**ASSESSMENT OF FOOD AVAILABLE FOR CONSUMPTION AT**

**THE NATIONAL AND HOUSEHOLD LEVELS**

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National surveys allow to assess food available for consumption, with the resulting data expressed as per capita food supply for human consumption. Such data can be used to estimate per capita food intakes and per capita nutrient intakes. The same is true for most household surveys. The term to be used for data derived from national and for these household surveys is either “food supply” or “food available for consumption” rather than “food consumption”. Only a few typologies of household surveys measure food consumption.

Chapter 3 of the present volume provides a detailed illustration of methods suitable for measuring food consumption at the individual level.

The present chapter considers survey methods suitable for a quantitative assessment of food available for consumption/consumed at national and household levels.

It is noteworthy that per capita food supply for human consumption assessed through surveys at national level provides no information on its distribution within the countries (in terms of geographical areas or socio-economic groups) and on its distribution according to seasons.

On the contrary, per capita food supply for human consumption and per capita food consumption assessed through surveys at household level may provide information on its distribution within the countries (in terms of geographical areas or socio-economic groups) and on its distribution according to seasons. However, it provides no information on its distribution within the household according to individual characteristics which determine nutrient needs (typically age, sex, body weight, physical activity level and physiological status).

Contrary to previous editions, in this 3rd edition of "R.S. Gibson: Principles of Nutritional Assessment", methods which are designed to estimate the exposure to hazardous substances or the intake of nutrients through chemical analysis are not considered, even though they are sometimes based on food supply at household level. It is the case of some Total Diet Studies based on market basket studies. Similarly, methods suitable for qualitative assessment such as food frequency or food diversity or any other instruments aimed to capture only part of the food available for consumption such as methods using the Universal Product Codes (UPCs) approach are not considered neither in this chapter.

**2.1 Measurement of food available for consumption at the national level: Food balance sheets (FBSs)**

This source of information is particularly precious for countries where household food consumption surveys and individual food consumption surveys are not performed regularly on a representative sample of the population. It is the case for some low-income countries.

Several terms have been used to describe FBSs. These include “country’s food supply”, “national food accounts”, “food moving into consumption”, “food consumption statistics”, “food disappearance data”, “food available for consumption” and “consumption level estimates”. In this chapter the term “country’s food supply” is being used.

FBSs present a comprehensive picture of the pattern of a country's food supply during a specified reference period: the calendar year, the agricultural year or the crop year (FAO, 2021c). The sources of supply and its utilization are reported for each food item potentially available for human consumption: primary commodities such as “soybeans” and processed commodities such as “oil of soyabeans”.

The country’s food supply is calculated from national food production plus imports plus food taken from stocks. Exports and food added to stocks are then subtracted, to obtain an estimate of gross country’s food supply. The estimate of food diverted for non-human uses (e.g. animal feed, seed, non-food use) and of food loss up to retail level are subtracted from the gross country’s food supply to obtain the net country’s food supply (i.e. total food available for human consumption in a country at the retail level) (FAO 2021d).

For the purposes of the FBS, “food loss” closely aligns with “post-harvest/post-slaughter loss”. It represents the quantities of food that leave the production/supply chain at any stage (e.g., during production, processing and distribution) up to the retail level (FAO 2021a). Food loss may be considerable in countries where the agricultural products reach the consumer after travelling long distance and/or passing through several intermediaries before the retail level. In such cases, large amounts of food are lost because damaged, especially for perishable foods such as fresh fruit and vegetables or processed foods with a short shelf life. Assumptions for losses may be based on expert opinion obtained in the countries. Losses or waste at the retailer, food catering and household level are not considered in the compilation of FBS. For this reason, total food availability estimates derived from the FBS are likely to be higher than average food consumption at household level.

In some cases, information on country’s stocks is not available. The effect of this data gap is reduced by preparing FBSs as a moving average for 3-year periods for all countries (<https://www.fao.org/economic/the-statistics-division-ess/publications-studies/publications/food-balance-sheets/zh/> )

Both official and unofficial data are used for compilation of FBSs; National statistical offices constitute an important data source. However, directly measured data on food availability at national level may be difficult to obtain (FAO, 2021a) and FBS compilers often derive estimates of food availability by making certain adjustments based on other existing data sets that measure food production or consumption. Two official data sources may provide additional information useful to the estimation of a country’s food availability: industrial output surveys and Household Consumption and Expenditure Surveys (HCES) (see paragraph 2.2 for the description of HCES surveys).

In its free online database (FAOSTAT), FAO provides free access to FBSs for over 245 countries and territories and covers all FAO regional groupings from 1961 to the most recent year available (<https://www.fao.org/faostat/en/#home>, accessed February 2023). The FBSs reported are “standardized FBSs”: the quantity of primary commodities available for consumption (e.g., wheat) include the quantity of processed commodities (e.g., bread) converted back to their primary commodities. The list of food commodities (such as “cassava”) in each of the 24 food groups (such as “starchy roots”) can be found in the definition and standard section of the FAOSAT FBS website (<https://www.fao.org/faostat/en/#data/FBS>, accessed February 2023). Data on per caput food supplies are expressed in terms of quantity and in terms of caloric value (referred to as Dietary Energy Supply – DES) and protein and fat content- by applying appropriate food composition factors for all primary and processed products.

The per capita supply available for human consumption is obtained by dividing the food supply by the partaking population estimate in each country; it is expressed in grams per capita of individual food commodities. FAO uses mid-year official population estimates released by the United Nations Development Program (UNDP). The most recent data are available at <https://population.un.org/wpp/> (accessed August 2022). According to the last FAO recommendation for FBS compilers, the number of migrants and tourists must be subtracted from the population estimates. The number of migrants and tourists should be calculated as the difference between country’s outbound travelers and inbound visitors (FAO 2021a).

The accuracy of food balance sheets, which are in essence derived statistics, is of course dependent on the reliability of the underlying basic statistics. The coverage and accuracy of underlying statistics vary a great deal between countries. In some low-income countries, the coverage and quality of the statistics - especially for food diverted for non-human food uses and for food stocks - has many gaps. Systematic errors may also increase in countries where food systems become more sophisticated. FBSs may result in an underestimate of per capita food supply in low-income countries where subsistence agriculture is widespread. In fact, household consumption of vegetal food products obtained through growing or gathering and of animal food products obtained through breeding or hunting are not considered in the calculation. FAO documents emphasize that availability for human consumption is by no means identical with consumption. The quantities of food available for human consumption, as estimated in the food balance sheet, reflect only the quantities reaching the consumer at retail level. The amount of food (and of nutrients) actually consumed may be lower than the quantity shown in the food balance sheet depending on the degree of loss and waste of edible food and nutrients in the household, e.g., during storage, in preparation and cooking (which affect vitamins and minerals to a greater extent than calories, protein and fat), as plate-waste, as fed to domestic animals and pets or thrown away (<https://www.fao.org/economic/the-statistics-division-ess/methodology/methodology-systems/supply-utilization-accounts-and-food-balance-sheets-background-information-for-your-better-understanding/en/>).

When making use of FAO FBS data, one must bear in mind that in the last few years FAO has changed its methodology to develop FBSs. The new methodology is illustrated in the document “The New Food Balances and the utilization variables” (FAO, 2021a). Key differences between new and old FBS (FBS) are described in FAO (2021b). With the release of FBS data for 2019, the new methodology used for 2014–2019 has been applied backwards to cover 2010–2013, therefore giving consistent time series of national food supply from 2010 to 2019. The per capita food supply data for 2010-19 have been compiled using the 2019 UNPD population data, whereas the series up to 2009 has been compiled using the 2015 (or even earlier) version of the UNPD population data. The FBS preceding 2010 will soon be recompiled using the new methodology.

**2.2. Measurement of food available for consumption at the household level: Household surveys**

Household food consumption is the food and beverages available for consumption by the household, family group, or institution. It is defined as the total amount of food and beverages available for consumption in the household or prepared and consumed outside the household.

Household surveys are of two types, those developed in the 80s as an alternative to individual surveys to inform nutrition where *food consumption* is measured (Household Food Consumption Surveys – HFCS) and those more widely used in low- and middle-income economies to inform on global food security and poverty where *food available for consumption* is measured (Household Consumption and Expenditure Surveys – HCES). They can also be used for surveys conducted in institutions (e.g. for institutionalized elderly).

In the past, some surveys with the same characteristics as HFCS or HCES were conducted in high income countries with the objective of dietary assessment. As for some HCES they were based on the record of food quantities entering the household, either purchased, received as gifts, or produced for household use over a reference period. They were called food account method (Burk & Pao, 1976) or food inventory method (Turrini et al., 2001). Individual food consumption of the household components was often also recorded as an additional component of the survey, leading to an important burden on the sampled households. Such surveys are now rare and have been substituted by individual food consumption surveys.

During HFCS and HCES, data on acquisition and/or expenditure and/or consumption of commodities including foods and beverages are collected. HFCS and HCES are less expensive than individual food consumption surveys and require a lower burden for participants. However, many of the technical problems and limitations of household surveys are the same as those of individual dietary surveys and are discussed in other sections (Chapters 4 and 5). Thus, diet might be altered by the design of the survey or the recording process.

Typically, HFCS and HCES are conducted on large nationally representative sample of households ([Fiedler et al., 2012](http://journals.sagepub.com/doi/pdf/10.1177/15648265120333S205)). These surveys all involve collecting information on demographic and socioeconomic characteristics of the household, thereby enabling data to be presented in terms of income level, family size, region of the country, etc. Attention must be paid to the sampling design of these surveys to ensure that a representative national sample is obtained, as noted in chapter 1, paragraph 1.4.2. The sampling design should account for the influence on food consumption of season, holidays, weekends, socioeconomic status and region to obtain information on the annual mean food consumption and of food consumption patterns of a population.

2.2.1. Household Food Consumption Surveys (HFCS).

HFCS measure all food and beverages consumed within a household during a specified period. They require careful supervision by the interviewer and good cooperation of the respondents. In general, these surveys are more complicated and costly to undertake than HCES and are therefore not always carried out frequently, or even at regular intervals. They are now rarely performed; they have been substituted with individual food consumption surveys even if more costly.

*i. Weighed household food record method*

Food records (also called food diaries) are usually completed over at least a 1-wk period, by either the householder or a fieldworker. The food eaten by the household is recorded through this method. During the survey period, the weight or volume of each food consumed at each meal is recorded, before subdivision into individual helpings (Burk & Pao, 1976). Detailed descriptions of all foods (including brand names) and their method of preparation are recorded. For composite dishes, the amount of each raw ingredient used in the recipe and the final weight of the prepared composite dish is also recorded. In some surveys the plate wastes from each meal are collected and separated so that individual food items wastes are weighed and recorded.

*ii. Household 24-h recall method*

In this method, the household member responsible for the food preparation is interviewed to obtain information on both household composition and household food consumption over the previous 24-h period. In the first stage of the interview, information is collected on the dishes and ingredients consumed, followed by details on the quantity, focusing particularly on those foods that are important sources of energy.

A technical guide for measuring household food consumption using a 24-h recall was developed by Swindale & Ohri-Vachaspati (1999), providing detailed instructions and sample questionnaires that can be used to collect the data, quantify the portion sizes of food consumed, and analyze the results.

2.2.2. Household Consumption and Expenditure surveys (HCES).

Household Consumption and Expenditure surveys (HCES) are typically performed within Household Expenditure Surveys (HES), i.e. economic surveys designed to inform national economic policy which are usually implemented by national statistical agencies.

HCES are less costly than HFCS and are widely used in low-income settings (FAO, 2023). They are usually conducted every 3-5 years. HCES refer to a heterogeneous group including Household Income Expenditure Surveys (HIES), Living Standards Measurement Studies (LSMS) and National Household Budget Surveys (NHBS). LSMS are multi-topic surveys for which technical assistance can be provided by the World Bank’s LSMS group.

HCES were primarily designed to measure household food available for consumption in a reference period through the expenditure approach (i.e., the monetary value of the food). Over time, quantities of foods and beverages have also been collected and these surveys have been repurposed to serve other needs such as monitoring food security leading to improvement in survey design to capture food data of higher quality.

Food consumption estimates generated from acquisition data or a combination of both acquisition and consumption data are usually referred to as 'apparent consumption' or “food available for consumption” to distinguish them from actual consumption (Fiedler & Mwangi, 2016). Data collected in HCES on food available for consumption are quite often used as a proxy for the quantities eaten.

HCES vary in their complexity and respondent burden. Data are collected through a diary or recall with reference period ranging usually from seven days to one month. Food and beverages, wasted, spoiled, or fed to pets or livestock are frequently not accounted for but, in some cases, wastes can be weighed, or a wastage factor can be applied. Food and beverages prepared and consumed outside of the house have always been poorly captured in most HCES but there is a trend to improve the collection of this consumption and in recent HCES a special module has been added to collect personal expenditure on snacks, meals, sweets, and drinks consumed outside the home. Adjustments can also be made for the presence of non-household members during the survey period. Ideally HCES should report all the sources of consumption, either purchased, received as gifts, or produced for household use.

Some HCES collecting only food entering the households (based on concept of acquisition) assume that there are no major changes in household stocks during the survey period. An important limitation of this simplified methodology is related to the fact that some foods (e.g. grains) are not perishable and can be stored. As a consequence, if the survey is conducted in a period of drawing-down stocks to meet current consumption, household consumption is underestimated. On the contrary, if the survey is conducted in a period of stocks accumulation for later consumption, household consumption will be overestimated ([Smith et al., 2014](http://www.ihsn.org/sites/default/files/resources/IHSN_WP008_EN.pdf)). It is therefore recommended that these simplified HCES are no longer used.

A study conducted in Tanzania in 2007 and 2008 with the use of eight different survey designs of HCES assessed the effect on over and under reporting of survey length, level of detail of food list and diary versus record methodology (Beegle et al., 2010). Over and under reporting appeared to depend on the specific setting in terms of share of consumption from home production, dietary diversity, and fraction of meals eaten in the household.

The experiment by Beegle et al. (2010) was combined with extensive research on 100 available HCES surveys to identify possible strategies towards improvement and harmonization of survey methodologies to collect more reliable food data for poverty or food security analysis (Carletto, Zezza & Banerjee, 2013, Smith et al., 2014, Zezza et al, 2017). Based on this research FAO and WB (2018) developed guidelines for the collection of food data in HCES. Low and middle-income countries are recommended to adopt these guidelines so that food data collected in HCES are of better quality and standardized between countries.

**2.3. Main uses of national or household surveys**

2.3.1. Uses of FBS

Respect to other sources of data on food supply, FBSs data have the comparative advantage of being easily accessible and of providing a global coverage of countries food supplies with a rather consistent methodology.

Access of FBS data makes it easy to assess its correlation with other data which have a global coverage. For instance, associations between mortality at national level and per capita food supply assessed through FBSs have sometimes been studied. However, any interpretation in terms of causal/effect of such observed association is highly questionable and should be discouraged.

On the contrary, FBS is an appropriate and extremely rich source of data for observational studies. Del Gobbo et al. (2015) have developed calibration models by matching FBSs per capita food supply data with estimated individual food intake by age and sex at country level. The authors suggest that these models could be used not only to improve per capita food intakes estimates but even to assess individual food intakes by age and sex, based on countries FBSs. FBS are also quite frequently used to compare per capita food supply between countries and regions and to assess time trends since 1961 at country, regional and global level. They can also be used to formulate agricultural policies concerned with the production, distribution and consumption of foods.

But one of the main uses of FBS is to monitor global hunger and inform national diets or nutrient adequacy. FBSs data can provide insights into the countries and regions that are most likely to be at greatest risk for low intakes of some nutrients.

However, given the importance of the decisions that may be taken based on this basis, users need to have a good understanding of FBSs data. Jacobs & Sumner (2002) provide a thorough analysis of their appropriate uses and potential weaknesses.

i. *Inform trends in global hunger*

Ideally, the assessment of food insecurity should be based on data from nationally representative individual or household surveys (see paragraph 2.2). However, only a few countries conduct such surveys on an annual basis. FBSs therefore have a key role in the assessment of global food insecurity, published yearly in the report “The State of Food Security and Nutrition in the World” by FAO, IFAD, UNICEF, WFP and WHO (2022). This global monitoring report identifies countries in which food insecurity is most prevalent, monitors food security trends over time and provides projections of future food insecurity. Thus, the per capita Dietary Energy Supply (DES) estimated from FBSs is used as proxy of the average energy intake of the population. The DES is combined with information on the inter-household variability in per capita “Dietary Energy Consumption” estimated from HCES and the minimum energy requirement at population level to estimate the Prevalence of Undernourishment (PoU) (Wanner, 2014). The use of data on inter-household variability in the PoU calculation is crucial. Indeed, food (and consequently energy) is not equally distributed among households within a country. A mere comparison between per capita DES with energy requirements at country level would largely underestimate the prevalence of food insecurity at household level in many countries.

PoU is one of the indicators of Sustainable Development Goal 2 (FAO 2021e).

*ii. Inform on macronutrient availability at national level*

Nutrient supply per capita can be estimated by combining supply data from FBSs expressed in g/capita/day with a food composition database for all primary and processed items. Energy (kcal/capita/day), protein (g/capita/day), and fat (g/capita/day) supplies are freely available by year and country on FAO website (<https://www.fao.org/faostat/en/#data/FBSH>) where they can be viewed and downloaded.

It is noteworthy that FAO nutrient supply data are obtained through a common global food composition database, not considering the differences in composition of foods items between countries. The food composition database is available in FAO (2001a) but no reference is provided in terms of data source.

Due to uncertainties in the data and process used to develop FBSs, macronutrients are often expressed as percentage of energy (e.g. percentage of calories from proteins) or as ratios between nutrients (e.g. ratio of unsaturated fatty acids to saturated fatty acids) (Sasaki & Kesteloot, 1992) rather than through per capita nutrient supply.

The assessment of nutrient density indeed allows to compare diet quality between countries which have differing levels of accuracy of the food supply data and thus differing level of under/over estimation of total nutrient per capita supply. However, the assessment of the percentage of energy, protein fat and nutrients derived from each food group and the comparison of such data by countries can be jeopardized by a differing level of under/over estimation between food groups.

*iii. inform food security indicators at national level*

Five indicators present in the FAO “Suite of indicators of food security” are derived from 3-year moving averages of FBS

(<https://data.apps.fao.org/catalog/dataset/faostat-food-security/resource/a9a2c6ac-4c3b-4604-bb81-35a3a782763e> , accessed September 2022):

* Share of dietary energy supply derived from cereals, roots and tubers (percent, 3-year average)
* Dietary energy supply used in the estimation of the Prevalence of Undernourishment (kcal/cap/day, 3-year average)
* Average dietary energy supply adequacy (percent, 3-year average)
* Average protein supply (g/cap/day, 3-year average)
* Average supply of protein of animal origin (g/cap/day, 3-year average)

Among these, a key nutritional indicator is the share of energy from cereals, roots and tubers. This percentage is typically high in low-income countries where these staple foods constitute a very large part of the diet with a resulting in low diversity and low micronutrient supply. The average supply of protein of animal origin is an indicator of diets with low supply of high-quality proteins.

*iv. inform micronutrient availability at national level*

Several efforts have been made to use FBS for the assessment of the adequacy of nutrient supply at global level, in different regions of the world and in individual countries. To this aim FBSs have been matched not only to energy, and macronutrients but also to full range of vitamins and minerals.

FBSs provide national data and thus do not provide any information on the per capita nutrient supply by age and sex while the different age and sex groups have very different micronutrient needs. However, the age and sex distributions of each country allow to calculate at national level the theoretical weighed estimated average requirement (EAR) for each micronutrient. The percentage of the population at risk of inadequacy may be estimated as the proportion of the population with usual intakes under the theoretical mean requirement of the population. The distribution of usual intake in the population is inferred considering as mean usual intake the per capita nutrient supply and the estimated within person variability for each nutrient. This method, called EAR cut-point method, is described in detail in chapter 8.b. of the present volume.

Wuehler, Peerson & Brown (2005) performed this analysis in 176 countries based on the estimated phytate supply and considering its bioavailability (based on the estimated phytate-to-zinc molar ratios). The estimated zinc supply was estimated based on FBSs combined with a common global food composition database for all countries.

Arsenault, Hijmans & Brown (2015) used FBSs from three countries (Bangladesh, Senegal, and Cameroon) and assessed the per capita availability for eight micronutrients (vitamin A, vitamin C, vitamin B6, riboflavin, niacin, folate, calcium and zinc). A common food composition database was compiled and used for all three countries, but additional country-specific adjustments were made to consider the different processing of staple foods which lead to differing nutrient composition of food as ingested (e.g. percentage of refined wheat at country level). Two indicators of adequacy were used: 1) the per capita nutrient supply expressed as a percentage of the theoretical weighed EAR of each country and 2) the percentage of the population that has an adequate usual intake, as estimated with the EAR cut-point method (see chapter 8.b). Each nutrient gap in the food supply was calculated as the difference between the current amount in the food supply minus the amount of the nutrient needed to achieve 80% prevalence of adequate intakes. Linear optimization modeling was used to determine the optimal mix of crops to fulfill the nutrient gaps for several nutrients.

Smith et al. (2016) performed a very comprehensive estimate of per capita supply for 23 macro- and micronutrients in 225 food groups in 152 countries over 50 years (1961 to 2011) by combining FBSs data with several ancillary data. Food supply by age and sex was assessed considering the percentage of edible food and the level of fortification in each food group together with data from individual and household surveys at country level. In each country an ad-hoc food composition database was compiled based on six national and regional food composition tables. Nutrient losses during the processing of cereals to flour were considered. The distribution of nutrient per capita supply by age and sex was derived through a probabilistic method (Monte Carlo simulations).

2.2.3. Uses of data from household surveys

Data on household food availability for consumption derived from household surveys and HCES in particular are largely used for the assessment of global and national trends in food security in low- and middle-income countries or to inform on food consumption patterns. The World Bank has developed the most comprehensive repository of HCES data worldwide. It is publicly accessible for free to answer the increasing needs of such data (<https://microdata.worldbank.org/index.php/home>).

Data sources and relevant methods used to produce diet-related food security indicators from household consumption surveys are summarized on the Data4Diet platform developed by the INDDEX project (2018).

HCES with carefully designed consumption modules are a valuable source of data for household-level food security and nutrition measurement ([Russell et al., 2018](https://www.cambridge.org/core/journals/public-health-nutrition/article/assessing-food-security-using-household-consumption-expenditure-surveys-hces-a-scoping-literature-review/96457C0B555E934B56C3FA5785313878); [Zezza et al., 2017](https://www.sciencedirect.com/science/article/pii/S0306919217306802)). However, consumption modules are heterogeneous across countries. Main differences among HCES are 1) the length of the recall period; 2) whether data are collected at acquisition or consumption level, or both; 3) whether there is information on the mode of food acquisition (purchases, own production, and in-kind); 4) whether or not information on food consumed away from home is collected and in what form; 5) whether food detail is collected through open recall or a list, and, if a list, how disaggregated and specific the foods and food groups are; and 6) the use of non-standard units without available conversions ([Smith et al., 2014](http://www.ihsn.org/sites/default/files/resources/IHSN_WP008_EN.pdf)). Therefore, comparisons across countries can be inaccurate and the indicators of food security and nutrition derive from some HCES survey may bear a large uncertainty. For example, if the food consumption module has a short food list with aggregated items, the matching with a [food composition database](https://inddex.nutrition.tufts.edu/node/204) leads to large uncertainty in the assessment of the per capita supply of nutrients. If food consumed away from home is not considered, the assessment of food security and nutrition indicators is uncertain.

*i. Inform PoU*

Dietary energy is never equally distributed within a country. For this reason, as mentioned in paragraph 2.3.1.i, information on the variability in the distribution of household per capita dietary energy consumption is used to estimate the PoU at national level. Such information is generated from household surveys. Updated instructions related to the estimation of PoU using HCES data can be found in a FAO e-learning course available here: <https://elearning.fao.org/course/view.php?id=386> (accessed January 2023).

Data on height by age and sex and of the percentage of pregnant and lactating females in each country are used to calculate the weighed average of normative per capita *minimum energy requirement*. The process is illustrated in the methodology section of the State of Food Insecurity (SOFI) annual report (FAO, IFAD, UNICEF, WFP and WHO,2022). The calculation of *energy requirement* requires an estimate of the Physical Activity Level (PAL) by age/sex groups. When such data are not available, a normative PAL of 1.55 is generally used.

The PoU calculation takes into account the level of inequality in accessing dietary energy between households (by correcting excess variability in food data collected in HCES due to measurement errors) and the expected component of variability due to differences in individuals’ body weight and physical activity levels.

*ii. inform food security indicators and per capita nutrient availability*

Estimates of per capita food, nutrient and energy intake available for consumption can be calculated by multiplying the edible portion of foods with food composition tables. The number of household members and visitors eating each meal can be recorded to estimate the per capita availability. Socioeconomic characteristics of the household allow to estimate per capita food available for consumption at regional and/or national level by category of socio-economic groups, education, household size, etc*.*

Moltedo et al. (2014) developed detailed instructions for analyzing food security using household survey data and FAO and the World Bank have developed a free standalone software (ADePT-FSM (Food Security Module)) that allows users to easily derive food security indicators from HCES data. (<https://www.fao.org/food-agriculture-statistics/statistical-domains/food-security-and-nutrition/methodology/en/> accessed January 2023).

Moltedo et al. (2018) developed detailed instructions for estimating per capita availability for consumption of micronutrients and amino acids using food data collected in HCES.

With regards to nutrient adequacy based on HCES it is worth reminding that only appropriately measured intakes at individual levels should be compared with sex- and age-specific nutrient recommendations to estimate the nutrient adequacy in the different age and sex population groups (Section 8.1.1). However, it is still possible to estimate ratios of per capita availability of nutrients to the average weighed nutrient requirement at population level. These ratios do not allow to estimate the prevalence of inadequacy in the population but may provide a gross indication of issues in covering requirements some specific nutrients at population level. (Moltedo et al. 2018)

Preliminary attempts to estimate the prevalence of nutrient inadequacy (PoNI) based on household data have been performed. To this aim, a pre-treatment of data is needed so as to remove within-person variation (i.e. to adjust for excess day-to-day variability). Moltedo et al. (2022) compared the prevalence of inadequacy estimated with pre-treated household survey data versus individual food consumption survey. The analysis was performed for eight micronutrients (vitamins A, B1, B2, B6, B12 and C, and calcium and zinc) with the use of Bangladesh datasets.

*iii. Reconciliation between FBSs and HCESs*

Grünberger K. (2014) compared per capita food supply from country-specific FBSs with that of 64 HCESs from 51 low- and middle-income countries, for 16 major food groups. Overall, the results of the reconciliation suggest that average consumption of cereals, eggs, fish products, pulses and vegetables are likely to be underestimated in FBS, whereas fruits, meat, milk and sugar products are likely to be overestimated in FBS. Both FBS and HCES are prone to measurement errors. Even though the estimated differences in average total food supply per capita were moderate, there is considerable uncertainty in the estimate of availability of single food groups at country and global level.

2.3.3. National and household surveys in the global assessment of food security and diet quality by age and sex

As mentioned in chapters 3 and 4, individual food consumption data are key to assess the distribution of usual food and nutrient intake in different population groups within a country and thus to evaluate the adequacy of the diet (chapter 8b). A publicly available global database such as the FAO/WHO GIFT platform (<https://www.fao.org/gift-individual-food-consumption/en/>) includes only data collected through quantitative individual food consumption survey.

Other global databases make use of FBS and HCES data to model the intake of foods and nutrients by age and sex worldwide, by filling the gaps in individual food consumption data. It is the case of the Global Dietary Database initiative (GDD) and of the Institute for Health Metrics and Evaluation (IHME) database.

The GDD database is available at [https://www.globaldietarydatabase.org/](https://eur04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.globaldietarydatabase.org%2F&data=04%7C01%7Ccatherine.leclercq%40crea.gov.it%7C84114c58280c43ad19aa08d9727a593f%7Cd59c04b9bde247f7b1b80be26a568618%7C0%7C0%7C637666692265894279%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=AxC9sr6WZsKQkroH29%2FCbikl9baPzsf9kOXe5zhvxxk%3D&reserved=0) (accessed November 2022) and provides modeled data for 55 dietary factors including 14 foods, 7 beverages, 15 macronutrients and 19 micronutrients in 185 countries. Modeled data are provided by country, year of primary data collection, age, sex, education level, urban or rural residence, and pregnancy/nursing status.

The IHME initiative database is available at <http://www.healthdata.org/results/data-visualizations> (accessed November 2022). Modeled data are provided by country, age, sex and year of primary data collection in 204 countries for 87 indicators, including 15 dietary indicators (9 foods and 6 nutrients). These dietary indicators are included in the Global Burden of Diseases (GBD), a worldwide observational epidemiological study. Key research papers based on the analysis of GBD data are published each year in a special issue of The Lancet (<https://www.thelancet.com/gbd/about>).

**Conclusion**

In conclusion, the assessment of food available for consumption through household and national surveys provides key information for the global monitoring of food security. They are less expensive than individual food consumption surveys and can therefore be performed more frequently.

Conversely, they are not fit to assess individual food consumption and, consequently, to assess nutrient adequacy of the diet.

National, household and individual surveys are thus complementary. Efforts to take full advantage of this complementarity should be encouraged so that better data are available to monitor the adequacy of diets. Indeed, better data on what people eat is a key requirement for better policies.

**Summary**

The present chapter illustrates how National Food Balance Sheets (FBSs) and Household Surveys allow a quantitative assessment of food available for consumption at national and household levels respectively. Data are expressed as per capita food supply for human consumption and can be used to estimate per capita food intakes and, through matching with food composition data, per capita energy and nutrient intakes.

Food Balance Sheets are calculated from national food production plus imports plus food taken from stocks. Exports and food added to stocks are then subtracted, to obtain an estimate of gross country’s food supply. The estimate of food diverted for non-human uses (e.g. animal feed, seed, non-food use) and of food loss up to retail level are subtracted from the gross country’s food supply to obtain the net country’s food supply (i.e. total food available for human consumption in a country at the retail level). FBSs are particularly precious for low-income countries where household food consumption surveys and individual food consumption surveys are not performed regularly on a representative sample of the population. Food Balance Sheets provide no information on its distribution within the countries (in terms of geographical areas or socio-economic groups) and on its distribution according to seasons. The methodology to assess FBSs has recently been modified.

On the contrary, household surveys may provide information on its distribution within the countries (in terms of geographical areas or socio-economic groups) and on its distribution according to seasons. Household food consumption is the food and beverages available for consumption by the household, family group, or institution. It is defined as the total amount of food and beverages available for consumption in the household or prepared and consumed outside the household.

Household surveys are of two types, surveys where *food consumption* is measured (Household Food Consumption Surveys – HFCS) and those more widely used in low- and middle-income economies to inform on global food security and poverty where *food available for consumption* is measured (Household Consumption and Expenditure Surveys – HCES). Efforts have recently been made to improve and harmonize household surveys.

Prevalence of Undernourishment (PoU) at national level is based on FBSs, making use of HBS. It is a key indicator to assess food insecurity at global level.

National and Household surveys provide no information on the availability of food/nutrients according to age, sex and physiological status. Interpreting data collected through such surveys in terms of nutritional adequacy of the diet without complementing them with data collected at individual level is highly uncertain.

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