy foods – to avoid | 15 |
| Tobacco | Tobacco/kava | Not classified | 81 |
| Kava | Tobacco/kava | Not classified | 48 |

SOURCE: Kiribati 2019/20 HIES.

# ANNEX 3
# Processing the food data collected in the 2019/20 KHIES

In the food consumption module of the 2019/20 Kiribati Household Income Expenditure Survey (KHIES), households were asked if they consumed some specific foods, at home, over the previous seven days and, in the case of an affirmative answer, households were asked to report the total quantity they consumed and, of this quantity, what were the quantities purchased in cash, what were the quantities that came from own production and what were the quantities received for free or in exchange for some specific foods, such as coconut, fish, seaworms, vegetables, fruits or cooked foods. Together with the quantity consumed, the unit of measurement in which the quantity was procured, and the amount spent to get the food were also reported. In addition to the in-house consumption module, households were also asked to report on the number of meals (breakfast, lunch and dinner), snacks, hot drinks or non-alcoholic beverages consumed away from home, and the respective amounts spent to get these meals (or estimated value where the food away from home was gifted).

Food quantities collected in the in-house food consumption module were converted into grams, and nutrient values were allocated to the quantities using the nutrient values from the Pacific Nutrient Database (PNDB) developed by SPC in collaboration with FAO and the University of Wollongong (UOW).[I]

- Households were asked to report quantities consumed in the unit of measurement in which the product was acquired (bundle, bag, kilogram, cup, etc.). To convert all the quantities into grams,[II] a regional market survey was conducted in parallel to collect information on the weight in grams of one unit of product. The information was collected in 107 villages spread across 21 islands. The market survey collected information for 345 combinations of products/units of measurement, while from the food files there were 783 combinations of products/units (of which 234 corresponded to combinations of product/standard units, such as kilograms, grams, litres, millilitres, ounces or pounds). For the uncovered combinations (around 3 823 transactions), ad hoc conversions provided by KNSO or the median price of the product in grams were used.
- A two-step outlier procedure was used to correct for some improbable/implausible quantities. First, the quantities reported for each combination of product/unit of measurement together with the respective amount spent and the unit value were examined. Outliers were detected using the Tukey interquartile range (IQR) approach with a multiplier of 2.5, and respective quantities or values were corrected using the median quantity or amount corresponding to the combination of product/unit. At the end of this first outlier detection, 0.71 percent of amounts were corrected and 0.50 percent of the original quantities were corrected. After all the quantities were converted into grams, the outstanding quantities consumed per capita and area of residence (urban and rural) were reviewed. Again, the Tukey interquartile range (IQR) approach was used with a multiplier of 2, and whenever the quantity was out of the range [25th percentile −2*IQR, 75th percentile +2*IQR] the quantity in grams was replaced by the median quantity reported of that product in that area. Around 1.5 percent of the quantities in grams were corrected. Note that we also corrected the corresponding amount using the corrected quantity and the median price of one gram of product.
- After applying a refuse factor to obtain the edible portion of the food, all the quantities in grams were then further converted into kcal using nutrient factors from the PNDB database.
- To convert the food consumed away from home into kcal, the approach was different. Quantities of food consumed away from home were not collected as units of measurement but rather as the number of meals. The dietary energy content of breakfast, lunch and dinner was estimated using the median cost of one kcal consumed in the house by expenditure quintile and area, and applying a cost adjustment factor of 1.1.[III]

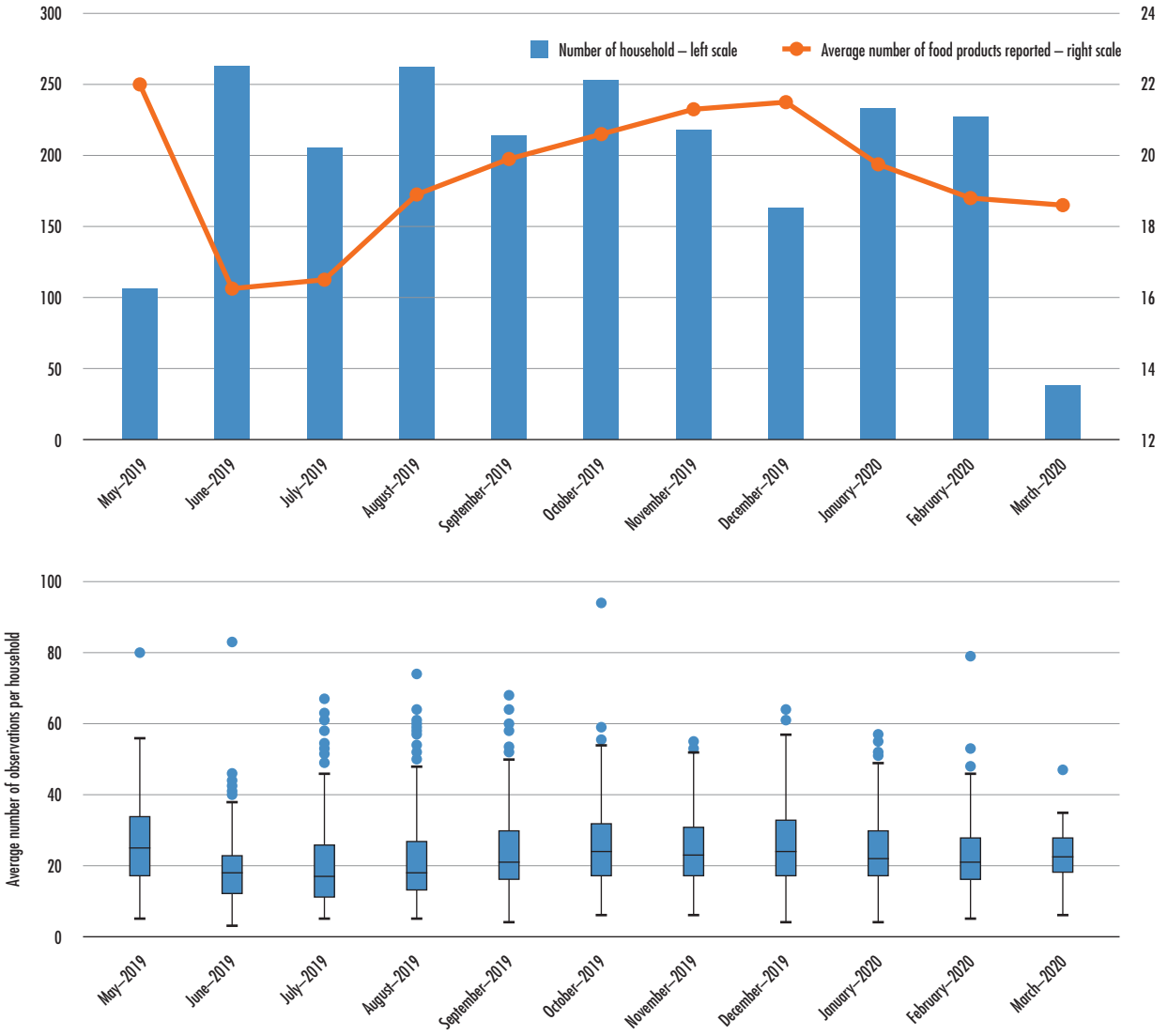
[I] SPC, UOW and FAO (2020). The Pacific Nutrient Database User Guide: A tool to facilitate the analysis of poverty, nutrition and food security in the Pacific region. Pacific Community, University of Wollongong and the Food and Agriculture Organization of the United Nations. 15 pp.

[II] The gram is the reference unit used in all the Food Composition Tables that allocate the nutrient value for 100 grams of edible portion of the products. Therefore, to convert the quantities into nutrient values, it is important to first convert all quantities collected in local units of measurement into grams.

[III] The Pacific Statistics Methods Board recommends using a cost adjustment of 1.25 to account for the difference in the cost of one kcal consumed in house and outside the house, due to the margin applied by the food seller for the recovery of the rent and salaries required to run a business. However, this multiplier is too high when we further account for differences that exist in the cost of one kcal consumed in the house by the least vs the most wealthy households.

**FIGURE 48**
Distribution of number of transactions per household by survey round over the previous seven days

Temporal distribution of the sample and average number of products reported




SOURCE: Kiribati 2019/20 HIES.

For snacks and non-alcoholic beverages, the median cost of one snack or non-alcoholic beverage consumed in the house was used, aggregating only among products corresponding to a snack or non-alcoholic beverage. For bottles of water we applied a conversion of 0 as water does not bring energy, and for hot drinks consumed away from home we used the average of the nutrient content of different kinds of hot drinks, assuming that one hot drink consumed away from home has an average weight of 250 grams (corresponding to one cup without applying a density factor).

- To account for seasonal consumption, the survey was conducted from May 2019 to March 2020. The distribution of the total and average number of transactions per household for each month for evidence of potential issues during data collection due to fatigue of the enumerator or other causes was reviewed. As seen in Figure 48, there is a small drop in the overall number of transactions in the months of June and July, and few households (36) reported less than five transactions; most of these households were enumerated in June 2019 (9 households), July 2019 (8 households) and January 2020 (4 households). For these households there may be an issue of underreporting the true consumption.

# ANNEX 4
# Regression analysis of the impact of characteristics of the household on the average dietary energy consumption

To assess the impact of the socioeconomic, demographic and regional characteristics of the household on the dietary energy consumption, a simple linear regression was performed linking the average dietary energy consumption to household characteristics:

$$ln(DEC_i) = \beta_0 + \beta_1 \ ln(inc_i) + \sum_j^n \beta_j HHchar_{ij}$$

where

$DEC_i$ is the dietary energy consumption of household $i$

$inc_i$ is the per capita total expenditures of household $i$

$HHchar_{ij}$ is the characteristic $j$ of the household $i$.

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Logarithm household total expenditures** | 0.32*** | 0.02 | 17.60 | 0.000 |
| **Region**[1] | | | | |
| Northern | 0.04 | 0.03 | 1.27 | 0.208 |
| Central | 0.03 | 0.04 | 0.94 | 0.350 |
| Southern | −0.07* | 0.03 | −2.10 | 0.037 |
| Line and Phoenix Islands | −0.09** | 0.03 | −2.73 | 0.007 |
| **Gender of the head of the household**[2] | | | | |
| Female | −0.05* | 0.02 | −2.29 | 0.023 |
| **Total number of children less than 14 years in the household**[3] | | | | |
| 1 child | −0.23*** | 0.03 | −7.12 | 0.000 |
| 2 children | −0.40*** | 0.04 | −10.82 | 0.000 |
| 3 children | −0.47*** | 0.04 | −11.86 | 0.000 |
| 4 children and more | −0.62*** | 0.04 | −17.46 | 0.000 |
| **Age class of the head of the household**[4] | | | | |
| Age 35 to 44 | 0.00 | 0.02 | −0.19 | 0.852 |
| Age 45 to 54 | −0.03 | 0.02 | −1.61 | 0.110 |
| Age 55 and older | −0.09*** | 0.02 | −3.98 | 0.000 |
| **Marital status of the head of the household**[5] | | | | |
| Married | −0.11*** | 0.02 | −4.38 | 0.000 |
| **Education level of the head of the household**[6] | | | | |
| Lower secondary school | 0.02 | 0.02 | 0.83 | 0.408 |
| Higher/post/tertiary education | 0.02 | 0.03 | 0.83 | 0.408 |

[1] South Tarawa is reference, [2] Male headed household is reference, [3] No child is used as reference category,
[4] Head of the household less than age 35 years is used as reference category, [5] Head of the household not married is used as reference,
[6] Pre- or primary school is used as reference category

Number of observations = 2 182, Population size = 19 609

*** $p$ value < 0.001, ** $p$ value < 0.01, * $p$ value < 0.05

SOURCE: Kiribati 2019/20 HIES.

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Percentage of adults in the households who are overweight or obese** | 0.00*** | 0.00 | 4.45 | 0.000 |
| **Household member involved in fishing activities**[7] | −0.03 | 0.02 | −1.72 | 0.087 |
| **Household involved in handicraft activities**[7] | 0.02 | 0.02 | 0.96 | 0.340 |
| **Household involved in livestock activities**[7] | 0.00 | 0.03 | 0.04 | 0.967 |
| **Household is selling copra**[7] | 0.03 | 0.02 | 1.33 | 0.185 |
| **Household receives remittances**[8] | −0.03* | 0.02 | −2.19 | 0.030 |
| **Household has access to a safe source of drinking water**[9] | −0.04* | 0.02 | −2.07 | 0.040 |
| **Household has access to private toilet**[9] | −0.07*** | 0.02 | −4.05 | 0.000 |
| **Classes of severity level of food insecurity**[10] | | | | |
| Moderately food insecure | −0.02 | 0.02 | −0.74 | 0.461 |
| Severely food insecure | −0.04 | 0.04 | −1.01 | 0.315 |
| **Constant** | 7.24*** | 0.07 | 101.38 | 0.000 |

[7] Household not involved in these activities is used as reference, [8] Household does not receive remittances is used as reference,
[9] Household with lack of access to these facilities is used as reference, [10] Food secure or mildly food insecure household is the reference category

Number of observations = 2 182, Population size = 19 609

*** $p$ value < 0.001, * $p$ value < 0.05

SOURCE: Kiribati 2019/20 HIES.

# ANNEX 5
# Regression analysis of the impact of characteristics of the household on the average cost of 1 000 kcal

To assess the impact of the socioeconomic, demographic and regional characteristics of the household on the average cost of 1 000 kcal, a simple linear regression was performed linking the average cost of 1 000 kcal to household characteristics:

$$kcalcost_i = \beta_0 + \beta_1 \ ln(inc_i) + \sum_j^n \beta_j HHchar_{ij}$$

where

$kcalcost_i$ is the average cost of 1 000 kcal of household $i$

$inc_i$ is the total expenditure of household $i$

$HHchar_{ij}$ is the socioeconomic or demographic characteristic $j$ of the household $i$.

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Logarithm household total expenditures** | 0.47*** | 0.03 | 17.53 | 0.000 |
| **Region**[1] | | | | |
| Northern | 0.19*** | 0.04 | 4.26 | 0.000 |
| Central | 0.10 | 0.06 | 1.77 | 0.079 |
| Southern | 0.20*** | 0.04 | 4.74 | 0.000 |
| Line and Phoenix Islands | 0.31*** | 0.04 | 7.05 | 0.000 |
| **Gender of the head of the household**[2] | | | | |
| Female | −0.11*** | 0.03 | −3.65 | 0.000 |
| **Total number of children less than 14 years in the household**[3] | | | | |
| 1 child | −0.22*** | 0.04 | −5.03 | 0.000 |
| 2 children | −0.28*** | 0.05 | −6.14 | 0.000 |
| 3 children | −0.41*** | 0.05 | −9.00 | 0.000 |
| 4 children and more | −0.48*** | 0.05 | −9.95 | 0.000 |
| **Age class of the head of the household**[4] | | | | |
| Age 35 to 44 | −0.05 | 0.03 | −1.36 | 0.177 |
| Age 45 to 54 | −0.18*** | 0.03 | −5.27 | 0.000 |
| Age 55 and older | −0.20*** | 0.04 | −4.91 | 0.000 |
| **Marital status of the head of the household**[5] | | | | |
| Married | −0.09* | 0.04 | −2.42 | 0.017 |
| **Education level of the head of the household**[6] | | | | |
| Lower secondary school | −0.05 | 0.04 | −1.37 | 0.172 |
| Higher/post/tertiary education | −0.01 | 0.05 | −0.14 | 0.886 |

[1] South Tarawa is reference, [2] Male headed household is reference, [3] No child is used as reference category,
[4] Head of the household less than age 35 years is used as reference category, [5] Head of the household not married is used as reference,
[6] Pre- or primary school is used as reference category

Number of observations = 2 182, Population size = 19 609

*** $p$ value < 0.001, * $p$ value < 0.05

SOURCE: Kiribati 2019/20 HIES.

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Percentage of adults in the households who are overweight or obese** | 0.00 | 0.00 | −1.89 | 0.061 |
| **Household member involved in fishing activities**[7] | −0.01 | 0.03 | −0.46 | 0.647 |
| **Household involved in handicraft activities**[7] | −0.04 | 0.02 | −1.62 | 0.108 |
| **Household involved in livestock activities**[7] | −0.17*** | 0.04 | −4.06 | 0.000 |
| **Household is selling copra**[7] | −0.01 | 0.03 | −0.43 | 0.666 |
| **Household receives remittances**[8] | 0.00 | 0.02 | 0.19 | 0.847 |
| **Household has access to a safe source of drinking water**[9] | 0.03 | 0.02 | 1.14 | 0.255 |
| **Household has access to private toilet**[9] | −0.01 | 0.02 | −0.32 | 0.750 |
| **Classes of severity level of food insecurity**[10] | | | | |
| Moderately food insecure | −0.01 | 0.03 | −0.26 | 0.799 |
| Severely food insecure | 0.07 | 0.06 | 1.13 | 0.259 |
| **Constant** | 0.35** | 0.12 | 2.95 | 0.004 |

[7] Household not involved in these activities is used as reference, [8] Household does not receive remittances is used as reference,
[9] Household with lack of access to these facilities is used as reference, [10] Food secure or mildly food insecure household is the reference category

Number of observations = 2 182, Population size = 19 609

*** $p$ value < 0.001, ** $p$ value < 0.01

SOURCE: Kiribati 2019/20 HIES.

# ANNEX 6
# Profile of the food insecure

To establish the main factors that characterize the food insecure, a simple ordered logistic regression[I] is performed linking the categorical variable on the level of severity of food insecurity (classes for severity level of food insecurity which takes the value of 1 for "food secure or mildly food insecure", 2 for "moderately food insecure" and 3 for "severely food insecure") to the characteristics of the household:

$$logit\ (P) = ln\ [P/(1-P)] = \beta_0 + \beta_1\ ln(inc_i) + \sum_j^n \beta_j HHchar_{ij}$$

where

$P$ is the probability of belonging to class k of food insecurity

$P/(1-P)$ is the odds of belonging to higher class of food insecurity versus the probability of belonging to lower classes of food insecurity

$inc_i$ is the per capita total expenditure of household $i$

$HHchar_{ij}$ is the socioeconomic or demographic characteristic $j$ of the household $i$.

In the output table below, the coefficients represent the ordered log odds (logit)

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Logarithm household total expenditures** | −0.66*** | 0.12 | −5.35 | 0.00 |
| **Household lives in rural area** | −0.60*** | 0.18 | −3.40 | 0.00 |
| **Household headed by a female** | −0.03 | 0.12 | −0.24 | 0.81 |
| **Head of the household is married** | −0.36* | 0.15 | −2.35 | 0.02 |
| **Age class of the head of the household**[1] | | | | |
| Age 35 to 44 | 0.12 | 0.16 | 0.74 | 0.46 |
| Age 45 to 54 | 0.13 | 0.17 | 0.78 | 0.44 |
| Age 55 and older | −0.08 | 0.17 | −0.48 | 0.63 |
| **Total number of children less than 14 years in the household**[2] | | | | |
| 1 child | 0.13 | 0.18 | 0.74 | 0.46 |
| 2 children | 0.20 | 0.18 | 1.11 | 0.27 |
| 3 children | 0.49** | 0.19 | 2.54 | 0.01 |
| 4 children and more | 0.96*** | 0.21 | 4.64 | 0.00 |
| **Household has access to a safe source of drinking water**[3] | 0.20 | 0.11 | 1.78 | 0.08 |
| **Access to private toilets** | −0.17 | 0.13 | −1.33 | 0.19 |
| **Level of education of the head of household**[4] | | | | |
| Lower secondary school | −0.21 | 0.17 | −1.25 | 0.21 |
| Higher/post/tertiary education | −0.82*** | 0.17 | −4.77 | 0.00 |

[1] Head of the household is less than age 35 years old is reference category, [2] No child is the reference category,
[3] Less than 33% of adults belonging to the household who are overweight or obese, [4] Primary or pre-school level is reference category

Number of observations = 2 182, Population size = 19 608

*** $p$ value < 0.001, ** $p$ value < 0.01, * $p$ value < 0.05

SOURCE: Kiribati 2019/20 HIES.

[I] Testing the proportional odd assumption, it was found that there is no difference in the coefficients between models with a $p$ value = 0.008. Therefore we accept the assumption that the coefficients that describe the relationship between the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories.

| | Coefficient | Std. Err. | t | $p > t$ |
|---|---|---|---|---|
| **Household is selling copra** | −0.52*** | 0.15 | −3.35 | 0.00 |
| **Household involved in livestock activities** | 0.01 | 0.18 | 0.04 | 0.97 |
| **Any household member involved in fishing activities** | 0.38*** | 0.12 | 3.05 | 0.00 |
| **Household involved in handicraft activities** | 0.22 | 0.13 | 1.76 | 0.08 |
| **Household receives remittances** | −0.17 | 0.13 | −1.37 | 0.17 |
| **Proportion of adults belonging to the household who are overweight or obese**[3] | | | | |
| 33 to 50% | 0.09 | 0.24 | 0.38 | 0.71 |
| 50 to 75% | 0.06 | 0.25 | 0.24 | 0.81 |
| More than 75% | −0.25 | 0.26 | −0.93 | 0.35 |

[3] Less than 33% of adults belonging to the household who are overweight or obese

Number of observations = 2 182, Population size = 19 608

*** *p* value < 0.001

SOURCE: Kiribati 2019/20 HIES.

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