

# Data4Diets: Building Blocks for Diet-related Food Security Analysis

Online at [inddex.nutrition.tufts.edu/data4diets](https://inddex.nutrition.tufts.edu/data4diets)

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## About Data4Diets

The Data4Diets platform has been created as part of the International Dietary Data Expansion (INDDEx) Project. The objective of the Data4Diets platform is to aid program implementers, policy makers, and researchers to identify which diet-related food security indicators are best suited for their objectives, understand how the indicators should be constructed and used, and know which data sources and methods are preferred for producing these indicators and information.

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- Minimum Acceptable Diet (MAD-IYCF)
- Minimum Dietary Diversity (MDD-IYCF)
- Minimum Dietary Diversity for Women (MDD-W)
- Modified Functional Attribute Diversity (MFAD)
- National Average Supply of Protein
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- National Fruit and Vegetable Availability
- Packaged Food Retail Volume
- Per Capita Food Supply Variability
- Percent of Energy Comprised of Ultra-Processed Foods
- Population Share with Adequate Nutrients
- Prevalence of Undernourishment
- Shannon Entropy Diversity Metric
- Share of Food Consumed Away from Home of Total Food Consumption
- Total Individual Energy Intake
- Total Individual Macronutrient Intake
- Total Individual Micronutrient Intake
- Volatility of Food Prices

# Deconstructing food security for improved measurement and action: The Data4Diets framework

## About Data4Diets

The Data4Diets platform Version 1.0 was developed by the International Dietary Data Expansion (INDDEX) Project, which was implemented by the Tufts University Friedman School of Nutrition Science and Policy between 2015 and 2022, with funding from the Bill and Melinda Gates Foundation. Version 1.0 of the platform was released in 2020. [Please click here](#) for a list of core team members and reviewers involved in the Data4Diets initiative.

The objective of the Data4Diets platform is to aid program implementers, policy makers, and researchers to identify which diet-related food security indicators are best suited for their objectives, understand how the indicators should be constructed and used, know which data sources and methods are preferred for producing these indicators, and access case study examples of how indicators have been analyzed to produce actionable policy information. The Data4Diets platform provides a searchable set of indicators, descriptions of common data sources and methods, links to guidelines for indicator construction, and concrete case studies illustrating ways in which each type of indicator has been leveraged for diet-related food security policy and programming.

In 2023, The Innovative Methods and Metrics for Agriculture and Nutrition Actions (IMMANA) programme graciously sponsored the Tufts Friedman School to implement an update to the existing indicators on the platform, referred to as Version 2.0. IMMANA is co-funded by UK Foreign Commonwealth and Development Office (FCDO) and the Bill & Melinda Gates Foundation.

## The Data4Diets framework

The most widely accepted definition of food security derives from the 1996 World Food Summit, which describes food security as a "state in which all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" ([Food Agriculture Organization \[FAO\], 1996](#)).

Experts agree that no single indicator can capture all of the dimensions of this definition. And yet, in practice, people commonly use single food security indicators without consideration of which dimensions of this definition are being captured (or not) by their chosen metric. Given the multidimensional nature of the food security construct, there has been continued debate about the best way to conceptualize, select, and organize the array of existing food security indicators. Most commonly, food security metrics reflect one of the 'pillars' of availability, access, and utilization (and sometimes also stability) ([USAID, 1992](#); [Webb & Rogers, 2003](#)). Others have chosen to group food security indicators by the unit of observation, such as national, market, household, and individual ([Lele et al., 2016](#)).

The Data4Diets platform follows a framework proposed by [Coates \(2013\)](#), which identifies six policy-relevant dimensions of the food security construct that are inherent to the 1996

World Food Summit definition and were shown to reflect people’s own experience of the problem of food insecurity. The six food security components in the Data4Diets platform—slightly adapted from Coates (2013)—are: **quantity** (caloric sufficiency), **quality** (nutrient adequacy), **preferability**, **safety**, **stability**, and **sustainability**, all of which can be measured at four levels (national, market, household, and individual) (**Figure 1**). The indicators in the Data4Diets platform are considered 'diet-related food security indicators' in that they measure whether food is sufficiently available, accessible, and utilizable to meet consumption needs (where needs include preferability, quality, quantity, safety, stability, and sustainability). As such, the Data4Diets platform was developed to align with the INDDEx Project objective of expanding the use of consumption and dietary data worldwide.

**Figure 1. Dimensions and levels for food security measurement**

	Quality	Quantity	Preferability	Safety	Stability	Sustainability
National, Market (Available)						
Market, Household, Individual (Accessible)						
Household, Individual (Utilizable*)						

Indicators in the Data4Diets platform are categorized according to the dimension(s) to which they relate most closely.\*\* Please see our [FAQs](#) and inclusion/exclusion criteria for further detail regarding the selection of indicators for the Data4Diets Platform.

\*Note: 'Utilizable' in this context refers to individual food consumption. It can be examined, along with other information such as illness and biological use of nutrients, to understand the extent to which diet contributes to nutrition outcomes.

\*\*Note: Not all food security indicators were designed to capture one of these six dimensions; many indicators are not specific to a single dimension, and therefore are presented under more than one dimension in the Data4Diets platform. Furthermore, this matrix approach highlights those dimensions where specific, accepted metrics are lacking—such as that of food preferences.

## Understanding the ‘Dimensions’ and ‘Levels’ terminology in the Data4Diets platform

### Food Security Dimensions:

The Data4Diets platform uses the terminology of ‘food security dimensions’ to refer to the different aspects of food security, as per the 1996 World Food Summit definition ([FAO, 1996](#)

). Despite the multiple dimensions in the definition of food security, too frequently food security is measured using existing indicators that are either non-specific or only capture one piece of this multi-dimensional problem. As a result, some dimensions are rarely measured (e.g. safety, preferences) and users are often unclear which aspect of food security is actually captured by a given indicator. [Coates \(2013\)](#) asserts that a preferred approach is to develop and select indicators that specifically reflect each of these six dimension(s) to provide a holistic picture of the food security situation at a national, market, household or individual level. This approach should help to better diagnose the nature of food insecurity problems and develop solutions that are tailored to those problems. Thinking about food security through the lens of the different dimensions also highlights dimensions that have drawn the most policy attention (e.g. quantity and, increasingly, quality) and those that have been historically overlooked (e.g. safety and preference).

The food security dimensions in the Data4Diets platform are defined in the following way:

*Quality:* These indicators measure diet quality including aspects related to diversity, adequacy, moderation, and overall balance. Depending on the indicator, quality can range from considering the full dietary pattern and all foods/food groups or only specific macronutrients and micronutrients that are available, accessible, or consumed by the population of interest at national, market, household, and individual levels.

*Quantity:* These indicators relate to food sufficiency, primarily expressed as dietary energy (calories) that are available, accessible, or consumed by the population of interest at national, market, household, and individual levels.

*Preferability:* These indicators relate to whether people are able to exercise the choice to consume foods that they prefer, i.e. those that are culturally and/or personally acceptable. Experiential food security scales (e.g. Household Food Insecurity Access Scale, Food Insecurity Experience Scale) capture lack of choice by measuring people's self-reported consumption behaviors in reaction to food access constraints. Proxy information could be used to infer choice constraints from purchasing behavior or experimental data at market, household, and individual levels.

*Safety:* These indicators relate to the safety of the food supply and food consumed as measured through foods available that are free of contamination or exposure (through consumption) to specific contaminants at national, market, household, and individual levels. More generally, food safety refers to the handling, preparation, and storage of foods that prevent food-borne illness.

*Stability:* These indicators relate to the inter- and intra-annual certainty and stability of food availability, access, and consumption—often in relation to food prices and other shocks—at the national, market, household, and individual levels.

*Sustainability:* These indicators relate to the long-term future preservation and assurance of food availability, access, and consumption at national, market, household, and individual levels—for example, through sustainable diets that could contribute to a reduced environmental impact.

### Data Collection Levels:

The Data4Diets platform uses the terminology of 'data collection levels' to refer to the

different levels at which the Data4Diets indicators are most commonly collected (national, market, household, individual). The data collection levels (national, market, household, individual) referred to in the Data4Diets platform correspond roughly to the food security pillars of availability, accessibility, and utilization of food as conceived in the historical approach to measuring food security. National- and market-level data can be used to measure the availability of food that is sufficient in terms of quantity and quality, stable, sustainable, safe, and meets consumer preferences. Market-, household-, and individual-level data can be used to measure the accessibility of food that is sufficient in terms of quantity and quality, stable, sustainable, safe, and meets consumer preferences, while individual-level data can be used to measure the utilization of food that meets these same criteria. (Note: 'Utilization' in this context refers to individual food consumption. It can be examined, along with other information such as illness and biological use of nutrients, to understand the extent to which diet contributes to nutrition outcomes).

The data collection levels in the Data4Diets platform are defined in the following way:

*National:* This level refers to data that are collected at the national-level and represent national-level averages (e.g. Food Balance Sheets), which cannot be disaggregated to lower data collection levels (i.e. units of analysis) like households and individuals.

*Market:* This level refers to data that are collected from a country's domestic markets by monitoring prices (e.g. Vulnerability Analysis and Mapping) or purchasing behavior (e.g. Euromonitor). Market-level data are often available at either a national or sub-national level.

*Household:* This level refers to data that are collected from and about households with sub-national representability (e.g. household consumption and expenditure surveys); these data can be aggregated up to the national level but cannot be used (without large assumptions) to draw conclusions about individual access to and consumption of foods.

*Individual:* This refers to data that are collected at the individual level (e.g. quantitative 24-hour Dietary Recalls), which, if collected in a nationally (or regionally) representative way, can be aggregated up to the national (or regional) level in order to draw conclusions about consumption patterns and preferences about the population in a region or country.

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# Data4Diets: FAQs

## How were indicators selected for the Data4Diets platform?

We systematically reviewed existing literature and indicators currently being used by key institutions to identify relevant food security and nutrition indicators. All indicators we selected fit into our predefined inclusion/exclusion criteria (see below). Some of the documents and tools we reviewed included the [Food Security Information Network User's Guide for Existing Indicators](#), the [ADePT Food Security Module Indicators](#), the [FAO/WHO GIFT Draft Indicators](#), the [FAO food security indicators](#), the [Feed the Future Indicators](#), and the [Global Nutrition Report \(2016\)](#). We then evaluated the indicators based on the predefined inclusion/exclusion criteria and carefully reviewed selected indicators to check for redundancies. Indicators that measured the same concept but were articulated slightly differently were collapsed into a single indicator.

## How was this initial set of indicators and information selected?

The inclusion/exclusion criteria used for selecting indicators were as follows:

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Indicator captures one or more of the key food security dimensions (i.e. quantity, quality, cultural preference, safety, stability, sustainability) measured at the national, market, household, or individual level	No indicators measuring causes or consequences of food insecurity (e.g. empowerment, anthropometric outcomes)
Indicator is in active use, defined as: <ul style="list-style-type: none"><li>• Tested or validated in one or more countries and/or actively promoted and used by one or more international organizations</li></ul>	No indicators related to program implementation (e.g. process indicators, coverage indicators)
Indicator fills a necessary gap (Note: if the indicator is not readily available or in active use, it may still be included in this framework, with relevant caveats, on the grounds that it could fill a data gap with further testing and validation.)	

## Why are so many indicators focused on quantity and quality?

The strong focus on quantity and quality is a reflection of the current types of indicators that have been widely adopted and used.

## Can I see the original full list of indicators?

Yes. The full list of indicators is available upon request. Please send your request either through the 'Feedback' tab OR send us an email at: [inddex@tufts.edu](mailto:inddex@tufts.edu).

# Data Sources and Methods

12 results

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INDDEx Data4Diets

## 24-hour Dietary Recall (24HR)

### Highlights

- The 24-hour dietary recall (24HR) method provides quantitative information on individual diets.
- The international standard approach uses the multiple pass 24HR technique, in which the respondent recalls foods and beverages consumed—and their quantities—in the past 24 hours.
- A single 24HR provides an estimate of mean intake of foods and nutrients, while collecting a second 24HR on a sub-sample of the population allows for an estimate of 'usual intake.'

## Summary

The 24-hour Dietary Recall (24HR) method provides comprehensive, quantitative information on individual diets by querying respondents about the type and quantity of all food and beverages consumed during the previous 24-hour period ([Gibson & Ferguson, 2008](#)). A standard multiple pass 24HR includes having the respondent iteratively provide increasingly granular data about each food or drink and its preparation method and other attributes, as well as an estimation of the portion size consumed. The multiple pass approach has been validated in many low- and middle-income countries ([Gibson et al., 2017](#)).

Enumerator-administered, rather than self-administered, 24HRs are often used in low- and middle-income countries because they are quick, culturally sensitive, and provide quantitative data on both foods and nutrients ([Gibson et al., 2017](#)). Data from 24HR can be used to assess dietary patterns, food groups, or nutrient intake. In order to analyze the nutrient content, the food data must be matched with nutrient information from a [food composition database](#). Mean intakes of foods and nutrients can be measured using a single 24HR, while assessing the "usual intake" of a population requires that repeat 24HRs are collected from a sub-sample of the study population ([Gibson & Ferguson, 2008](#)).

Individual-level quantitative dietary data can also be used to develop a better understanding of typical household food preparation, cooking methods, and brand names of foods consumed within the household. Furthermore, if individual-level dietary data are collected in conjunction with information on socioeconomic status, education, and health, the data can be used to examine linkages between income levels and dietary choices, as well as dietary patterns and health outcomes.

While 24HRs offer a higher degree of accuracy in assessing food and nutrient intake relative to [Food Frequency Questionnaires \(FFQ\)](#) or estimates derived from [Household Consumption and Expenditure Surveys](#)

(HCES), they are collected infrequently on nationally representative samples, and when they are collected, these data are typically not publicly available ([Pisa et al., 2018](#)). However, there is increasing interest in, and demand for, individual-level quantitative dietary data, particularly in light of the nutrition transition and rapid food system changes ([Coates et al., 2017](#)). For example, the [Food and Agriculture Organization and World Health Organization Global Individual Food consumption data Tool](#) (FAO/WHO GIFT) aims to make publicly available existing quantitative individual food consumption data from countries all over the world. In addition, the [Global Dietary Database](#) (GDD) provides information on dietary intakes of foods and nutrients for children and adults by age, sex, pregnancy/nursing status, rural/urban, and level of education.

## Strengths:

- 24HRs provide quantitative estimates of individual food consumption and nutrient intake
- Can structure survey—and analyses—to include information on food sources and preparation methods
- Can account for foods consumed together that may enhance or inhibit micronutrient absorption
- Offer a higher degree of accuracy in assessing food and nutrient intake relative to [FFQs](#) or estimates derived from [HCES](#)

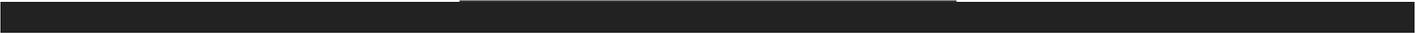
## Weaknesses:

- Given relative complexity of 24HR surveys, significant training of enumerators is required to minimize errors in data collection
- Accurately recalling the quantity consumed can be challenging for respondents and a relatively large source of error in 24HRs compared to enumerator-administered [Weighed Food Records](#) (WFR)
- Data are frequently collected from small samples that are not nationally representative
- As with other surveys that rely on memory and are administered by an enumerator, there is potential for recall bias and interviewer bias
- Like most surveys, to capture seasonal variation data collection must span the entire year or be repeated in multiple seasons

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End of Data Source / Method: 24-hour Dietary Recall (24HR)

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## Demographic and Health Surveys (DHS) & Multiple Indicator Cluster Surveys (MICS)

### Highlights

- The Demographic and Health Surveys (DHS) and UNICEF's Multiple Indicator Cluster Surveys (MICS) are publicly available data sources that can be used to analyze nutritional status by health, demographic, and geographic variables for a nationally representative sample of women and children.
- Both data sources are useful for assessing breastfeeding trends and infant and young child feeding practices within and across countries over time.
- DHS and MICS data do not include comprehensive quantitative food consumption data, but the existing data can be used to provide insights on the relationships between infant and young child feeding and nutritional outcomes within and across countries over time.
- DHS and MICS are highly comparable data sources.

### Summary

The Demographic and Health Survey (DHS) Program has been supported by USAID for over 30 years ([DHS, 2018](#)). More than 320 surveys in over 90 countries have been conducted since the program's inception, gathering information on select nutrition indicators, as well as fertility, reproductive health, maternal health, child health, immunization, HIV and AIDS, maternal and child mortality, malaria, and other indicators ([Fabic et al., 2012](#)). DHS data can be explored online through the [DHS STATcompiler](#) or downloaded for further analysis ([DHS, 2018](#)).

The Multiple Indicator Cluster Surveys (MICS) program is the largest household survey program on children and women worldwide. The MICS was developed by UNICEF to assist countries in filling data gaps on children's and women's health statuses ([UNICEF, 2018](#)). MICS was officially launched in 1994 in South Asia with 28 indicators, and now includes over 300 surveys in 112 countries, with 237 distinct indicators (counting those requiring sex disaggregation). The MICS data on infant and young child feeding can be explored online through an [interactive portal](#), as well as downloaded for further analysis ([UNICEF, 2018](#)).

Neither DHS nor MICS includes comprehensive food consumption data, although the standard questionnaire includes several infant and young child consumption indicators on breastfeeding and feeding practices. The data collected in both surveys represent only children age five years old and under and women ages 15-49 years old. In addition, useful analyses can be carried out to understand the relationship between infant and young child feeding practices and nutritional outcomes (e.g. stunting, wasting). Several specific food consumption indicators can be calculated with DHS and MICS data ([USAID, 2017](#); [UNICEF, 2018](#)), including:

- Initial breastfeeding
- Breastfeeding status
- Median duration and frequency of breastfeeding
- Percentage of children 6-23 months who are fed according to [infant and young child feeding practices](#)

DHS and MICS are designed to be nationally representative, with typical sample sizes ranging from 5,000 to 30,000 households. These types of surveys are usually repeated in a given country every three to five years.

## Strengths:

- Publicly available, well-documented data sources that are free to use
- Provide information on trends over time as data are collected routinely in many countries (~5 years)
- A core set of survey modules are standardized across countries allowing for comparability over time and place; some countries include additional modules (e.g. biomarker data)

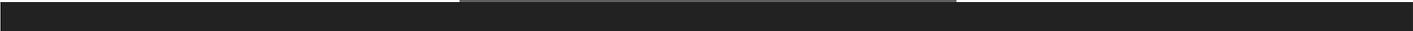
## Weaknesses:

- Do not include food consumption data on entire diet
- Only representative of children under five years old and women 15-49 years old
- Relies on proxy-reporting by one adult female for children under five

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End of Data Source / Method: Demographic and Health Surveys (DHS) & Multiple Indicator Cluster Surveys (MICS)

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Household level measures							
<u>Household dietary diversity score (HDDS)</u>	Household	12	24 hours	Household dietary diversity and proxy for household food access and socioeconomic status	No	Socioeconomic Status	FAO
<u>Food consumption score (FCS)</u>	Household	8	7 days	Measures "usual" household consumption; Standardized food group weights are used to construct index.	Yes	Not Validated	WFP
Individual level measures							
<u>Minimum Acceptable Diet (MAD)</u>	Infant/child (6-23 months)	8 (from MDD)	24 hours	Measures both minimum dietary diversity and minimum meal frequency.	Yes	Not Validated	WHO
<u>Minimum Dietary Diversity (MDD)</u>	Infant/child (6-23 months)	8	24 hours	Measures infant and child dietary quality and adoption of complementary feeding practices	Yes	Nutrient Adequacy	WHO
<u>Minimum Dietary Diversity for Women (MDD-W)</u>	(Individual) Women 15-49*	10	24 hours	Dichotomous indicator that measures the dietary diversity of an individual woman; associated with nutrient adequacy in many contexts and can be used as a proxy for overall diet quality	Yes	Nutrient Adequacy	WHO, USAID
Women's Dietary Diversity Score (WDDS/IDDS)**	(Individual) Women 15-49*	9	24 hours	Continuous indicator that was the basis for the MDD-W (sometimes referred to as the Individual Dietary Diversity Score (IDDS))	No	Superseded by MDD-W	

\*Women of reproductive age

\*\*The WDDS, also referred to as the Individual Dietary Diversity Score (IDDS), was not included in the Data4Diets Platform as it has been superseded by MDD-W

Dietary diversity indicators can be constructed using a specific module relevant to that dietary diversity indicator (e.g. Household Dietary Diversity module, MDD module for children from 6-23 months). In addition, the various dietary diversity scores can be constructed from existing data, as long as the recall period is aligned. Some potential data sources include Household Consumption and Expenditure Surveys (HCES), Demographic and Health Surveys (DHS) & Multiple Indicator Cluster Surveys (MICS), or Food Frequency Questionnaires. More generally, dietary diversity modules are frequently included as short modules in multi-purpose household survey questionnaires.

Dietary diversity scores are not direct measures of consumption and not all have been validated as proxy measures of nutrient adequacy. A significant drawback of the household-level indicators is that scores do not provide information on whether the household dietary diversity is shared equally by all individual members of the household. For more precise population measures of nutrient adequacy by age/sex groups individual-level data from [24-hour Dietary Recalls](#) or [Weighed Food Records](#) should be used.

## Strengths

- Relatively easy to use and to integrate as a short module into surveys
- Requires fewer resources than attempting to measure quantitative dietary consumption data for nutrient adequacy
- Calculating the scores is a straightforward process and training others to collect data does not require a large amount of time
- Dietary diversity scores can give an idea of what types of foods are consumed

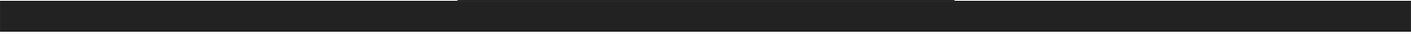
## Weaknesses

- Modules usually require tailoring to specific contexts
- Scores do *not* provide detailed information on quantitative dietary intakes and are not a direct measure of nutrient adequacy; the cut-offs for the MDD-W do not predict nutrient adequacy in all contexts for all population groups
- Household-level dietary diversity scores do not provide information on individual household members and cannot be used to draw conclusions about individuals

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End of Data Source / Method: Dietary Diversity

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## Euromonitor International

### Highlights

- Euromonitor is a pay-for-access source of market data for various foods spanning packaged food and fresh food.
- This is a useful source for standardized consumer purchase data that can be compared across countries for which data exist, over time.
- Euromonitor only includes high- and middle-income countries (n=54), and only one country (South Africa) in sub-Saharan Africa.

## Summary

Euromonitor International is a market research firm that provides data on consumer trends, products, and services globally. Although the data Euromonitor provides are largely targeted toward brands looking to understand consumer trends to strategically grow their market share, the database can also be a valuable source of market information to understand purchasing behavior for fresh and packaged foods and beverages.

Passport is a database product offered by Euromonitor that contains consumer purchase data for various industries in 54 countries, and includes Packaged Foods, Fresh Foods, Soft Drinks, and Alcoholic Beverages. The Passport: Nutrition database contains data on the amount of eight nutrients that are purchased through packaged foods and soft drinks in 54 countries.

The nutrient components and nutrients included in the database are:

- Energy (calories)
- Protein
- Carbohydrate
- Sugar
- Fat
- Saturated fat
- Fiber
- Salt

These data are only accessible through private license (either institution or individual), thus limiting access and relevance. Furthermore, the Euromonitor data only exist for 54 countries, all of which are in high- and middle-income countries.

## Strengths

- Contains nutrient composition of packaged food and beverage products
- Standardized data that can be compared across countries and over time
- Easy-to-use interface, with access to dashboards, data, and graphics to visually compare nutrients or product categories purchased by country
- Historical data from 2009 and five-year forecast data

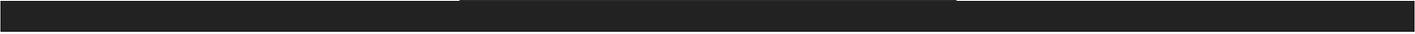
## Weaknesses

- Users must pay to gain access to the database
- Only includes high- and middle-income countries (n=54), and only one country (South Africa) in sub-Saharan Africa. The Passport: Nutrition database is limited to eight nutrients, and does not include micronutrients
- Contains data on how much of each nutrient or type of food is purchased, not actually consumed

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End of Data Source / Method: Euromonitor International

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## Experience-based Scales

### Highlights

- Experience-based food insecurity scales capture psychosocial and behavioral manifestations of insecure food access.
- Experience-based food insecurity scales result in a metric that is quick and easy to use in surveys and straightforward to interpret and understand.
- Experience-based food insecurity scales can be used to assess and target interventions to specific geographic or demographic segments of a population, but should not be used for household and individual eligibility screening.

## Summary

Experience-based food insecurity scales capture insecure food access (i.e. the access dimension of food security) and assess the food insecurity of a population by asking about behavioral and psychological indications of food insecurity (Coates et al., 2007). Food security is achieved when "all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food" (Food and Agriculture Organization [FAO], 2001). Existing experience-based scales can be used either at the individual level or the household level in order to estimate levels of food insecurity in a given region or country. The Food Insecurity Experience Scale (FIES), developed by FAO and collected through the Gallup World Poll, was designed and validated specifically for individual-level data collection, while the Household Food Insecurity Access Scale (HFIAS), one of the FIES antecedents, was designed specifically for household-level data collection. With a slight modification, the FIES can be used at the household level and the HFIAS can be used for individuals.

Experience-based food insecurity scales were developed in part to respond to the call for a broader definition of the term "hunger" and can capture beginning stages of severe food insecurity, such as uncertainty regarding food access and lowering quality of diet (Ballard et al., 2013), as well as more severe situations where the quantity of the food consumed is perceived by respondents to be restricted.

Four experience-based food insecurity scales are included in the Data4Diets platform: FIES, Household Hunger Scale (HHS), HFIAS, and the Latin American and Caribbean Food Security Scale (ELCSA). They all share common roots in the US Household Food Security Survey Module. Experience-based indicators are constructed from short questionnaires that capture manifestations of insecure access to sufficient, culturally acceptable, quality food at the household (or individual) level, such as having to reduce the number of meals consumed or cut back on the quality of the food due to a lack of resources. Responses to the modules, which can be easily included in diverse types of surveys, make it possible to locate the household or individual on a scale of

severity of insecure food access. While these four food security scales share a common origin, and the questions that comprise them are very similar, they differ slightly with respect to the number of questions in each respective survey module, reference period, response categories and analytical approach.

<b>Indicator</b>	<b>Level*</b>	<b>When to use?</b>	<b>Validated</b>	<b>Developed by</b>
<u>FIES</u>	Individual-level indicator for cross-country comparisons	For comparing food security across countries or for measuring individual (or household) food insecurity	Yes, multi-country validation	FAO with data collection by Gallup World Poll
<u>HFIAS</u>	Household-level indicator	For measuring household (or individual) food insecurity in a single country	Yes	FANTA with Tufts & Cornell
<u>HHS</u>	Household-level indicator focused on severe food insecurity	For comparing hunger (severe food insecurity) across countries or in a single country	Yes, multi-country validation	FANTA
<u>ELCSA</u>	Household-level indicator developed for use in Latin America	For measuring household (or individual) food insecurity in Latin America	Yes, in Latin American countries	United Nations

\*Note this is the primary purpose for which the indicator was developed and validated, but each one can also undergo minor adaptations to be used at the other level (individual or household)

Due in part to their short length, experience-based scales are relatively quick and easy to use and inexpensive to integrate into larger surveys. Because experience-based scales do not directly address specific diets, focusing instead on the experience of food insecurity, they can be used cross-culturally and the FIES and HHS have been validated to show this ([Cafiero et al., 2016](#); [Ballard et al., 2011](#)).

## Strengths

- Measuring food insecurity with experience-based scales can be relatively inexpensive and quick to conduct and analyze
- Experience-based food insecurity scales capture the psychosocial and behavioral manifestations of insecure food access effects even when measurable clinical signs of prolonged hunger, under- or over-nutrition are absent
- Such scales are relatively easy for policy makers to interpret and understand

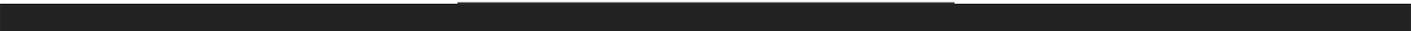
## Weaknesses

- Food insecurity experience scales are intended for population-level use only, and should not be used, for instance, to screen households for program eligibility

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End of Data Source / Method: Experience-based Scales

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## FAO/WHO Global Individual Food consumption data Tool

### Highlights

- FAO/WHO GIFT is a multipurpose dietary data platform with global coverage.
- FAO/WHO GIFT is a growing open-access platform that will disseminate at least 50 datasets by 2023.
- FAO/WHO GIFT shares harmonized individual quantitative food consumption data in the form of indicators and microdata.

## Summary

To date, individual food consumption data are largely underutilized due to poor dissemination and lack of harmonization. The Food and Agriculture Organization (FAO) of the United Nations, supported by the World Health Organization (WHO), has developed the [FAO/WHO Global Individual Food consumption data Tool \(FAO/WHO GIFT\)](#). FAO/WHO GIFT's mission is to make publicly available existing dietary data (i.e. individual quantitative food consumption data) from all countries around the world, collected through both large nationwide surveys and small-scale surveys ([Leclercq et al., 2019](#)).

FAO/WHO GIFT focuses on dietary data collected through [24-hour Dietary Recalls](#) or [Weighed Food Records](#). These methods collect detailed information on all foods and beverages consumed by individuals and in which quantities ([Gibson, 2005](#); [Baranowski, 2013](#)). This type of dietary data provides important information on the quantity of all foods consumed by different age and sex sub-groups of a study population ([Del Gobbo et al., 2015](#); [Coates et al., 2017](#)). Dietary data have the unique benefit of providing the information needed to compute food-based indicators that are suitably disaggregated to address the needs of different population sub-groups, which in turn inform agricultural and food policies and programs at the global, national and sub-national level. In addition, individual-level food consumption microdata are necessary to perform refined dietary exposure assessment in the area of food safety. In other words, only the use of such microdata leads to exposure assessments that are neither unnecessarily conservative, nor put sensitive sub-population groups unduly at risk.

Dietary data included in the FAO/WHO GIFT platform are post-harmonized with the FoodEx2 classification and a description system. FoodEx2 was first developed by the European Food Safety Authority (EFSA) and later scaled up to the global level with the support of FAO and WHO. FoodEx2 eases the comparability of data from different data sources, and the matching of food intake and food composition data or chemical occurrence data.

Data disseminated through the FAO/WHO GIFT platform are aimed at supporting policy-makers, program planners, NGOs, and other stakeholders in taking informed evidence-based decisions at

the country, regional, and global level in the area of nutrition and food safety.

FAO/WHO GIFT has three main features:

1. **Inventory Map:** The FAO/WHO GIFT platform displays an inventory, presented in the form of a map, in which existing datasets in each country are shown as dots. Each dataset is documented through a metadata report providing a comprehensive description of the data. The inventory map was developed through a joint effort of the Nutrition and Food Systems Division (ESN) of FAO in partnership with the Global Dietary Database at Tufts University and the Nutrition and Metabolism Section at the International Agency for Research on Cancer (IARC), building on their previous work in this field.
2. **Ready to use food-based indicators:** The FAO/WHO GIFT platform provides high quality and easy to understand food-based indicators in the area of nutrition and food safety. These indicators are presented in the form of infographics to ensure that users with varied levels of scientific literacy can benefit from the data.
3. **Microdata download:** End-users such as food safety, agriculture, and nutrition experts may need access to the harmonized dietary data in order to derive more specific information. FAO/WHO GIFT is the first global database allowing users to download harmonized dietary data in the form of microdata.

## Strengths/Weaknesses

Strengths:

- FAO/WHO GIFT is constantly being updated and aims at achieving global coverage
- Suitable for both expert and non-expert users
- All datasets are harmonized with the same food classification and description system (FoodEx2)
- FAO/WHO GIFT allows users to download microdata free of charge for further analysis

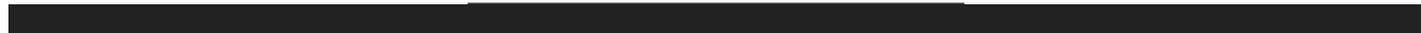
Weaknesses

- Some of the datasets available in the platform are small scale datasets which are representative of a very limited geographical area (sometimes a village)
- Datasets from different countries or areas, although post-harmonized, were collected following different methodological protocols and hence are not fully comparable

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End of Data Source / Method: FAO/WHO Global Individual Food consumption data Tool

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## Food Balance Sheets (FBS)

### Highlights

- Food Balance Sheets (FBS) are useful to illustrate long-term trends in national food supplies and are a free, publicly available data source for almost all countries dating back to 1961.
- FBS include information on the food supply and its utilization at the national level for primary and processed commodities.
- FBS data cannot be disaggregated to determine the distribution of food available for consumption spatially, seasonally, or by demographic characteristics.

## Summary

Food Balance Sheets (FBS)—also referred to as national food accounts, supply/utilization accounts, food disappearance data, or food consumption level estimates—are developed by the Food and Agriculture Organization (FAO) of the United Nations in conjunction with national statistics offices. FBS are commonly used data to estimate food supply and its utilization at the national level (FAO, 2001). Foods tracked through the FBS include both primary commodities (e.g. wheat, rice, fruit, vegetables) and a number of processed commodities (e.g. vegetable oils, butter).

FBS data present a comprehensive picture of the pattern of a country's food supply and show the sources of supply and utilization for each food item (FAOSTAT, 2018). The equation for the calculation of total food supply (food available for consumption), is as follows:

**Food available for consumption = starting stocks + (quantity imported + quantity produced) – (quantity exported + seed + animal feed + waste + other non-food uses) - ending stocks** (FAO, 2001).

Data on non-commercial food production and detailed information on processed foods are not available in FBS (Coates et al., 2012). Fewer than 100 foods are accounted for in FBS, limiting the level of detail available (Grünberger, 2014). Given the limited level of specificity of foods in FBS it can be difficult to match these food items with food composition databases (FCDB) in order to calculate nutrient availability in the food supply. However, FAO provides information on per capita energy, protein, fat and carbohydrates by matching data to food composition database. In addition, several efforts have been made to match FBS to energy, macronutrients, and a full range of vitamins and minerals (e.g. Smith et al., 2016).

FBS report food *available* for consumption at the aggregate, national level and do not directly measure food consumption by households or individuals. Therefore, FBS data cannot be disaggregated to determine the distribution of food consumption spatially, seasonally, or by

demographic characteristics. Despite some of the limitations of FBS data, one of their key strengths is that they are a free, publicly available data source for almost all countries dating back to 1961 for most variables. FBS data can be accessed through [FAOSTAT](#).

## Strengths:

- Standardized data that allow for comparisons over time
- Provides proxy information on trends of population-level consumption patterns based on food available for consumption in food supply
- Easy to access and analyze, as it is publicly available and free to use through [FAOSTAT](#)
- Data available for over 245 countries and territories; collected every year starting in 1961 (presented as three-year averages)

## Weaknesses:

- Limited specificity foods and processed foods, which prevents nuanced analyses of food supply composition
- Limited specificity of foods and processed foods also hinders making accurate links to food composition databases to assess nutrient availability of the food supply.
- [FAOSTAT](#) is updated annually but there is an approximately three-year lag in reporting
- Quality and coverage vary across countries and commodities
- Non-commercial or subsistence production not usually included

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End of Data Source / Method: Food Balance Sheets (FBS)

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## Food Composition Databases

### Highlights

- Food Composition Databases (FCDB), also referred to as Food Composition Tables (FCT), are data that provide the nutritional content of foods.
- FCDBs are a required input in order to convert foods from food consumption data to nutrient intakes.
- Due to limited funding support for FCDBs the tables are often missing data for key foods or lacking valid analytical data for key nutrients.

## Summary

Food Composition Databases (FCDB)—sometimes also referred to as Food Composition Tables (FCT) if in printed or PDF format—are collections of data on the nutritional content of foods. They are derived from quantitative analyses of representative samples of foods ([Gibson, 2005](#)). FCDBs have multiple uses, including for nutrient analysis of foods from dietary consumption surveys, nutrition labeling, and to inform nutrition-sensitive agricultural policies ([Charrondiere et al., 2011](#)). The [Food and Agriculture Organization](#) (FAO) is the global coordinator of the [International Network of Food Data Systems](#) (INFOODS), through which it compiles a directory of national, regional, and international FCDBs that can be useful to those interested in analyzing food and nutrient availability and consumption, food fortification or supplementation programs ([Greenfield & Southgate, 2003](#)). In addition, FAO/INFOODS produces guidelines for [developing FCDBs](#), [food matching](#), and [converting food data](#) (FAO/INFOODS, 2018).

FCDBs are sometimes available online, but not always. [FAO/INFOODS](#) provides contact information and links to country and regional FCDBs. In addition, the [ILSI Research Foundation](#) has created the [World Nutrient Databases for Dietary Studies](#) (WNDDS), which catalogues 90 electronically available FCDBs and provides detailed information about each one. Electronic access to these data means that the information can be quickly updated, they contain a greater volume of material, and they are readily available for users with internet access ([Greenfield & Southgate, 2003](#)). Additionally, online FCDBs make it easier for the information to be reformulated according to the needs of various users.

While some low- and middle-income countries have national FCDBs, they often contain data that is several decades old and/or rely on information that is from another country's FCDB. This is due to the expense and time-intensive nature of analyzing or gathering nutrient composition data ([Greenfield & Southgate, 2003](#)). Frequently, borrowed food composition data comes from the USDA and EU FCDBs, or from other countries in the region and regional FCDBs ([Coates et al., 2017](#)). However, nutrient contents of foods can vary due to environmental factors, production, and processing and thus can differ from one country to the next and even within countries ([Greenfield & Southgate, 2003](#)).

). Rapid food processing advancements and globalized food systems can challenge the task of keeping FCDBs both up-to-date and specific to the locale ([Thompson & Subar, 2013](#)). These various issues may result in decreased precision when it comes to identifying the nutrient content in a given food.

Given the complexity of FCDBs, adequate training on food composition data use is recommended, to comprehend and use the data. One recommended resource is the FAO e-learning course on food composition data ([Food Composition Data E-learning Course, 2013](#)).

## Strengths:

- Food composition data have a wide variety of uses, including matching foods with nutrients from dietary assessment data in order to conduct analyses, nutrition labeling, policy making, and nutrition-sensitive agriculture
- Well-developed national FCDBs can offer a picture of the types of food available and consumed
- When FCDBs are paired with dietary consumption data, researchers are able to answer questions about nutrient adequacy in a population

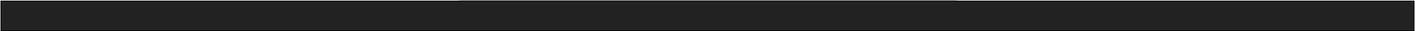
## Weaknesses:

- Differences in the development of FCDBs (e.g. nutrient calculations and sampling) can reduce comparability of nutrient data for specific foods across databases
- Adequate training on food composition data use is recommended to comprehend and use the data in FCDBs
- Food composition data that are outdated or from other countries are sometimes relied upon to update the national FCDBs of low- and middle-income countries

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End of Data Source / Method: Food Composition Databases

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## Food Frequency Questionnaires (FFQ)

### Highlights

- Food Frequency Questionnaires (FFQ) are a method for collecting dietary data and use a context-specific food list to estimate the usual diet and understand the relationship between consumption patterns and health outcomes.
- Data from FFQs are advantageous for measuring consumption of specific foods or specific nutrients consumed by a given population.
- Because FFQs do not typically weigh foods or quantify using household utensils, they tend to not be as accurate as other quantitative dietary assessment methods (e.g. [24-hour Dietary Recalls](#) and [Weighed Food Records](#)).

### Summary

Food Frequency Questionnaires (FFQ) are a type of dietary assessment instrument that attempts to capture an individual's usual food consumption by querying the frequency at which the respondent consumed food items based on a predefined food list. Given that food lists are culturally specific, FFQs need to be adapted and validated for use in different contexts ([Thompson & Subar, 2013](#)).

FFQs are a common method for measuring dietary patterns in large epidemiological studies of diet and health. FFQs are often limited to the food items that are a source of nutrients related to the particular dietary exposures under study, for example, fruit and vegetable consumption or foods with high levels of saturated fat. Dietary diversity scores are a type of metric that are often calculated from a simplified FFQ (see the description of [Dietary Diversity](#) metrics to learn more). Food consumption modules of [Household Consumption and Expenditure Surveys](#) (HCES) that use a food list and an extended recall period can also be considered a type of FFQ.

In general, FFQs rely on a longer recall period in order to capture foods that are not consumed every day but are still part of the individual's typical diet. FFQ recall periods vary greatly, but typically range from 7 to 30 days (although some are as long as one year). A drawback is that recall bias may increase with longer periods of recall ([Coates et al., 2012](#)). However, these measures of 'usual intake' are a more valid indicator of the relationship between diet and health outcomes than those capturing only a single 24-hour snapshot of the diet ([24-hour Dietary Recalls](#) can only provide information on usual intake if data are collected from respondents on multiple non-consecutive days). Longer FFQs can better assess total diets, but shorter FFQs have higher response rates and lower respondent burdens ([Thompson & Subar, 2013](#)).

FFQs typically collect information on the frequency of consumption but not necessarily on the quantity consumed. When FFQs do include questions about quantity consumed it is typically based on standard portion sizes, rather than direct weight or use of household utensils. Therefore,

FFQs are not as accurate as other quantitative dietary assessment methods (e.g. 24-hour Dietary Recall) (Coates et al., 2012). Additional measurement error is introduced when food lists are not specific to the studied population, when questionnaires use inconsistent or imprecise portion sizes (Shim et al., 2014), or when the food lists are not granular enough to make an accurate match to a food composition table for deriving nutrient content of the diet. Because food lists are developed with a specific population in mind, it can be difficult to accurately compare results across populations (cultures or countries) with different dietary patterns.

### **Strengths:**

- Better at estimating 'usual diet' due to longer recall period than the 24-hour Dietary Recall or 24-hour Weighed Food Records
- Captures individual-level dietary patterns
- FFQs can be easier and less time-consuming to implement than a 24-hour Dietary Recall, if the food list is relatively short (e.g. <100 items)

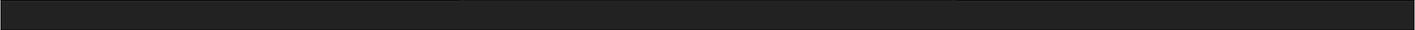
### **Weaknesses:**

- FFQs require substantial up-front investment to develop and validate the instrument (food list and quantities) for a given context or country.
- Usual frequency of intake is prone to measurement error, particularly with recall periods longer than seven days (and usual portion size questions are prone to measurement error)
- If the FFQ is too long it can be more time consuming to administer than a standard 24-hour Dietary Recall and cause respondent fatigue
- Like most surveys, to capture seasonal variation data collection must span the entire year or be repeated in multiple seasons

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End of Data Source / Method: Food Frequency Questionnaires (FFQ)

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## Household Consumption and Expenditure Surveys (HCES)

### Highlights

- Household Consumption and Expenditure Surveys (HCES) are complex surveys conducted on a nationally representative sample to characterize important aspects of household socioeconomic conditions including food acquisition and/or consumption.
- HCES, while traditionally used for poverty monitoring among other things, are increasingly being used for food security and nutrition-related analyses.
- Due to the heterogeneity of HCES across countries, it is important to understand some of the key differences before using data from the food consumption module for food security and nutrition purposes.

## Summary

Household Consumption and Expenditure Surveys (HCES)—also referred to by a variety of other names including Household Income and Expenditure Surveys (HIES), Household Budget Surveys (HBS), or Living Standards Measurement Surveys (LSMS)—are complex surveys conducted on a nationally representative sample to characterize important aspects of household socioeconomic conditions (Coates et al., 2012). Typically, HCES are conducted every 3-5 years in a range of countries and cover 7,000 to 20,000 households to provide a statistically representative sample (Fiedler et al., 2012). Most HCES are implemented by national statistical agencies, often with technical assistance from the [World Bank's Living Standard Measurement Study \(LSMS\) group](#).

The results of HCES have wide-ranging utility. Their primary purpose is to provide information for poverty monitoring, the calculation of national accounts, and as an input for consumer price indices (Smith et al., 2014). However, there is increasing interest in using the food consumption module from HCES as a source of nationally representative data for assessing food security and nutrition. Furthermore, HCES collect a wide range of data on determinants and outcomes (e.g. socioeconomic status, education), potentially enriching food security and nutrition analyses. Based on existing research there is wide consensus that HCES, with carefully designed consumption modules, are a valuable source of data for household-level food security and nutrition measurement (Russell et al., 2018; Zezza et al., 2017).

One of the major drawbacks of using HCES is that the consumption modules are heterogeneous across countries, which means that not all HCES data lend themselves to the same food security and nutrition analyses, and comparisons across countries can be inaccurate. Some of the key ways in which the consumption modules differ across surveys include: 1) the length of the recall period; 2) whether data are collected for acquisition, consumption, 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). For example, if the food consumption module has a short food list with aggregated items making it difficult to match with a food composition database, excludes food away from home, and has a long recall period (>14 days) then the consumption module may not be adequate for measuring certain food security and nutrition indicators, such as total household-level calorie availability.

While the 'C' in HCES stands for 'consumption', HCES collect data on acquisition, consumption, or both. While consumption data refers to the food consumed by the household, acquisition data refers to the food acquired through purchases, own-production, and in-kind. Acquisition data serve as a proxy for food consumption, as households may build food stocks or consume food stocks during the reference period, as compared to consumption, which collect data on food consumed in a specified period. This is an important point because some foods (e.g. grains) are not perishable and can be stored, therefore some households may be drawing down stocks acquired to meet current consumption, while other households may be accumulating stocks that will be consumed after that period (Smith et al., 2014). Another type of HCES collects a combination of acquisition and consumption data, wherein households report what they acquired through purchases and what they consumed from own-production and transfers (Smith, 2003). Food consumption estimates generated from acquisition data or a combination of both acquisition and consumption data are typically referred to as 'apparent consumption' in the literature to distinguish from actual consumption (Fiedler & Mwangi, 2016).

The World Bank Microdata Library has the most comprehensive and publicly accessible repository of HCES data. Data also can be accessed—often for a fee—from countries' National Statistics Office, though each country has its own policies and procedures regarding data sharing. The International Household Survey Network (IHSN) is an informal network to promote data standards and dissemination where additional information (e.g. survey catalogs, guidelines, and software) on existing HCES can be found (IHSN, 2018).

## Strengths:

- Typically nationally representative and sometimes representative at provincial and district levels
- Typically collected every 3-5 years, allowing for an examination of trends
- Food consumption data from HCES are an important source of information on food security and nutrition
- Include a wide range of data on determinants and outcomes (e.g. socioeconomic status, education), enabling various analytical options.

## Weaknesses:

- Due to issues with the structure of some consumption modules (e.g. no information on food consumed away from home), the data may not be useful for certain food security and nutrition analyses
- Some HCES only measure 'apparent consumption' (based on acquisition data), not actual consumption
- The food list is not always designed with the level of detail needed to make exact matches

between the food items in the food list and a food composition database

- Recall periods in HCES vary from 1 to 365 days, with long recall periods (>2 weeks) raising concern about reliability and recall bias
- Household-level data from HCES do not allow for measurement of individual-level food security and nutrition indicators
- Many HCES do not capture seasonal variation

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End of Data Source / Method: Household Consumption and Expenditure Surveys (HCES)

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## Weighed Food Record (WFR)

### Highlights

- Weighed Food Records (WFR) provide quantitative information on individual diets and are considered a "gold standard" for dietary assessment.
- WFR are often used for the relative validation of other dietary assessment methods such as Food Frequency Questionnaires and 24-hour Dietary Recalls.
- Due to the high cost and time investment of WFR, they are more frequently used to collect data for small, non-representative samples.

## Summary

Weighed Food Records (WFR), also called weighed food diaries or simply weighed records, are considered the "gold standard" of individual quantitative dietary assessment methods (Carlsen et al., 2010). WFR require the respondent or enumerator to weigh all foods and beverages at the time of consumption (rather than asking respondents to recall their consumption, as is done in the 24-hour quantitative recall, or 24HR). Any plate waste must also be recorded, as well as a description of the food along with preparation methods and brand names.

Though no dietary assessment methodology can completely prevent measurement error, WFR are often considered the most precise method when it comes to quantifying food intake, since each food is weighed, eliminating issues associated with portion size estimation through recall. As a result, the high degree of accuracy produced by WFR means they are often used as the reference method in validation studies of other dietary assessment methods (e.g. Alemayehu et al., 2011; Nightingale et al., 2016).

If working in a low- or middle-income country with low literacy levels the presence of a trained enumerator in the household is typically required throughout the period being assessed, from the time the first food or beverage is consumed in the morning to when the last one is consumed at night. When using WFR to collect dietary data, enumerators must be carefully trained to standardize measurement, instrument calibration, and interviewing methods in order to reduce measurement error. While enumerator-administered WFR provide very accurate estimates of dietary intake, they can be intrusive and time-consuming, as well as potentially distort the behavior of respondents' due to the presence of an enumerator throughout the day (Ortega et al., 2015).

Furthermore, administering a WFR can be difficult in populations where people are out of the home for all or most of the day (e.g. urban areas or school age children), as the enumerator would have to accompany respondents throughout the day. If the population of interest is literate, then a food diary or self-administered WFR could be used, in which the respondent weighs and records all of the foods and beverages consumed over a specified period (e.g. 24 hours). Due to the

expense and small sample size of most WFR collections, care must be taken to ensure that the sample is representative of the studied population ([Wrieden et al., 2003](#)).

## Strengths:

- Offer a high degree of accuracy in assessing food and nutrient intake relative? to other recall-based dietary assessment methods
- Provide quantitative estimates of individual food consumption and nutrient intake
- Take into account preparation methods and the effect on estimated nutrient content
- Applicable to diverse groups with a wide range of dietary patterns

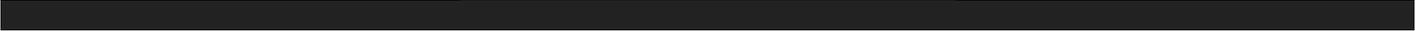
## Weaknesses:

- Significant training is required to minimize errors in data collection
- Data are frequently collected from small samples that are not nationally representative
- Enumerator-administered WFR are intrusive and can distort respondent behavior
- Like most surveys, to capture seasonal variation data collection must span the entire year or be repeated in multiple seasons

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End of Data Source / Method: Weighed Food Record (WFR)

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## World Food Programme (WFP) Vulnerability Analysis and Mapping (VAM)

### Highlights

- The Vulnerability Analysis and Mapping (VAM) of the World Food Programme (WFP) provides publicly available food security data.
- Data include market prices for commodities, select calculated food security indicators, dynamic maps, and food security reports at the national, administrative, and market levels.

## Summary

The [Vulnerability Analysis and Mapping \(VAM\) platform](#) is a central source of food security monitoring data and analysis managed by the [World Food Programme \(WFP\)](#). The platform offers multiple products that allow users to visualize and download data on commodity prices and calculated food security indicators, such as the [Food Consumption Score \(FCS\)](#). In addition, users can access timely geospatial, economic, and food security situational analyses produced by VAM analysts that can offer additional context and insight into a country's current food security situation.

Two WFP VAM products that are particularly useful for calculating indicators included in the Data4Diets platform include the Economic Explorer and the mVAM Databank. The [Economic Explorer](#), a tool included in the [VAM Data Visualization Platform](#), allows users to visualize and download commodity price data at the country and market levels over time (month and year). The [mVAM Databank](#) provides the [FCS](#) for select countries, using data collected via mobile technology.

## Strengths:

- Contains up-to-date, open data supplemented by dynamic visualizations that allow users to perform preliminary analysis within the platform and download charts as .png files
- Provides monthly and annual data on commodity prices at country and market level
- Multiple types of data and analytic reports provide detailed food security and economic context within individual countries, administrative districts, and markets

## Weaknesses:

- The market data available across commodities, dates, or level of collection is not consistent between countries, which limits inter-country comparability
- mVAM Databank with the [FCS](#) is only available for a select number of countries, and not all countries included have multiple years of data available

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# Food Security Indicators

42 results

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INDDEx Data4Diets

## Consumer Food Price Index

### Overview

Consumer food price indices (CFPIs) are one of several types of market-level indices included in Data4Diets, along with [food price volatility indices](#) and various [food affordability metrics](#). Consumer food price indices use market data to measure food inflation rates (i.e., price changes) over time compared to a reference period of an average basket of commonly consumed foods. Unlike consumer food price indices, general consumer price indices are broader-based and include both food and non-food items in the basket of goods.

Most countries calculate CPIs and CFPIs on a regular basis. The [International Monetary Fund \(IMF\)](#) and OECD (for OECD countries) are responsible for compiling and harmonizing national CPIs, both general and food-specific, into a database. Monthly harmonized country and regional CPI data are reported for 200 countries in a time series beginning in 2000 and are updated in [FAOSTAT](#) quarterly.

### Method of Construction

The construction of national consumer food price indices differs by country, with variability in factors such as the food basket composition, weighting approaches, geographic reference area, and method of aggregation. Country-specific information on the construction of general and food CPIs is available [here](#). The methodology for consolidating and reporting CPIs at the regional level in FAOSTAT, including imputing missing data, can be found [here](#). Further information on how to calculate consumer food price indices is presented in Chapter 8 of the Consumer Price Index Manual, "Calculating Consumer Price Indices in Practice" ([ILO, 2020](#)).

### Uses

Consumer food price indices are used by countries to monitor food inflation, inform monetary policy, track poverty, and determine thresholds for social protection program eligibility and benefit size, among other uses. Because this indicator is calculated based on a basket of food goods, the underlying disaggregated data would be needed if the desire is for insight into the prices of particular food groups or individual commodities.

### Strengths and Weaknesses

One strength of the food CPI data available through [FAOSTAT](#) is that it has been standardized for comparison. While the FAOSTAT interface allows for inter-regional and country comparisons, caution must be taken in comparing among regions and countries due to the aforementioned differences in the calculation of national food CPIs.

## Data Source

In addition to the databases described above, country-specific consumer food price data and indices are available directly from many national statistical agencies. [The Food Price Monitoring and Analysis \(FPMA\) Tool](#) developed by the FAO also provides data on domestic market prices of food commodities in member countries.

### Links to guidelines

- [IMF, ILO, Statistical Office of the European Union \(Eurostat\), United Nations Economic Commission for Europe, Organisation for Economic Co-operation and Development, The World Bank. \(2020\) Consumer Price Index: Concepts and Methods](#)
- [FAO. No date. Country-specific food CPI calculation method.](#)

### Food Security Dimensions

- Stability

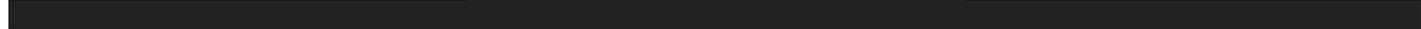
### Food Composition Database Required?

No

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End of Indicator: Consumer Food Price Index

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## Cost and Affordability of a Healthy Diet (CoAHD)

### Overview

Approximately 3.1 billion people cannot afford a healthy diet (FAO, 2020). Quantifying economic access to a nutritionally high-quality diet is a critical step in developing policies to enable affordable, healthy food for all. The Cost and Affordability of a Healthy Diet (CoAHD) is a metric developed by the [Food Prices for Nutrition Project](#), led by researchers at Tufts University in collaboration with the World Bank and IFPRI. The metric yields actionable information on the cost of healthy diets in countries around the world and the extent to which populations can afford to consume these diets.

The CoAHD is a type of food affordability measure, and is one of several market-level metrics included in [Data4Diets](#), along with [food consumer price indices](#) and [food price volatility metrics](#). There are several ways of determining food affordability. According to a [scoping review](#) conducted by the Global Alliance for Improved Nutrition (GAIN), food affordability can be measured based on income, social safety net assistance, and household expenditures (Djimeu et al., 2022). The Economist reports annually on food affordability at the country level as a dimension of its [Global Food Security Index](#) (GFSI), with metrics that include: changes in food costs reported through food consumer price indices, population under the poverty line, and inequality-adjusted income.

Among the newest and, increasingly, most impactful, approaches to quantifying food affordability is the suite of metrics developed by the [Food Prices for Nutrition \(FPN\) Project](#). These metrics include the Cost and Affordability of a Healthy Diet (CoAHD), which is now reported annually in the [SOFI report](#) along with other food security measures (FAO, IFAD, UNICEF, WFP, WHO, 2023). Other metrics in the suite developed by the FPN examine the cost and affordability of a nutrient-adequate (CoNA) diet and an energy-sufficient diet measured by the cost of caloric adequacy (CoCA), considered of lesser overall diet quality than the healthy diet modeled in the CoAHD.

### Method of Construction

The cost of a healthy diet is the monetary cost of purchasing, at current PPP\$/person/day, the least expensive foods that are locally available and meet the food-based dietary guidelines (FBDGs) and the energy requirements of a person at a value of 2330kcal/day. The affordability of a healthy diet is then measured as the ratio of the cost of a healthy diet to the \$1.12 food poverty line (52% of the international poverty line of \$2.15/day in 2017 PPP\$) ([World Bank](#)).

The CoAHD indicators draw information from four data sources ([FPN](#)):

- Consumer prices of food items in the local market
- Food composition of each food item to determine their nutrient contribution
- Daily requirements for health that the food items can meet
- Household income or similar data such as wages to determine the affordability of the food items

Additional details of the methodology used to compute these metrics can be found in [Herforth et al \(2023\)](#).

## Uses

The CoAHD provides useful information on the proportion of the population that can purchase a least-cost healthy diet given their income and the price of food available in local markets. It is a useful indicator to monitor and model the effects of food price variations on populations' healthy diet access across space and over time, including as the result of policy changes or various shocks such as conflict or pandemic disease that could be expected to affect consumer access to healthy foods.

## Strengths and Weaknesses

The CoAHD fills a big gap by providing context-specific affordability information for a healthy diet across 174 countries. A strength of this set of metrics is that it is relatively easy and inexpensive to develop and update as it usually pulls from existing, frequently updated, market-level data as opposed to household-level data or individual-level data that are typically collected less frequently.

Because the CoAHD indicator is typically (though not necessarily) calculated from secondary data aggregated across many data points, the accuracy and timeliness of the metric is dependent on the quality and availability of the underlying data, and data quality issues may not be apparent to users of the index.

## Data Source

The [Food Prices for Nutrition DataHub](#) is a resource housed by the World Bank that provides openly accessible data at the country level on the cost and affordability of healthy diets. Data on the availability and price of food are sourced from the [International Comparison Program \(ICP\)](#). These data are then combined with data on nutrition requirements, food composition, and available income to construct the CoAHD and related indicators that can be accessed through the DataHub.

### Links to guidelines

- [Food Prices for Nutrition. Software tools for calculating the Cost of a Healthy Diet. 2023.](#)
- [Herforth, A., Holleman, C., Bai, Y. & Masters, W.A. \(2023\). The cost and affordability of a healthy diet \(CoAHD\) indicators: methods and data sources.](#)

### Food Security Dimensions

- Quantity
- Quality
- Stability

Food Composition Database Required?

Yes

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End of Indicator: Cost and Affordability of a Healthy Diet (CoAHD)

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## Depth of Food Deficit

### Overview

The indicator that measures the depth of food deficit (kcal/capita) represents the average per capita amount of additional energy (kcal) needed for undernourished individuals to meet the Average Dietary Energy Requirement (ADER) (FAO, 2000). This indicator is derived from the Prevalence of Undernourishment (PoU) indicator (Cafiero, 2014).

### Method of Construction

Moltedo et al., (2014) described the calculation of the depth of food deficit indicator as follows:

"The average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide an estimate of the total food deficit in the country and is then normalized by the total population. This usually is within the range of 100–400 kilocalories per day. When it is lower than 200 kcal, it is considered low; between 200 and 300, moderate; and above 300 kcal, high." (p.155)

Two sources of information can be used to obtain estimates of the depth of food deficit, or to approximate the per capita daily average dietary energy consumed in the population, which is one of the parameters needed to estimate the PoU:

- The Dietary Energy Supply from the Food Balance Sheets (FBS) and the three-year moving average of the depth of food deficit as part of the Suite of Food Security Indicators can both be accessed on the FAOSTAT website under the "Data" tab.
- Alternatively, the food consumption data collected in Household Consumption and Expenditure Surveys (HCES) can be used to estimate the depth of food deficit. It is one of several indicators included in the ADePT-FSM (Food Security Module) software package, a free standalone software developed by FAO and the World Bank that allows users to derive food security indicators from household survey data. The software download and corresponding documentation can be found on the FAO website. The Moltedo et al. (2014) book published by the World Bank discusses the depth of food deficit indicator (pages 59-60) and provides instructions for analyzing food security using household survey data, and Moltedo et al 2018, which offers instructions for using ADePT-FSM to generate diet-related indicators from household data.

### Uses

The depth of food deficit is useful for problem identification, advocacy, and global and national monitoring. It is often used by researchers and practitioners to understand the degree of food insecurity in a country. Because it is available in the FAOSTAT Suite of Food Security Indicators for nearly all countries, it can be used to compare the severity of food deficit across multiple

countries ([Reddy et al., 2016](#)).

## Strengths and Weaknesses

The depth of food deficit is a cost-effective way to understand trends in food insecurity over time and across countries. This indicator does not measure dietary quality but represents the severity of dietary energy inadequacy.

Provided the HCES data that were used to estimate the PoU are representative at the subnational level, it is possible to disaggregate the depth of food deficit indicator below the national level. Not all HCES data are publicly available and easily accessible, and HCES data are typically collected only every 4-5 years.

The depth of food deficit indicator is also derived from PoU using FBS data from FAOSTAT. These data are publicly accessible and collected on an annual basis since 1961, but cannot be disaggregated sub-nationally, or at periods shorter than one year. When FBS data are used, the indicator will not capture intra-annual seasonality, price spikes, or other short-term shocks to the food system ([Cafiero, 2014](#)).

## Data Source

The depth of food deficit derives from the PoU, and the PoU is derived from daily per capita average dietary energy consumption. The latter can be estimated from the dietary energy supply variable from FBS or using food consumption data from HCES. FBS from FAOSTAT are already paired with food composition data by FAO. When using HCES data, the user matches foods to nationally relevant food composition data to produce energy values.

Several types of underlying data are needed to estimate the depth of food deficit indicator. Energy requirements are based on normative data on the population's age and sex structure, height, and physical activity level. The coefficient of variation, a measure of how food is distributed within the population, is informed by HCES survey data.

### Links to guidelines

- [Lele et al., \(2016\). "Measuring Food and Nutrition Security: An Independent Technical Assessment and User's Guide for Existing Indicators."](#)
- [Moltedo et al., \(2018\). Optimizing the use of ADePT-Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)
- [Moltedo et al., \(2014\). Analyzing Food Security Using Household Survey Data: Streamlined Analysis with ADePT Software.](#)

### Food Security Dimensions

- Quantity

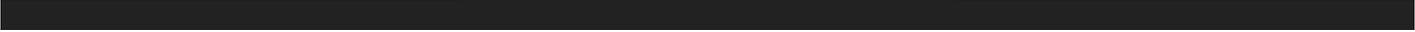
Food Composition Database Required?

No

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End of Indicator: Depth of Food Deficit

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## Diet Quality Index - International (DQI-I)

### Overview

The Diet Quality Index - International (DQI-I) is illustrative of a class of healthy diets metrics, which includes other metrics, such as the [Healthy Eating Index \(HEI\)](#). The DQI-I is highlighted here because it is one of the few indicators that has been validated across a range of cultural contexts with different dietary patterns.

The DQI-I is a composite, individual-level diet quality indicator. Created in 2003, it was the first indicator of healthy diets designed to enable cross-cultural diet quality comparisons ([Kim et al., 2003](#)). The DQI-I is built off existing indicators, such as the HEI and the Diet Quality Index (DQI), but was formulated to incorporate the many aspects of a diet which contribute to quality, including diversity, adequacy, moderation, and balance.

### Method of Construction

The DQI-I was formulated to capture many aspects of diet quality, namely: variety, adequacy, moderation, and balance. The table below summarizes basic information on how the components are defined and scored.

Diet quality component	Grouping of diet quality component	Scoring criteria	Score
Variety - food groups	5 food groups: meat/poultry/fish/egg, dairy/beans, grains, fruits, and vegetables	Each food group awarded 0 or 3 pts. 3 points awarded if at least 1 item from that group was consumed	0-15
Variety - protein sources	6 sources: meat, poultry, fish, dairy, beans, eggs	3 or more sources consumed: 5 pts 2 sources consumed: 3 pts 1 source consumed: 1 pts 0 sources consumed: 0 pts	0-5

Adequacy	8 groups: vegetables, fruit, grain, fiber, protein, iron, calcium, vitamin C	Between 0 and 5 points awarded for each of the 8 adequacy groups, depending on percentage of or Recommended Daily Allowances (RDA) met	0-40
Moderation	6 groups: total fat, saturated fat, cholesterol, sodium, empty calorie foods	Between 0 and 6 points awarded for each of the 5 moderation groups, depending on percentage of RDA met	0-30
Balance	2 groups: macronutrient ratio, fatty acid ratio	Between 0 and 6 points awarded, depending on ratio of macronutrients and between 0 and 4 points awarded depending on ratio of fatty acids	0-10

The DQI-I is calculated by summing each of the five sub-scores together, producing a number between 0 and 100. For more details about scoring, please refer to the "Construction of the DQI-I" section of [Kim et al., 2003](#).

## Uses

The DQI-I is used to assess the diet quality of individuals, and can be used in a variety of cross-cultural settings, making it useful in comparing diets across regions ([Kim et al., 2003](#)). Additionally, this indicator accounts for specific nutrients associated with chronic, diet-related illnesses and includes particular food groupings, such as empty calorie foods, that make it a particularly useful tool for assessing changing diet quality associated with the nutrition transition ([Kim et al., 2003](#)). As an individual-level indicator, it can be linked to individual health outcomes or demographic information ([Yun et al., 2009](#)).

## Strengths and Weaknesses

The main strength of the DQI-I is that it offers greater richness in its definition and evaluation of diet quality than many other composite diet quality indices. For example, the Healthy Eating Index is based solely on food group consumption ([USDA, 2006](#)), and the [DQI](#), the indicator on which the DQI-I is based, touches upon the same four diet quality components, but employs fewer measures and quantifies fewer micronutrients ([Newby et al., 2003](#)).

The DQI-I's weaknesses include the large amount of information required to calculate this

indicator; it is necessary to have multiple days of quantitative diet recall information from each respondent, which is not always feasible given resource constraints. The DQI-I uses weights to proportionally score food based on its assumed nutritional importance and researchers have found that standardized weights may not be applicable in all scenarios (Tur et al., 2005).

## Data Source

The DQI-I must be calculated from quantitative individual-level dietary data. Such data can be obtained from semi-quantitative food frequency questionnaires (FFQ), 24-hour dietary recalls, or weighed food records. Appropriate food composition tables for the context should be used to calculate the nutrient content of foods consumed [see the International Network of Food Data Systems (INFOODS) through the UN Food and Agriculture Organization (FAO) and the World Nutrient Databases for Dietary Studies (WNDDS) from the Agriculture and Food Systems Initiative.

Finally, to calculate the adequacy, moderation, and balance scores, Recommended Dietary Allowance (RDAs) or Reference Nutrient Intake (RNIs) can be obtained from the Institute of Medicine for the United States (IOM, 2006), British Nutrition Foundation for the United Kingdom (British Nutrition Foundation, 2016), and the European Food Safety Authority of the European Union (EFSA, 2017), among others.

### Links to guidelines

- British Nutrition Foundation (2021). Nutrition Requirements.
- European Food Safety Authority (2017). Dietary Reference Values for nutrients Summary report. EFSA Supporting Publications.
- Office of Dietary Supplements—Nutrient Recommendations and Databases. (n.d.-a). Retrieved December 20, 2022.

### Links to validation studies

- Kim et al., (2003). The Diet Quality Index-International (DQI-I) provides an effective tool for cross-national comparison of diet quality as illustrated by China and the United States. The Journal of Nutrition.
- Tur et al., (2005). The Diet Quality Index – International: Is it a useful tool to evaluate the quality of the Mediterranean diet?. British Journal of Nutrition.
- Shin et al., (2015). Dietary patterns and their associations with the Diet Quality Index-International (DQI-I) in Korean women with gestational diabetes mellitus. Clinical Nutrition Research.

### Food Security Dimensions

- Quality

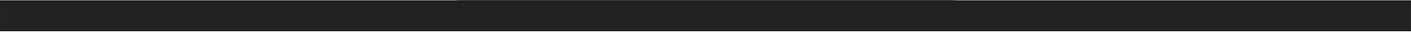
### Food Composition Database Required?

Yes

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End of Indicator: Diet Quality Index - International (DQI-I)

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## Dietary Energy Supply

### Overview

The dietary energy supply (kcal/capita/day) is an indicator calculated at the national level that serves as an estimate of the amount of calories from foods available for human consumption. This indicator does not yield any information on the affordability, access, or consumption of dietary energy by different population groups within a given country, which means that sufficient national supply does not ensure sufficient dietary energy consumption by nutritionally vulnerable groups. Nevertheless, it can be useful for determining whether a country's food supply contains enough dietary energy to meet aggregate population needs, and whether measures need to be taken to improve the amount of dietary energy available for the population.

This indicator can be accessed through FAO's FAOSTAT website. FAOSTAT contains national-level Food Balance Sheet (FBS) data, which are used to compute Dietary Energy Supply. Additional indicators in the Data4Diets platform related to quantity of the food supply that also use FBS data include depth of food deficit and national dietary energy available from non-staples, among others. Alternatively, if users are interested in calculating a similar measure but with household-level data, they should refer to the household dietary energy consumption indicator which relies on Household Consumption and Expenditure Survey (HCES) data.

### Method of Construction

This indicator can be accessed on the FAOSTAT website by selecting the Data tab and then selecting "Food Balances (2010-)" or "-2013, old methodology" under the "Food Balances" heading (depending on the time period of interest). Users can view and download the indicator data for a given country and year (or span of years) by selecting "Food supply (kcal/capita/day)" under the *Elements* section and selecting "Grand Total + (Total)" under the *Items Aggregated* section.

FAO calculates the national estimate of total food supply using data from a number of sources, including government agencies, marketing authorities, and industrial/manufacturing surveys, among others (FAO, 2001). This national estimate is derived from the sum of the elements of quantities of food from supply (production, import, and stock variation) minus the elements of quantities of food from utilization (export, manufacturing, feed, seed, waste, and other uses) for each commodity, expressed in raw equivalent. FAOSTAT converts the quantity of food to the dietary energy content of the edible portion of each type of food available for human consumption. This value is then divided by the population size and by 365 days to calculate the per capita daily dietary energy available for human consumption. This calculated value (kcal/capita/day) is available from FAOSTAT for individual food items and food groups as well as for the total food supply.

### Uses

When data from individual dietary surveys or household surveys are unavailable, this indicator serves as a proxy for national dietary energy consumption ([FAO, 2017](#)), though technically it is not an indicator of intake but rather an indicator of food available for consumption. Because these data are available annually for nearly all countries, it is a useful indicator for cross-country comparisons and analyses of trends over time within a country. When the dietary energy supply is disaggregated by food groups, the share of total dietary energy supply from each food group can offer a snapshot of the nutritional quality of the food supply.

This indicator also serves as the basis for other indicators of food security and nutrition, such as the Average Dietary Energy Supply Adequacy (ADESA) indicator ([Lele et al., 2016](#)), the [Prevalence of Undernourishment](#), and the [depth of food deficit](#) indicator.

## Strengths and Weaknesses

One benefit of this indicator is that it is available for more than 170 countries dating back to 1961. The data are regularly updated by FAO using a common methodology. The country-level data are provided by national governments and are centrally located on the [FAOSTAT](#) website.

A weakness of this indicator is that it does not reflect actual energy consumption but rather energy availability. In addition, since the indicator is a national-level estimate, it cannot be disaggregated by age or sex, or by any geographic scale smaller than the national level, nor does it capture disparities in dietary energy availability (or consumption) across population groups or seasons, as is possible with individual- or household-level dietary data. This indicator is limited to the foods that appear in the [FBS](#) and therefore does not capture all possible sources of dietary energy (e.g. insects or wild foods).

Although the [FBS](#) accounts for food wasted along the food chain, it does not account for losses incurred at the retail distribution level, plate waste, or other non-food uses at the household or individual level ([Lele et al., 2016](#)), and stock variations are not accurately captured.

## Data Source

The main source of data for this indicator is the FAO [FBS](#) data on the [FAOSTAT](#) website, which disaggregates elements of utilization and supply, and estimates total food available for human consumption. FAO pairs this information with food composition data to produce information on the national supply of energy and macronutrients (per capita/day). In addition, [Household Consumption and Expenditure Surveys](#) (HCES) could be used to calculate a similar indicator, such as [household average dietary energy consumption](#). Alternatively, [24-hour Dietary Recall](#) or [Weighed Food Records](#) could be used to calculate [total individual energy intake](#).

### Links to guidelines

- [FAO, \(2001\). "Food Balance Sheets: A Handbook."](#)

### Links to case studies

- [Using Food Balance Sheets in Cameroon to Determine the Healthfulness of the National Food Supply](#)

#### Food Security Dimensions

- Quantity

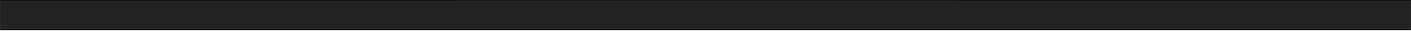
#### Food Composition Database Required?

No

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End of Indicator: Dietary Energy Supply

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## Dietary Exposure Assessment Indicators

### Overview

With an estimated 600 million cases of food borne illnesses annually, unsafe food is a threat to human health and economies globally. Food-borne diseases cost at least US\$100 billion in low- and middle- income countries (LMIC) each year, with 28 countries having losses exceeding US\$500 million, according to a recent World Bank study ([World Bank, 2018](#)). The Second International Conference on Nutrition (ICN2) held in 2014 stressed the link between food safety and human nutrition and the key role of food safety in achieving the Sustainable Development Goals ([WHO, 2017](#)). The first global study on the Food-borne Disease (FBD) was conducted by the Food-borne Disease Burden Epidemiology Reference Group (FERG) of the World Health Organization (WHO) and found that a considerable proportion of this burden of FBD falls on LMICs ([Havelaar et al., 2015](#); [Gibb et al., 2015](#); [Gibb et al., 2018](#)). Still, estimating the overall impact of food safety hazards in LMICs with the desired confidence is especially challenging as good quality data are not frequently available.

Risk assessments follow a four-step method: hazard identification, hazard characterization, exposure assessment, and risk characterization ([FAO/WHO, 2018](#)). Dietary exposure assessment is a critical step in risk assessment for microbiological or chemical agents in food ([FAO/WHO, 2009](#); [EFSA, 2011](#)). Dietary exposure is estimated by combining food consumption data with food chemical concentration data. Estimates of exposure can be obtained for the total population (including non-consumers) or for the sub-group who is exposed (consumers). Each consumer's exposure is estimated from his/her individual consumption records and the distribution of these values is compared with the health-based guidance values for the chemical or microbiological agent of concern.

### Method of Construction

**Chronic food consumption:** Average food consumption of at least two non-consecutive reporting days for a given food or group of foods and can be presented as:

- *Grams per day* (total population or consumers only): Estimated by considering the average food consumption of at least two non-consecutive reporting days for a given food or group of foods. Median consumption and high percentiles of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be obtained for the total population and for consumers only; or
- *Grams per kilogram body weight per day* (total population or consumers only): Estimated by considering the average food consumption of at least two non-consecutive reporting days for a given food or group of foods and dividing it by the subject's body weight (in kilograms). Median consumption and high percentiles of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be obtained for the total population and for consumers only.

**Acute food consumption:** Total consumption of a given food or group of foods during a

consumption day or eating occasion. It can be presented as:

- **Grams per day:** Estimated by considering the total daily consumption amount (in grams) of a given food or group of foods during each reporting day. Median consumption and high levels of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be obtained for each of the days covered in the survey or to consumption days only.
- **Grams per kilogram body weight per day:** Estimated by considering the total daily consumption amount (in grams) of a given food or group of foods during one reporting day and dividing it by the subject's body weight (in kilograms). Median consumption and high levels of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be obtained by considering each of the days covered in the survey or consumption days only.
- **Grams per eating occasion:** Estimated by considering the total consumption amount (in grams) of a given food or group of foods during one eating occasion. Median consumption and high levels of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be estimated considering only the eating occasions for which the food has been consumed.
- **Grams per kilogram body weight per eating occasion:** Estimated by considering the total consumption amount (in grams) of a given food or group of foods during one eating occasion and dividing it by the subject's body weight (in kilograms). Median consumption and high levels of consumption (for example 95<sup>th</sup>, 97.5<sup>th</sup>, or 99<sup>th</sup>) can be estimated considering the eating occasions for which the food has been consumed.

**Number of consumers or consumption days:** Displays the number of consumers (for chronic food consumption) or the number of consumption days (for acute food consumption) of a given food or group of foods in the survey.

**Percentage of consumers or consumption days:** Obtained by dividing the number of consumers (for chronic food consumption) or consumption days (for acute food consumption) of a given food or group of foods by the total number of subjects or total number of consumption days (respectively) in the survey.

## Uses

Food consumption combined with chemical occurrence data forms the basis for calculating food safety indicators. To estimate the potential dietary exposure to hazards over long periods, *chronic* food consumption is combined with mean or median occurrence data to perform dietary exposure assessment. On the other hand, food safety indicators based on *acute* food consumption can be used to quantify potential exposure to biological or chemical hazards during a short period in time (i.e. one reporting day or one eating occasion).

## Strengths and Weaknesses

Strengths:

- Estimates are based on age- and sex-disaggregated dietary data that can be combined with occurrence data, which allows the estimation of high percentile of dietary exposure to a variety of sources, whereas this is not possible when only summary statistics are available.
- Availability of age- and sex-disaggregated food consumption data enables dietary exposure

assessment of different population groups.

#### Limitations:

- Small sample size of surveys which are not representative at national level and/or small number of consumers (for rarely consumed foods) decrease the reliability of the estimates, in particular estimates of high levels of consumption.
- Daily food consumption amounts for occasionally consumed foods based on 24-hour dietary data tend to be overestimated, which can overestimate the potential exposure of high consumers, and lead to the imposition of overly restrictive risk management measures.
- The available dietary data may be outdated and not reflect current food supply and industry practices, providing a greater uncertainty when assessing consumption of foods introduced to the market or for which there may have been changes in consumption patterns after the surveys were conducted, and hence influence the results of dietary exposure assessment.

## Data Sources

To estimate dietary exposure, two different types of data are needed: food consumption data and chemical occurrence data in food ([FAO/WHO, 2009](#)). Availability of adequate food consumption data is often a limiting factor in dietary exposure assessments. In high-income countries, national institutes usually collect food consumption surveys, including individual dietary intake surveys, at regular multi-year frequencies. On the other hand, in LMICs the availability of food consumption data is often limited, and, if national sources exist, they are often outdated or lack adequate disaggregation (i.e. data are only available at household level in the case of [Household Consumption Expenditure Surveys](#)). Although available, per capita estimates from [Food Balance Sheets](#) and household level data do not allow for refined exposure estimations for different population groups. Similarly, individual food consumption summary statistics are an important piece of information for risk managers as an interim solution to compare conservative exposure estimates with health-based guidance values, but microdata are needed to perform refined exposure assessment when health-based guidance values are exceeded ([EFSA, 2011](#)). Individual- level quantitative dietary data, such as those collected through [24-hour Dietary Recalls](#) and [Weighed Food Records](#), are the most complete source of information on food consumption for refined dietary exposure assessments.

The Food Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) collaborate in the development of [FAO/WHO GIFT](#) (Global Individual Food consumption data Tool). [FAO/WHO GIFT](#) provides harmonized, age and sex disaggregated dietary data, both in the form of indicators and microdata available for download ([Leclercq et al., 2019](#)). These data can be combined with occurrence data, such as microbiological or food chemical concentration data to perform dietary exposure assessments. In addition, the Food Safety Collaborative Platform ([FAO/WHO FOSCOLLAB](#)) is an online tool hosted by WHO which integrates multiple sources of reliable food chemical concentration data to support food safety professionals as well as the FAO/WHO risk assessment process.

Both dietary data and chemical occurrence data that are shared through [FAO/WHO GIFT](#) and [FOSCOLLAB](#), respectively, are mapped with the FoodEx2 system. Experts interested in performing dietary exposure assessment by using probabilistic or deterministic models for which microdata are needed, can easily combine the microdata on food consumption shared through the [FAO/WHO GIFT](#)

platform with the chemical occurrence data available on FOSCOLLAB. [FAO/WHO GIFT](#) and [FAO/WHO FOSCOLLAB](#) are growing initiatives with frequent public releases of new datasets of indicators and microdata.

#### Links to guidelines

- [European Food Safety Authority \(2011\). Use of the EFSA Comprehensive European Food Consumption Database in Exposure Assessment.](#)
- [FAO/WHO \(2009\). Chapter 6: Dietary Exposure Assessment of Chemicals in Food.](#)

#### Links to validation studies

- [De Ruyck et al. \(2020\). Mycotoxin exposure assessments in a multi-center European validation study by 24-hour dietary recall and biological fluid sampling. Environment international.](#)
- [Cámara et al. \(2020\). Removal residues of pesticides in apricot, peach and orange processed and dietary exposure assessment. Food chemistry.](#)

#### Food Security Dimensions

- Safety

#### Food Composition Database Required?

No

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End of Indicator: Dietary Exposure Assessment Indicators

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## Food Consumption Score (FCS)

### Overview

The Food Consumption Score (FCS) is an index that was developed by the World Food Programme (WFP) in 1996. The FCS aggregates household-level data on the diversity and frequency of food groups consumed over the previous seven days, which is then weighted according to the relative nutritional value of the consumed food groups. For instance, food groups containing nutritionally dense foods, such as animal products, are given greater weight than those containing less nutritionally dense foods, such as tubers. Based on this score, a household's food consumption can be further classified into one of three categories: poor, borderline, or acceptable. The food consumption score is a proxy indicator of household caloric availability. Validation studies have demonstrated that the FCS and the Household Dietary Diversity Score (HDDS) are both associated with caloric intake, as well as with each other (Coates et al., 2007; Weismann et al., 2009). While the FCS has been validated against quantity of caloric intake (Leroy et al., 2015), there have been limited studies assessing how well FCS predicts nutrient adequacy (e.g. Marivoet et al 2019), and the results were mixed regarding its performance for this purpose.

### Method of Construction

A brief questionnaire is used to ask respondents about the frequency of their household's consumption of eight different food groups over the previous seven days. To calculate the FCS from these results, the consumption frequencies are summed and multiplied by the standardized food group weight (see the food groups and corresponding weights below). Households can then be further classified as having "poor," "borderline," or "acceptable" food consumption by applying the WFP's recommended cut-offs to the food consumption score.

Food Group	Weight
Main staples	2
Pulses	3
Vegetables	1
Fruit	1
Meat/Fish	4
Milk	4
Sugar	0.5

Oil	0.5
-----	-----

Steps:

1. Group food items in the specified food groups (condiments not included)
2. Sum all the consumption frequencies of food items within the same group
3. Multiply the value of each food group by its weight (see table)
4. Sum the weighted food group scores to obtain FCS
5. Determine the household's food consumption status based on the following thresholds: 0-21: Poor; 21.5-35: Borderline; >35: Acceptable.

For more in-depth information on calculation of FCS, see the technical document provided by the WFP ([2008](#)).

## Uses

This indicator is useful for categorizing and tracking households' food security across time, specifically as a proxy for the quantity dimension (i.e. household caloric sufficiency) of food security, for which this indicator has been validated. The FCS captures information about *usual* household diet, since it asks respondents to recall what they consumed over the past seven days. The FCS can be used in a range of ways, including for program monitoring and evaluation and population-level targeting. Since it is a standardized measure, it can also be useful in comparing households in different locations, as well as tracking cyclical changes in household diet if collected repeatedly across seasons or years. The WFP uses the FCS as part of its Comprehensive Food Security & Vulnerability Analysis ([CFSVA](#)) tool to assess food security and vulnerability in crisis-prone populations.

The FCS and [HDDS](#) are highly correlated and can be used interchangeably as a measure of household-level diet diversity and as a validated proxy for energy sufficiency in most contexts ([Maxwell et al., 2014](#); [Vaitla et al., 2017](#)). There have been limited studies assessing how well FCS predicts nutrient adequacy (e.g. [Marivoet et al 2019](#)), and the results were mixed regarding its performance for this purpose. Since the FCS and [HDDS](#) provide very similar information, the selection of one over the other can often be driven by the need for comparability with other surveys or by institutional preference. In other words, if an organization or individual is interested in comparing their results to those of a WFP survey, it makes sense to collect the FCS, while a comparison with other surveys may be more appropriately based on the [HDDS](#), if the [HDDS](#) had been used previously.

## Strengths and Weaknesses

The FCS indicator captures information about *usual* household diet, as it incorporates consumption frequency over a seven-day period. This is different from the [HDDS](#), which only gathers information about the previous day of consumption ([Kennedy et al., 2010](#)). Both the FCS and the HDDS were designed as potentially useful indicators to capture quantity (energy) and quality (nutrient adequacy). There have been limited studies assessing how well FCS predicts nutrient adequacy (e.g. [Marivoet et al 2019](#)), and the results were mixed regarding its performance

for this purpose.

By applying standard nutritional value weights to the food groups in the index, the WFP intends for the score to be a more accurate reflection of the calorie content of the diet pattern than an index where all food groups are equally weighted. That said, validation research by [Weismann et al. \(2009\)](#) suggests that these weights do not usefully increase the association of the FCS index with caloric intake over an un-weighted version of the index, and the weights themselves are not based on a clearly defined nutritional metric.

The FCS and [HDDS](#) need to undergo some adaptation to the context in which they will be used in order for enumerators to be able to list contextually appropriate examples of foods that belong to the food groups in the questionnaire. For both the FCS and [HDDS](#), one challenge is how to capture, and whether to exclude, small amounts of food consumed as seasonings or condiments. For both indicators, research has shown that the ability to accurately predict caloric adequacy is greatly increased by ensuring items consumed in small amounts are excluded so as not to overstate the nutritionally relevant diversity of a household's diet ([Lonvon & Mathiassen, 2014](#)).

Additionally, as household-level measures, neither the FCS nor [HDDS](#) are sensitive to intra-household inequities in food consumption, and therefore should not be used for interventions specifically targeting individuals, such as nutritionally vulnerable women or children. Please see the [Minimum Dietary Diversity for Women \(MDD-W\)](#) and [Minimum Dietary Diversity \(MDD\)](#) for children 6-23 months indicators for alternative individual-level measures.

## Data Source

In order to construct this indicator, household data must be obtained using the [WFP's standard food consumption score questionnaire](#) (see page 16). In some cases it may be possible to use secondary data from a seven-day food frequency questionnaire or the consumption module of a [Household Consumption and Expenditure Survey \(HCES\)](#) provided that: 1) the recall is seven days, 2) the frequency of consumption is collected, and 3) the food items can be mapped to the WFP's standard eight food groups (see table above). Additionally, WFP standardized food group weights must be used. More details can be found in the technical guidelines from the [WFP \(2008\)](#) and FCS data for select countries can be found on the [Vulnerability Analysis and Mapping Databank](#) and on the [VAM Resource Center](#).

### Links to guidelines

- [World Food Programme, \(2008\). Food consumption analysis: Calculation and use of the food consumption score in food security analysis.](#)
- [World Food Program \(2009\). Comprehensive Food Security and Vulnerability Analysis \(CFSVA\) Guidelines. First edition.](#)

### Links to validation studies

- [Baumann et al., \(2013\). Validity of food consumption indicators in the Lao context: Moving toward cross-cultural standardization. Food and Nutrition Bulletin.](#)

- [Leroy et al., \(2015\). Measuring the food access dimension of food security: A critical review and mapping of indicators. Food and Nutrition Bulletin.](#)
- [Wiesmann et al., \(2009\). "Validation of the World Food Programme's food consumption score and alternative indicators of household food security."](#)
- [Maxwell et al., \(2014\). How do indicators of household food insecurity measure up? An empirical comparison from Ethiopia. Food policy.](#)
- [Vaitla et al., \(2017\). The measurement of household food security: Correlation and latent variable analysis of alternative indicators in a large multi-country dataset. Food Policy.](#)

## Food Security Dimensions

- Quantity

## Food Composition Database Required?

No

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End of Indicator: Food Consumption Score (FCS)

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## Food Insecurity Experience Scale (FIES)

### Overview

The Food Insecurity Experience Scale (FIES) is one of the four experience-based food insecurity scales included in the Data4Diets platform, which also contains the [Household Hunger Scale \(HHS\)](#), the [Household Food Insecurity Access Scale \(HFIAS\)](#), and the [Latin American and Caribbean Food Security Scale \(ELCSA\)](#). The FIES was developed by the Food and Agriculture Organization (FAO) through the Voices of the Hungry (VoH) project, building on the pioneering work to develop the USDA Household Food Insecurity Survey Module, HFIAS, and the ELCSA. The FIES was derived from the adult-referenced questions of the ELCSA to create a shortened, standardized experience-based measure for use across sociocultural contexts ([Ballard et al., 2013](#)).

In 2014, FAO began collecting FIES data by leveraging the Gallup World Poll (GWP), which surveys nationally representative samples of the adult population annually in nearly 150 countries. With these data in hand, Voices of the Hungry (VoH) developed the analytical protocols necessary to take experience-based food security measurement global, making it possible to compare prevalence rates across countries and even sub-national populations ([Cafiero et al., 2016](#)).

### Method of Construction

The FIES module can be administered with either a one month or 12 month recall period, depending on the research or programmatic priorities. It consists of eight questions capturing a range of food insecurity severity, with yes/no responses. While developed primarily to measure the individual experience of food insecurity, the scale can also be modified for use at the household level, in which case the questionnaire can be administered to an individual who responds on behalf of the household. The FIES survey modules (individual and household versions) and translations can be found on the [VoH website](#). The creation of the scale requires a statistical module programmed in R, which can also be found on the [VoH website](#), along with supplemental explanatory materials.

Based on output from the model, two indicators are produced: the prevalence of severe food insecurity, and the prevalence of moderate or severe food insecurity (i.e., the prevalence of moderate and severe combined).

### Uses

The FIES is one of two indicators used for measuring progress toward achieving Goal 2.1 of the Sustainable Development Goals (SDGs), which relates to ending hunger and ensuring food access ([SDGs, 2016](#)). This indicator is currently used by FAO and a growing number of countries to monitor national and global food security trends.

The FIES can be used to measure food security for the following purposes:

- To **assess** the population **prevalence of food insecurity** (for both SDG monitoring and national use)
- To **identify vulnerable** populations
- To **guide** and **monitor** the effects of food security **policies and programs**
- To **identify risk factors and consequences** of food insecurity

The FIES does not quantify food consumption nor does it assess diet quality; doing so requires other methods and indicators such as a quantitative 24-hour dietary recall to quantify food consumption to calculate the Mean Adequacy Ratio (MAR) or a diet diversity index to determine the Minimum Dietary Diversity Score for Women (MDD-W) in order to gain a picture of the "adequacy" aspect of diet quality.

## Strengths and Weaknesses

The main strength of the FIES is that it produces population-level estimates of food insecurity that are comparable across countries, cultures, and sub-populations. The FIES analytical methodology can be applied to data collected using the HFIAS and the ELCSA survey modules to produce comparable results. Additionally, when the individual-referenced survey module is used, the FIES offers the advantage of allowing for disaggregation of data by gender (Brunelli & Viviani, 2014).

The FIES analytical methodology involves a sophisticated probabilistic approach to classify households according to their food security status. Though the results are statistically robust and comparable across countries and sub-populations, it may be challenging for non-specialists to conduct the analysis and produce the estimates. However, this analytic approach makes it possible to account for differences in experiences of food insecurity across specific cultural or personal perceptions. FAO provides tools, including software and learning materials, to support users, as well as technical assistance.

## Data Sources

The data required to calculate this indicator are collected using the eight-item FIES survey module (individual or household version), which can be easily integrated into a broader survey of individuals (e.g. a health and nutrition survey) or households (e.g. Household Consumption and Expenditure Survey [HCES]). The FIES survey modules, and translations of the individual version of the survey into 170 languages and dialects, can be found on the VoH webpage. Also included on the webpage is the FIES Statistical Software Package for conducting data analysis and producing estimates of the prevalence of food insecurity.

Links to guidelines

- Ballard et al. (2013). The Food Insecurity Scale: Development of a Global Standard for Monitoring Hunger Worldwide. Food and Agricultural Organization.
- FAO e-learning course (2018). SDG Indicator 2.1.2: Using the Food Insecurity Experience Scale.

## Links to validation studies

- [Cafiero et al. \(2018\). Food Security Measurement in a Global Context: The Food Insecurity Experience Scale. Food and Agricultural Organization.](#)
- [Wambogo et al. \(2018\). Validity of the food insecurity experience scale for use in sub-Saharan Africa and characteristics of food-insecure individuals. Current developments in nutrition.](#)

## Food Security Dimensions

- Quantity

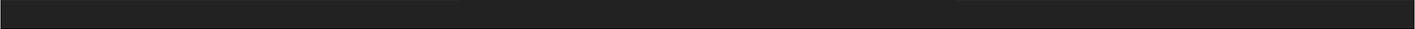
## Food Composition Database Required?

No

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End of Indicator: Food Insecurity Experience Scale (FIES)

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## Fresh Food Retail Volume

### Overview

Fresh food retail volume includes uncooked and unprocessed foods sold in various channels ([Euromonitor International, 2018](#)), and is an indicator that can be used to understand trends in shifting dietary patterns and changing dietary quality. Low- and middle-income countries have rapidly been undergoing a nutrition transition characterized by increased consumption of processed foods coupled with decreased consumption of fresh food ([Baket et al., 2020](#)). These changes come with serious health implications, as processed and ultra-processed foods tend to be less nutrient dense and have been linked with poorer diet quality ([Imamura et al., 2015](#)), as well as increased diet-related illness ([Micha et al., 2012](#)). The fresh food retail volume is a national-level indicator that quantifies the volume of fresh foods sold at markets (including supermarkets, wet markets, convenience stores, and online purchases), reported in kilograms per capita. It provides information on the quantity of healthier foods in the food supply and can provide a fuller picture of dietary transition when used in conjunction with the indicator for [packaged food retail volume](#) ([Global Nutrition Report, 2015](#)).

### Method of Construction

The total amount of fresh foods sold in various retail outlets of interest (e.g. supermarkets, wet markets, convenience stores) should be converted into kilograms and summed. This figure is divided by the total population of interest to determine the amount of fresh food retail volume (kg/capita). Currently, data for this indicator are collected for a subset of countries (none of which are low-income countries) and are available for purchase from [Euromonitor](#). If one has access to Euromonitor, data can be easily downloaded as national per capita values ([Euromonitor International, 2022](#)). If calculating this indicator from other market data (i.e. not using Euromonitor), it is necessary to clearly define what is meant by fresh foods and what is meant by markets. For example, the NOVA Food Classification system could be used to group foods into unprocessed/minimally processed, processed, and ultra-processed categories ([Monteiro et al., 2010](#)). Government ministries may also collect data related to market-level retail sales and/or volume.

### Uses

This indicator for fresh food retail volume, in combination with the indicator that measures [retail volume of packaged foods](#), has been recommended by the Global Nutrition Report to assess national food consumption diversity ([Global Nutrition Report, 2015](#)). When used in conjunction with other market-level data on production and/or consumption, it can also be used to capture the extent to which fresh foods are transported along the supply chain.

### Strengths and Weaknesses

This indicator is helpful in providing insight into the availability of fresh foods on the market. A drawback is that, as a national-level indicator, it does not capture any measurement of distribution among regional, socioeconomic, or age/sex groups. Furthermore, if using Euromonitor data, it only provides information at the aggregate level for the quantity of all fresh foods and for a select subset of high and middle-income countries. Therefore, if you are interested in more detailed information of specific fresh foods, or in identifying the quantity of fresh food retail volume for low-income countries, other indicators should be considered. For example, an indicator like [household adequacy of fruit and vegetable consumption](#) would be more appropriate for examining fresh food consumption (specifically fruit and vegetable consumption) on a finer scale and potentially comparing across sub-populations and groups.

Additionally, although fresh foods are assumed to be nutritionally superior to packaged ones, this indicator does not report macronutrient or micronutrient consumption, which would be better examined using an individual indicator such as [total individual micronutrient intake](#) or [total individual macronutrient intake](#). A clear drawback of using Euromonitor data is that these data are not publicly available and only exist for 54 countries, none of which are low-income countries ( [Euromonitor International, 2016](#)).

## Data Source

One potential data source for this indicator is [Euromonitor](#), which collects and compiles data on fresh food retail volume in 54 countries, none of which, however, are low-income countries, and access must be purchased ([Euromonitor International, 2022](#)). One publicly available alternative, would be to use [Food Balance Sheet \(FBS\) data](#) to calculate similar indicators such as [national fruit and vegetable availability in food supply](#), or [Household Consumption and Expenditure Survey \(HCES\) data](#) and [household adequacy of fruit and vegetable consumption](#).

### Food Security Dimensions

- Quantity
- Quality

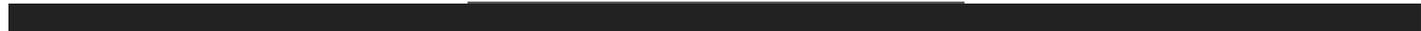
### Food Composition Database Required?

No

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End of Indicator: Fresh Food Retail Volume

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## Household Adequacy of Fruit and Vegetable Consumption

### Overview

Low fruit and vegetable consumption is one of the leading contributors to the global burden of non-communicable disease and death ([Lim et al., 2013](#)). A [2003 Food and Agriculture Organization \(FAO\) and World Health Organization \(WHO\) joint report](#) defines adequate fruit and vegetable consumption as an individual daily intake of 400 grams of fruit and vegetables (or the equivalent of five servings). The household adequacy of fruit and vegetable consumption indicator provides a measure of diet quality and can be used to understand diet patterns. Since this indicator uses [Household Consumption and Expenditure Survey \(HCES\)](#) data, analyses can be disaggregated to analyze patterns between regions, income groups, and sub-populations.

### Method of Construction

[HCES](#) data are used to construct this indicator by summing the total weight (in grams) of fruits and vegetables consumed by the household as reported by the respondent. This total can then be divided by the number of household members, and then divided by the number of days within the survey recall period. The resulting value is the number of grams of fruits and vegetables consumed per capita per day for the household (with infants and children included as household members). If this number is at or above 400 grams/capita/day, the household is classified as having adequate fruit and vegetable consumption. If it is below 400 grams/capita/day, the household is considered to have inadequate fruit and vegetable consumption.

This indicator is one of several indicators included in the [ADePT-FSM \(Food Security Module\)](#) software package, a free standalone software developed by FAO and the World Bank, that allows users to easily derive food security indicators from household survey data. The software download and corresponding documentation is available on the [World Bank's website](#).

Please also see the [Moltedo et al., 2014](#) book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data, and [Moltedo et al 2018](#), which offers instructions for using ADePT-FSM to generate diet-related indicators from household data. Alternatively, a national-level indicator measuring the [national availability of fruit and vegetables](#) (grams/capita/day) can be calculated using [Food Balance Sheets \(FBS\)](#).

### Uses

This household-level indicator can be used to identify inadequacy of fruit and vegetable consumption between population sub-groups, including those based on household income, gender of the household head, and different geographic areas. It can be used in studies to identify the potential socioeconomic and cultural determinants of inadequate fruit and vegetable consumption, which can advise local or national strategies to encourage consumption and improve dietary practices ([De Filippo et al., 2021](#); [Fanzo et al., 2020](#)).

# Strengths and Weaknesses

This household-level indicator reflects an important aspect of dietary quality based on the quantity of consumption of fruits and vegetables. Other indicators of adequacy of fruit and vegetable consumption may use the consumption of five servings per day as the definition of adequacy, rather than 400 grams ([Hall et al., 2009](#)), but the concept of serving size may differ by country.

These indicators may be subject to bias due to the considerable variability of definitions of fruits, vegetables, and portion sizes between countries ([Agudo, 2004](#)), though the data from [HCES](#) could be classified by the researcher into standardized categories of fruits and vegetables. A benefit of using grams instead of serving sizes is that it can improve comparability across countries.

This indicator is based on the WHO recommendation that all individuals in a population should consume at least 400 grams (5 servings) of fruits and vegetables per day. Because this measure is applied to household-level data, there is no consideration of individual consumption as the indicator is based on the total amount of fruits and vegetables per household divided by the number of individuals. The recommendation of 400 grams does not take into account different individual needs depending on age and sex, and the variation in the recommended nutrient intakes. Food-based national dietary guidelines should be referenced for more detailed information and requirements for individual age/sex groups ([FAO, 2022](#)). In addition to these other limitations, this indicator uses data collected from one individual within the household who is reporting everyone's consumption, which may not be accurate, especially given the increasing importance of food consumed away from home, particularly in urban areas. Because this is a household-level indicator, it can be used to compare diet quality across households but should not be used to draw conclusions about individuals within the same household or about specific age and sex groups in the population.

## Data Source

[HCES](#) data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data ([World Bank Microdata Library](#)). Otherwise, data can be accessed—often for a fee—from the National Statistics Office, though each country has its own policies and procedures. The International Household Survey Network ([IHSN](#)) is an informal network to promote data standards and dissemination. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the World Nutrient Databases for Dietary Studies ([WNDDS](#)), developed by the Agriculture and Food Systems Institute. In addition, [FBS](#) data could be used to calculate a similar indicator, such as [national fruit and vegetable availability in the food supply](#). Alternatively, market data such as [Euromonitor](#) could be used to calculate the [fresh food retail volume](#), or individual-level data such as [24-hour Dietary Recall](#) or a [Food Frequency Questionnaire \(FFQ\)](#), could be used to calculate consumption of specific food groups (e.g. fruits and vegetables).

Links to guidelines

- [Agudo \(2004\). Measuring intake of fruit and vegetables. Background paper for the joint FAO/WHO Workshop on fruits and vegetables for health.](#)

## Food Security Dimensions

- Quality

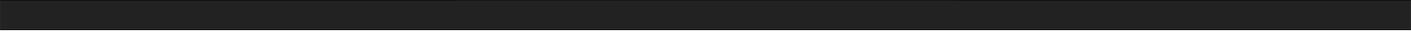
## Food Composition Database Required?

No

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End of Indicator: Household Adequacy of Fruit and Vegetable Consumption

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## Household Average Dietary Energy Acquisition or Consumption

### Overview

Household average dietary energy consumption per capita is an indicator that estimates calorie consumption based on the total amount of food acquisition or consumption by the household. Consuming an adequate number of calories is necessary (but not sufficient) for proper growth, development, and cognitive and physical functioning. Trends in household average per capita energy acquisition or consumption can provide early warnings of where there may be problems for population-level undernutrition or overweight/obesity for specific regions within a country or for the country as a whole. This indicator is different from the simpler indicator dietary energy supply, which cannot be disaggregated at a sub-national level and uses Food Balance Sheet (FBS) data to determine the calories per capita available at a national level.

### Method of Construction

To construct this indicator, existing Household Consumption and Expenditure Surveys (HCES) data can be analyzed with a statistical software program (e.g. Stata or R). Each household's reported acquisition or consumption of foods is converted into dietary energy (kcal) by matching individual foods with a Food Composition Table. The total quantity of calories is determined by accounting for the portion purchased or consumed, divided by the total number of members in that household. If data are collected over a number of days or if recall periods cover more than one day, the above calculation must also be divided by the number of days of collection in order to generate the number of calories/person/day.

An alternative option to the basic per capita measure is the Adult Male Equivalent (AME). The AME method takes account of the household size and composition (age, sex, and physical activity level) and assumes that the distribution of food within the household is in direct proportion to the biological requirement of each individual based on a specific physical activity level. Using a multiple of the AME to account for all members of the household provides a more accurate picture of households of different sizes and compositions than just using the per capita measure (Weisell & Dop, 2012). Table 9 on page 82 of the following International Food Policy Research Institute (IFPRI) document provides guidelines for benchmarking per capita calorie consumption in categories ranging from very low to very high (Smith & Subandoro, 2007).

This indicator is one of several indicators included in the ADePT-FSM (Food Security Module) software package, which is a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. The software and corresponding documentation can be downloaded from the World Bank website. Please also see the Moltedo et al. (2014) book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data (see pages 35 and 36), and Moltedo et al 2018, which offers instructions for using ADePT-FSM to generate diet-related indicators from household data.

## Uses

This measure of diet quantity provides an understanding of the energy available to a household, and can be used to assess the food insecurity (quantity dimension, caloric sufficiency), of a population in order to design appropriate interventions ([Smith & Subandoro, 2007](#)). This indicator, and others relying on [HCES](#) data, can be a good option when more granular data, such as individual-level dietary data, are not available. As this is an average per capita estimate based on data collected at the household level and is not based on individual-level data, it cannot be used for individual targeting or used to assess population sub-groups, such as pregnant and lactating women or young children.

## Strengths and Weaknesses

This indicator is designed for use with [HCES](#), and using the [ADePT-FSM](#) software package can ease some of the challenges of using household-level data for less experienced analysts. However, this indicator only estimates acquisition or consumption of dietary energy, and does not provide insight into nutrient adequacy or overall health of diet ([Smith, 2002](#); [Claro et al., 2010](#)).

## Data Source

[HCES](#) data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data ([World Bank Microdata Library](#)). Otherwise, data can be accessed - often for a fee - from the National Statistics Office, though each country has its own policies and procedures. The International Household Survey Network ([IHSN](#)) is an informal network to promote data standards and dissemination. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at the Food and Agriculture's (FAO) [International Network of Food Data Systems \(INFOODS\)](#) or the World Nutrient Databases for Dietary Studies ([WNDDS](#)), developed by the Agriculture and Food Systems Institute. In addition, [Food Balance Sheet \(FBS\)](#) data could be used to calculate a similar indicator, such as [dietary energy supply](#). Alternatively, [24-hour Dietary Recall](#) or [Weighed Food Records](#) could be used to calculate [total individual energy intake](#).

### Links to guidelines

- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)
- [Molledo et al. \(2014\). "Analyzing food security using household survey data. The World Bank.](#)
- [Molledo et al. \(2018\). Optimizing the use of ADePT-Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)

### Food Security Dimensions

- Quantity

Food Composition Database Required?

Yes

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End of Indicator: Household Average Dietary Energy Acquisition or Consumption

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## Household Dietary Diversity Score (HDDS)

### Overview

The Household Dietary Diversity Score (HDDS) was released in 2006 as part of the FANTA II Project as a population-level indicator of household food access. Household dietary diversity can be described as the number of food groups consumed by a household over a given reference period, and is an important indicator of food security for many reasons. A more diversified household diet is correlated with caloric and protein adequacy, percentage of protein from animal sources, and household income (Swindale & Bilinsky, 2006). The HDDS indicator provides a glimpse of a household's ability to access food as well as its socioeconomic status based on the previous 24 hours (Kennedy et al., 2011).

### Method of Construction

The following 12 food groups are used to calculate the HDDS indicator:

A.	Cereals
B.	Roots and tubers
C.	Vegetables
D.	Fruits
E.	Meat, poultry, offal
F.	Eggs
G.	Fish and seafood
H.	Pulses, legumes, nuts
I.	Milk and milk products
J.	Oil/fats
K.	Sugar/honey

L.	Miscellaneous
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Each food group is assigned a score of 1 (if consumed over the previous 24 hours) or 0 (if not consumed in the last 24 hours). The household score will range from 0 to 12 and is equal to the total number of food groups consumed by the household:

$$HDDS = \text{Sum} (A + B + C + D + E + F + G + H + I + J + K + L)$$

The average household dietary diversity score for the population of study can be calculated as follows:

$$\text{Sum} (HDDS) / \text{Total number of households surveyed}$$

If using data that were not initially collected using the HDDS questions, such as Household Consumption and Expenditure Surveys (HCES) data, the food items must be regrouped according to the 12 HDDS groups to calculate the indicator. Although there is no universal cut-off or target level that indicates that a household is sufficiently diverse, FANTA suggests two alternatives for using this indicator in a performance reporting context. One option is to use the dietary diversity patterns of wealthier households as a target (the richest 33%), which requires the assumption that poorer households will increase their dietary diversity as their incomes rise. A second option is to establish a target using the average dietary diversity of the 33% of households with the highest diversity. For more information on how to set these targets, see Swindale & Bilinsky (2006).

## Uses

The HDDS is a population-level indicator that is used as a proxy measure of household food access (Swindale & Bilinsky, 2006).

Unlike measures of dietary diversity collected at the individual level (e.g. Minimum Dietary Diversity for Women [MDD-W] and Minimum Dietary Diversity [MDD] for children 6-23 months), this indicator has not been validated as a proxy for adequacy of specific macronutrients or micronutrients. If the primary concern or research objective is to assess the diet quality of the population, then dietary diversity or other indicators of diet quality should be collected using dietary diversity indicators at the individual, not household, level (e.g. MDD-W and MDD). However, if the objective is to assess economic access to food, or to estimate which food groups households are consuming, then the household-level indicator is a more appropriate measure (Food and Agriculture Organization [FAO], 2011). Because household dietary diversity generally increases as income increases, this indicator is sometimes used as a proxy for the access dimension of food insecurity, and is one of the indicators frequently used to assess how interventions designed to increase household income have affected food consumption (Swindale & Bilinsky, 2006).

The HDDS can be used in conjunction with other indicators of food security status (e.g. Household Food Insecurity Access Scale [HFIAS]) to understand household access to certain food groups (Cafiero et al., 2014). The components of the indicator can also be used to examine dietary patterns (e.g., what percentage of households consume any type of animal source foods?). This indicator is required for all USAID Food for Peace (FFP) projects and must be collected at the projects' baseline and endline to assess the resilience of vulnerable communities and households (USAID, 2017).

). FAO also uses this indicator and developed a set of guidelines for its use in different contexts ([FAO, 2011](#)).

The HDDS and [Food Consumption Score \(FCS\)](#) are highly correlated and can be used interchangeably as a measure of household-level diet diversity and as a validated proxy for energy sufficiency in most contexts ([Maxwell et al., 2013](#)); however, neither of these indicators has been validated as a proxy for micronutrient adequacy. Therefore, before they are used to proxy nutrient adequacy they require further validation ([Leroy et al., 2015](#)). Since the HDDS and FCS provide very similar information, the selection of one over the other can often be driven by the need for comparability with other surveys or by institutional preference. In other words, if an organization or individual is interested in comparing their results to those of a World Food Programme survey, it makes sense to collect the FCS, while a comparison with other surveys may be more appropriately based on the HDDS, if the HDDS had been used previously.

## Strengths and Weaknesses

One strength of the HDDS is that the standardized questions are simple and can be easily understood by both enumerators and respondents, and the full set of questions usually takes less than 10 minutes per respondent ([Swindale & Bilinsky, 2006](#)). However, the standardized questionnaire provided by the [2011 FAO guidelines](#) is not culture or population specific, so it should be adapted appropriately in adherence with the guidelines before use in a specific context ([Kennedy et al., 2011](#)). For example, while the standard module does not explicitly ask about consumption of food away from home, enumerators could be trained to probe about additional foods consumed outside the home.

A drawback of the HDDS is that, because data are collected at the household level, it does not provide any information on the consumption of different food groups or overall dietary diversity by individuals in the household. Accordingly, the HDDS does not provide any information on intra-household food distribution. As mentioned above, the indicator has not been validated against any standard of adequacy to allow a judgement on what number of food groups constitute a "sufficiently diverse," versus "not sufficiently diverse" diet at the household level ([Mekonnen et al., 2020](#)). There is no universally accepted cut-off for this indicator that could separate households that have a "sufficiently diverse" diet from those that do not.

## Data Source

The source of data for the HDDS is based on a recall of food groups consumed by the household in the previous 24 hours, reported by the person primarily responsible for food preparation in the household. Other data sources can often be used to construct the HDDS indicator, including [24-hour Dietary Recall](#), [Food Frequency Questionnaires \(FFQs\)](#), and [Household Consumption and Expenditure Survey \(HCES\)](#) data, where information on food consumption is collected through a fixed list of foods or food groups.

[Links to guidelines](#)

- [Swindale and Bilinsky, \(2006\). "Household Dietary Diversity Score \(HDDS\) for Measurement of Household Food Access: Indicator Guide"](#)
- [Kennedy et al., \(2011\). "Guidelines for Measuring Household and Individual Dietary Diversity. Food and Agricultural Organization"](#).

#### Links to validation studies

- [Hoddinott and Yohannes, \(2002\). "Dietary Diversity as a Household Food Security Indicator"](#)
- [Cafiero et al. \(2014\). Validity and reliability of food security measures. Annals of the New York Academy of Sciences.](#)
- [Hussein et al. \(2017\) Household food insecurity access scale and dietary diversity score as a proxy indicator of nutritional status among people living with HIV/AIDS, Bahir Dar, Ethiopia. PloS one.](#)
- [Mekonnen et al. \(2020\). Can household dietary diversity inform about nutrient adequacy? Lessons from a food systems analysis in Ethiopia. Food Security.](#)

#### Food Security Dimensions

- Quantity
- Quality

#### Food Composition Database Required?

No

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End of Indicator: Household Dietary Diversity Score (HDDS)

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## Household Food Expenditure Share

### Overview

Engel's Law demonstrates that rises in income are followed by rises in food expenditure and an even higher rise in expenditure with other goods, so that the share of total income spent on food declines. Poorer and more vulnerable households spend a larger share of their income on food. The household share of food expenditure (as a proxy for income) is an indicator of household food security, especially helpful to understand the impact of food price fluctuations on the quality and quantity of household food consumption.

Changes in food prices may result in a higher share of total household expenditure on food. Very poor households consuming the lowest-cost foods may be unable to substitute for cheaper foods, reducing dietary quality or quantity consumed, and non-food expenditures that may be equally needed (e.g., on health and education) ([Lele et al., 2016](#)).

### Method of Construction

This indicator is commonly calculated with data from Household Consumption and Expenditure Surveys (HCES) that include the monetary value of household consumption disaggregated into food and non-food items. The share of household expenditure on food is equal to:

$$\frac{\textit{Expenditure on food}}{\textit{Total expenditure}} \times 100$$

The monetary value of non-purchased items, including consumption from own production and in-kind payments and transfers, must be imputed from available price information.

While no internationally agreed thresholds exist, [Smith and Subandoro \(2007\)](#) have proposed that households spending over 75% of their income on food are considered very high, and consequently food insecure, whereas 65-75% income expenditure on food is high, 50-65% is medium; and less than 50% is low.

This is one of the several indicators included in the ADePT-FSM (Food Security Module) software package, a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. The software can be downloaded on the World Bank website. Please also see pages 35-36 of [Moltedo et al. \(2014\)](#) for detailed instructions on the analyzes of food security using household survey data, and [Moltedo et al 2018](#), which offers instructions for using ADePT-FSM to generate diet-related indicators from household data. This indicator is also included in the FAO suite of food security indicators ([FAO, 2016](#)) as the share of food expenditures of the poor (population belonging to the first income quintile).

# Uses

The household food expenditure share indicator is used by governments, non-profits and international organizations to assess trends in food security, and identify populations vulnerable to price shocks (Lele et al., 2016). For example, the World Food Programme (WFP) uses this indicator, often in combination with other indicators such as the Food Consumption Score (Rose et al., 2013).

## Strengths and Weaknesses

Household share of food expenditure is useful because it is sensitive to food price fluctuations, especially for staple foods. Another strength is that it can be derived from HCES data, which are typically nationally representative. However, this indicator may underestimate the food expenditure share if the survey data do not adequately capture the value of home production of food (Rose, 2012). The inclusion (or exclusion) of consumption from food produced at home and consumed away from home potentially limits comparability of this indicator across countries when calculated with HCES, because definitions of food and non-food expenditures differ across countries (Schmidhuber, 2003).

## Data Source

HCES data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data. Otherwise, data can be accessed, often for a fee, from the National Statistics Office, though each country has its own policies and procedures. The [International Household Survey Network \(IHSN\)](#) is an informal network to promote data standards and dissemination.

### Links to guidelines

- [Lele et al. \(2016\). Measuring food and nutrition security: An independent technical assessment and user's guide for existing indicators. Food Security Information Network.](#)
- [Rose et al. \(2013\). Food security assessment at WFP. Report on continue development and testing of a standardized approach.](#)
- [International Scientific Symposium \(2002\). Measurement and assessment of food deprivation and undernutrition. Rome, 26-28 June.](#)
- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)
- [Smith et al., \(2014\). "Assessment of the reliability and relevance of the food data collected in national household consumption and expenditure surveys."](#)

### Links to validation studies

- [Akerele \(2015\). Household food expenditure patterns, food nutrient consumption and nutritional vulnerability in Nigeria: implications for policy. Ecology of Food and Nutrition.](#)

- [Harris et al. \(2020\). Nutrition transition in Vietnam: changing food supply, food prices, household expenditure, diet and nutrition outcomes. Food Security.](#)
- [Kumar et al. \(2020\). Assessing food and nutrition security in Nepal: Evidence from diet diversity and food expenditure patterns. Food Security.](#)

## Food Security Dimensions

- Quantity
- Quality

## Food Composition Database Required?

No

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End of Indicator: Household Food Expenditure Share

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## Household Food Insecurity Access Scale (HFIAS)

### Overview

The Household Food Insecurity Access Scale (HFIAS) is one of the four experience-based food insecurity scales included in Data4Diets, along with the [Household Hunger Scale \(HHS\)](#), the [Latin American and Caribbean Food Security Scale \(ELCSA\)](#), and the [Food Insecurity Experience Scale \(FIES\)](#). The HFIAS was developed between 2001 and 2006 by the USAID-funded Food and Nutrition Technical Assistance II (FANTA) project. The cross-country validation of the HFIAS provided the foundation for the development of the [HHS](#) (Ballard et al., 2011).

Like other experience-based indicators, the HFIAS is constructed from a short questionnaire that captures households' behavioral and psychological manifestations of insecure food access, such as having to reduce the number of meals consumed or cut back on the quality of the food due to lack of resources. Responses to the questionnaire enable the household to be pinpointed on a spectrum that indicates the degree of severity of insecure food access.

### Method of Construction

The HFIAS module consists of nine "occurrence" and nine "frequency-of-occurrence" questions, that should be answered according to the household food security experience in the previous 30 days. The respondent is first asked if a given condition was experienced (yes or no) and, if it was, with what frequency (rarely, sometimes, or often). The resulting responses can be transformed into either a continuous or categorical indicator of food security. When calculating the HFIAS as a continuous indicator, each of the nine questions is scored 0-3, with 3 being the highest frequency of occurrence, and the scores are added together. The total HFIAS can range from 0 to 27, indicating the degree of insecure food access. As a categorical variable, households are categorized as food secure, mildly food insecure, moderately food insecure, or severely food insecure (for more details see Table 4, page 14, in [Coates et al., 2007](#)). The more affirmative responses and the more frequent the experience is, the more severe is the food insecurity of a household. For more in-depth information on using and interpreting the HFIAS, refer to the guide created by FANTA ([Coates et al., 2007](#)).

### Uses

Information gathered from the HFIAS can be used to assess prevalence of household food insecurity of a population, as well as changes in food insecurity over time. This is useful in the population-level food policy making, and monitoring and evaluation of food access-related programs. The HFIAS has been used in myriad surveys to measure food insecurity in various contexts. For example, an adapted version is used in the publicly available [Bangladesh Integrated Household Survey](#), and in the Malnutrition and Enteric Infections: Consequences for Child Health and Development (MAL-ED) Network cohort study, which assessed relationships between food security and birthweight (McQuade et al., 2019). Another illustrative example is the inclusion of the HFIAS as one of the tools used for rapid Emergency Food Security Assessments conducted by

the World Food Programme ([WFP, 2009](#)).

Like all experience-based food insecurity scales, the HFIAS does not quantify food consumption nor assess adequacy of diet quality; doing so would require other methods and indicators, such as a [24-hour dietary recall](#) to calculate the [Mean Adequacy Ratio \(MAR\)](#), or a diet diversity index to determine the [Minimum Dietary Diversity Score for Women \(MDD-W\)](#).

## Strengths and Weaknesses

One strength of the HFIAS is that it is able to detect aspects of food insecurity involving decreased access to a sufficient quantity or quality of food. It also detects psychosocial manifestations of anxiety and uncertainty around food access, with negative implications for health and wellbeing ([Ballard et al., 2013](#)). Additionally, it is understandable and validated to many contexts, including urban (e.g. [Mohammadi et al., 2012](#)) and rural (e.g. [Knueppel et al., 2010](#)) settings. It is also relatively short and can easily be added as a module to other household surveys.

One of the weaknesses of this indicator is that some of the items in the questionnaire do not meet strict psychometric criteria for cultural invariance, meaning that it should not be used to make comparisons across diverse socio-cultural countries and contexts ([Deitchler et al., 2010](#)). In the process of testing the HFIAS for cultural invariance, the [HHS](#) was developed as a cross-culturally valid alternative. It consists of three of the more severe items from the HFIAS and has been validated for cross-country comparison ([Ballard et al., 2011](#)). The HFIAS is more comprehensive than the HHS and has a broader measurement range, meaning that it can capture conditions ranging from mild food insecurity to very severe food insecurity, whereas the HHS focuses only on the most severe end of the food security spectrum. The HFIAS should undergo some basic adaptation of terms for the context in which it will be used in order to improve its performance (guidance for this process can be found in Section 2 of the HFIAS user manual, [Coates et al., 2007](#)). The HFIAS is meant for population-level use only, meaning that it should not be used, for instance, to screen households for program eligibility.

When data are collected at the household level, the selected respondent, usually the primary food preparer, may not always be in a position to accurately represent the experience of all household members. If any member of the household is reported as experiencing a food insecurity condition on the questionnaire, the entire household is classified as food insecure. This means the indicator potentially overestimates the number of food insecure *individuals* in a household, while providing an accurate count of households with at least one food insecure member. Relatedly, bias may be introduced from the fact that the selected respondent's perception of their household's experience is not representative of all other household members ([Coates et al., 2010](#)).

## Data Source

The data required to calculate this indicator are collected using the HFIAS module ([Coates et al., 2007](#)), which can be easily integrated into a broader household survey.

[Links to guidelines](#)

- [Coates et al \(2007\). Household Food Insecurity Access Scale \(HFIAS\) for Measurement of Food Access: Indicator Guide. \(V. 3\). Washington, D.C. FHI 360/FANTA.](#)

#### Links to validation studies

- [Gebreyesus et al. \(2014\). Is the adapted Household Food Insecurity Access Scale \(HFIAS\) developed internationally to measure food insecurity valid in urban and rural households of Ethiopia?. BMC Nutrition.](#)
- [Knueppel et al. \(2010\). Validation of the Household Food Insecurity Access Scale in Rural Tanzania. Public Health Nutrition.](#)
- [Mohammadi et al. \(2012\). Validity of an adapted Household Food Insecurity Access Scale in urban households in Iran. Public health nutrition.](#)
- [Ambikapathi et al. \(2018\). Food purchase patterns indicative of household food access insecurity, children's dietary diversity and intake, and nutritional status using a newly developed and validated tool in the Peruvian Amazon. Food security.](#)

#### Food Security Dimensions

- Quantity

#### Food Composition Database Required?

No

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End of Indicator: Household Food Insecurity Access Scale (HFIAS)

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## Household Hunger Scale (HHS)

### Overview

The Household Hunger Scale (HHS) is one of the four experience-based food insecurity scales included in the Data4Diets platform, along with the [Household Food Insecurity Access Scale \(HFIAS\)](#), the [Latin American and Caribbean Food Security Scale \(ELCSA\)](#), and the [Food Insecurity Experience Scale \(FIES\)](#). The HHS, derived directly from the HFIAS, is different from the other household food insecurity indicators because it assesses only the most severe experiences of food insecurity. The three hunger-related aspects of insecure food access included were shown to be invariant across multiple sociocultural contexts ([Deitchler et al., 2010](#)), allowing for cross-country comparisons. The FIES is also validated for cross-country comparisons using different psychometric criteria from the HHS, which includes a broader range of questions related to the food insecurity experience (i.e. not just extreme food insecurity). In contrast, the ELCSA is only validated for the Latin America and Caribbean context, while the HFIAS has limited cross-country comparative ability.

### Method of Construction

The HHS module consists of three "occurrence" and three "frequency-of-occurrence" questions, that should be answered according to the household food security experience in the previous 30 days. The respondent is first asked if a given condition was experienced (yes or no) and, if it was, with what frequency (rarely, sometimes, or often). All questions are worded to be as universally relevant as possible, and focus strictly on the hunger-specific experience of insecure access to food.

The resulting responses can be transformed into either a continuous or a categorical indicator of hunger. When calculating the HHS as a continuous indicator, each of the six questions is scored 0- 2, with 2 being the highest frequency of occurrence. The score for each of the three questions is then added together, the totalHHS ranging from 0 to 6, which indicates the degree of insecure food access. Households can also be categorized as "little to no hunger in the household" (0-1), "moderate hunger in the household" (2- 3), or "severe hunger in the household" (4-6). For more guidance, see Table 6 on page 13 in [Ballard et al., 2011](#).

### Uses

The HHS can be used to observe the prevalence of hunger over time and across countries or regions, informing policies and programs of food insecurity and hunger. It can also be included in nutrition and food security surveillance systems, informing humanitarian responses. For example, the HHS is one of the main indicators used in the Integrated Food Security Phase Classification System (IPC), an approach developed to measure and address acute food security crises ([IPC, 2012](#)). Additionally, the United States Agency for International Development (USAID) requires that all of their Bureau for Humanitarian Affairs food assistance projects utilize HHS in both baseline and endline evaluations ([FANTA III, 2015](#)).

Like other experience-based food insecurity scales, the HHS does not quantify food consumption nor assess adequacy of diet quality; doing so would require other methods and indicators, such as [24-hour dietary recalls](#) to calculate the [Mean Adequacy Ratio \(MAR\)](#), or a diet diversity index to determine the [Minimum Dietary Diversity Score for Women \(MDD-W\)](#).

## Strengths and Weaknesses

The HHS requires little time for implementation and allows for valid comparisons over time, across countries or regions, and among important demographic groups, such as different female- versus male-headed households ([Deitchler et al., 2010](#)).

Due to the focus of the HHS on the more severe food insecure behaviors, such as skipping meals or going to bed hungry, it is generally only useful in contexts with severe food insecurity and, as such, was heavily used during the peak of the Somalia famine in 2011/12 ([Maxwell et al., 2013](#)). Similar indicators, such as [FIES](#), [ELCSA](#), or [HFIAS](#) may be more appropriate for detecting the full range of food insecurity.

When data are collected at the household level, the selected respondent, usually the primary food preparer, may not always be in a position to accurately represent the experience of all household members. If any member of the household is reported as experiencing a food insecurity condition on the questionnaire, the entire household is classified as food insecure. This means the indicator potentially overestimates the number of food insecure *individuals* in a household, while providing an accurate count of households with at least one member experiencing food insecurity. Relatedly, bias may be introduced from the fact that the selected respondent's perception of their household's experience is not representative of all other household members ([Coates et al., 2010](#)).

Finally, the HHS can also be used as an individual-level indicator, although in that case results would not be comparable to other studies that used household-level data.

## Data Source

The HHS is a short module that consists from three to six questions that can be included as part of household surveys. Detailed guidance for adapting and implementing the indicator, as well as the module itself, is available in the HHS guide created by FANTA ([Ballard et al., 2011](#)).

[Links to guidelines](#)

- [Ballard et al. \(2011\). Household Hunger Scale: Indicator Definition and Measurement Guide. Washington, DC: Food and Nutrition Technical Assistance II Project, FHI 360.](#)
- [Maxwell et al. \(2013\). How Do Different Indicators of Household Food Security Compare? Empirical Evidence from Tigray. Feinstein International Center, Tufts University: Medford, USA.](#)
- [IPC Global Partners \(2021\). Integrated Food Security Phase Classification Technical Manual Version 3.1. Evidence and Standards for Better Food Security and Nutrition Decisions.](#)

#### Links to validation studies

- [Deitchler et al. \(2010\). Validation of a Measure of Household Hunger for Cross-Cultural Use. Washington, DC: Food and Nutrition Technical Assistance II Project \(FANTA-2\), FHI 360.](#)

#### Food Security Dimensions

- Quantity

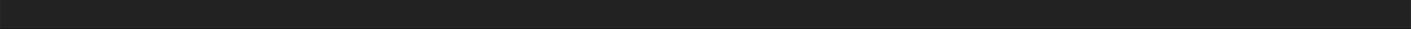
#### Food Composition Database Required?

No

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End of Indicator: Household Hunger Scale (HHS)

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## Household Share of Animal Protein in Total Protein Consumption

### Overview

The household share of animal protein in total protein acquisition and/or consumption is a household-level indicator that can be used as a proxy measure of diet quality at the population level. Surveys that collect data on acquisition are a proxy for food consumption, as households may build food stocks or consume food stocks during the reference period, as compared to consumption-based surveys, which collect data on food consumed in a specified recall period ( [Fiedler et al., 2016](#)). Both of these types (acquisition and consumption) collect information on food that is purchased, own-produced, or received as a transfer. A third type of [Household Consumption and Expenditure Survey \(HCES\)](#) collects a combination of acquisition and consumption data wherein households report what they acquired through purchases and what they consumed from own-production and transfers ( [Smith, 2003](#)). Animal source protein is more likely than plant protein to be highly digestible and more easily utilized by the human body, in addition to having all of the essential amino acids, which cannot be synthesized by the body and must be acquired through the diet ( [Ghosh et al., 2012](#)). Protein quality has significant impacts on nutritional status, and insufficient dietary protein quality has been linked to stunting in children ( [Semba et al., 2016](#); [Ghosh et al., 2012](#)). Protein quality is especially important in populations where individuals are prone to frequent infections that both decrease intestinal absorption and increase the body's demand for protein to fight off infection ( [Ghosh et al., 2012](#)). In addition, a higher percentage of animal source protein is likely to introduce a variety of micronutrients that are either less frequent in other types of foods or less bioavailable in plant source foods.

### Method of Construction

The data required to construct this indicator can be taken from an [HCES](#) that records both the type and quantities of foods acquired and/or consumed by each household ( [Smith et al., 2014](#)). A food composition table (preferably local or regional, if available) is then used to estimate the protein composition of the foods recalled in the survey. The food commodities that are considered to be animal source foods are meat (red and white), fish, eggs, milk, and cheese ( [Molledo et al., 2014](#)). The share of animal protein in total protein consumption can be calculated using the fraction below, which is then multiplied by 100 to obtain the percent:

$$\frac{\text{Total protein consumed from animal source}}{\text{Total protein consumed from all sources}}$$

This is one of the several indicators included in the ADePT-FSM (Food Security Module) software package, a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. The software can be downloaded on the World Bank website.

Please also see the Moltedo et al., 2014 book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data, and Moltedo et al 2018, which offers instructions for using ADePT-FSM to generate diet-related indicators from household data.

## Uses

This indicator is often used by FAO, UNICEF, and national statistics bureaus for food security situation reports and nutrition reports. This indicator can also provide an understanding of changing patterns in diet quality over time, especially in populations with increasing or decreasing wealth, considering that higher incomes have been associated with greater consumption of or expenditure on animal source foods (Mayen et al., 2014; Our World in Data, 2022).

## Strengths and Weaknesses

This indicator provides information on one aspect of dietary quality at the population level based on household data and it can be produced using existing HCES data. However, since this indicator only measures one of many important aspects of diet quality, it should be used in conjunction with other indicators for a more comprehensive understanding of household diet quality (e.g. the household share of dietary energy from non-staple foods). For this indicator to be accurate it is important that the food lists of instruments used for data collection are sufficiently detailed to match the diets of respondents. If the food list just includes "meat" as an aggregate category then it is difficult to match with specific values in the Food Composition Table, which can result in inaccuracies as the protein content varies by type of meat. Another drawback related to the HCES data source, but specific to this indicator, is that quantities of some animal source foods can be difficult to estimate given the varied cuts of meat and associated challenges of estimating the edible portion.

## Data Source

HCES data can be used to calculate this indicator. The World Bank Microdata Library has the most comprehensive and publicly accessible repository of data. Otherwise, data can be accessed—often for a fee—from the National Statistics Office, though each country has its own policies and procedures regarding data access. The International Household Survey Network (IHSN) is an informal network to promote data standards and dissemination. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems (INFOODS) or the World Nutrient Databases for Dietary Studies (WNDDS), developed by the Agriculture and Food Systems Institute. In addition, FBS could be used to calculate a similar indicator, such as the national average supply of protein. Alternatively, data from a 24-hour Dietary Recall or Food Frequency Questionnaire (FFQ) could be used to allow for calculation of individual intake of specific food

groups (e.g. animal source foods).

#### Links to guidelines

- [Moltedo et al. \(2014\). Analyzing food security using household survey data. The World Bank.](#)
- [Moltedo et al. \(2018\). Optimizing the use of ADePT-Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)
- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)
- [Smith et al. \(2014\). Assessment of the Reliability and Relevance of the Food Data Collected in National Household Consumption and Expenditure Surveys. International Household Survey Network.](#)
- [Robinson & Pozzi \(2011\). Mapping supply and demand for animal-source foods to 2030. Food and Agricultural Organization.](#)

#### Food Security Dimensions

- Quality

#### Food Composition Database Required?

Yes

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End of Indicator: Household Share of Animal Protein in Total Protein Consumption

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## Household Share of Dietary Energy from Macronutrients

### Overview

The household share of dietary energy from macronutrients is a household-level indicator based on food consumption or acquisition that quantifies the percentage of caloric intake from the three macronutrients: protein, fat, and carbohydrates. Some surveys collect data on food consumption and acquisition (a proxy of food consumption) separately, other surveys use both and account for transfers and own production of food (Smith, 2003). All three macronutrients have distinct and important functions in the body, such as proper growth, development, and cognitive and physical functions. Undernutrition, overweight/obesity and their health implications due to improper macronutrient intake continue to be a major public health concern worldwide (Muller & Krawinkel, 2005).

### Method of Construction

Data on food consumption or acquisition type and weight/volume and a Food Composition Database is necessary to estimate calories from each macronutrient for each food consumed. The total grams of each nutrient are added together, distinguishing fiber from other carbohydrates, and the caloric value of each is calculated using the following equation:

$$\text{Calories (Kcal)} = [\text{Protein (g)} \times 4] + [\text{Fats (g)} \times 9] + [\text{Av. Carbohydrates (g)} \times 4] + [\text{Fiber (g)} \times 2] + [\text{Alcohol (g)} \times 7]$$

$$\text{* Total Carbohydrates} = [\text{Available Carbohydrates} + \text{Fiber}]$$

**\*\* Alcohol is not a macronutrient, but contains calories**

Finally, the proportion of calories from each macronutrient is calculated by dividing the calories from each macronutrient by the total calories consumed and multiplying by 100 to determine the percentage. An example of how to calculate the household share of dietary energy from fats goes below:

**Household share of dietary energy from fats =**

$$[\text{Fats (g)} \times 9] / [\text{Protein(g)} \times 4] + [\text{Fats (g)} \times 9] + [\text{Carbohydrates (g)} \times 4] + [\text{Fiber (g)} \times 2] + [\text{Alcohol(g)} \times 7]$$

This is one of the several indicators included in the ADePT-FSM (Food Security Module) software package, a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. Please also see pages 35-36 of Moltedo et al. (2014) for detailed instructions on the analyzes of food security using household survey data, and Moltedo et al 2018, which offers instructions for using ADePT-FSM to generate diet-related indicators from household data.

## Uses

This indicator provides an understanding of the overall macronutrient balance of a population's diet. Imbalanced consumption indicates an imbalanced diet ([Moltedo et al., 2014](#)). This indicator provides understanding on trends on energy consumption quantity and quality.

## Strengths and Weaknesses

This indicator is easy to interpret, communicate and can be constructed from existing [Household Consumption Expenditure Survey](#) data. However, it does not calculate the distribution of macronutrient consumption among members of a household. Another limitation is that it does not provide information on the consumption of micronutrients, which are also essential elements of diet quality. If the data come from household surveys, this indicator cannot be used for individual targeting.

## Data Source

[HCES](#) data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data. National Statistics Office also provide this type of data, for free, though each country has its own policies and procedures regarding data access. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data ([NFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary [\[CJ1\] Studies \(WNDDS\)](#). In addition, [FBS](#) could be used to calculate a similar indicator, such as the [national average supply of protein](#), for use in understanding the macronutrient balance of the national food supply. Alternatively, [24-hour Dietary Recall](#) or [Weighed Food Records](#) could be used to calculate [total individual macronutrient intake](#).

### Links to guidelines

- [Moltedo et al. \(2014\). Analyzing food security using household survey data. The World Bank.](#)
- [Moltedo et al. \(2018\). Optimizing the use of ADePT Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)
- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)

### Food Security Dimensions

- Quantity
- Quality

### Food Composition Database Required?

Yes

---

End of Indicator: Household Share of Dietary Energy from Macronutrients

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## Household Share of Energy Consumed from Non-Staples

### Overview

The Household Share of Dietary Energy Consumed from Non-staples is an indicator of dietary quality because staple foods are generally low in micronutrients; diets based predominantly on staple foods are associated with micronutrient deficiencies ([Arimond et al., 2010](#); [Ruel, 2003](#)). A higher value of this indicator (i.e. higher consumption of non-staple foods) suggests higher dietary quality at the household level ([Smith & Subandoro, 2007](#)). Household Consumption and Expenditure Surveys (HCES), often used to calculate this indicator, collect data consumption and acquisition (which is a proxy for food consumption) ([Fiedler et al., 2016](#)) ([Smith, 2003](#)).

### Method of Construction

First, data on food consumption (or acquisition) are grouped into "staple" and "non-staple" foods. Cereals, roots, and tubers, should be classified as staples, while all other foods should be classified as non-staples ([Smith & Subandoro, 2007](#)). Then, food composition tables (preferably local or regional) are used to estimate the energy (kcal) of the foods recalled in the survey.

The following equation is used to calculate the household share of energy consumed from non-staples:

$$\frac{\textit{Total energy from non-staples(kcal)}}{\textit{Total energy from all foods (kcal)}} \times$$

The household share of energy consumed from *staples* is often calculated using the same method, but the numerator is the total energy from *staples* and the fraction has an inverse interpretation ([Smith & Subandoro, 2007](#)).

### Uses

This indicator can provide understanding of diet quality within and across populations, and it is useful for analyzing changes in dietary patterns over time, especially if they relate to changes in wealth and living standards. Typically, as populations become wealthier, they transition from diets high in staples to more diverse diets that include more vegetables, fruits, legumes, and other non-staples ([Lele et al., 2016](#)).

### Strengths and Weaknesses

This household-level indicator can be used as a simple proxy for certain aspects of dietary quality

including at sub-national level. However, it cannot be used to evaluate the diet quality of individuals within the household. This indicator could be misleading if ultra-processed foods are classified as non-staple foods, because they would inflate the numerator without being micronutrient dense ([Louzada et al., 2015](#)).

## Data Source

[HCES](#) data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data. National Statistics Office also provide this type of data, for free, though each country has its own policies and procedures regarding data access. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies ([WNDDS](#)).

### Links to guidelines

- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)

### Food Security Dimensions

- Quality

### Food Composition Database Required?

Yes

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End of Indicator: Household Share of Energy Consumed from Non-Staples

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## Household Share of Food from Various Sources

### Overview

The household share of food by source is an indicator that quantifies the contribution of a given food source (market, own-production, gifts, etc.) to total calories acquired or consumed by a household. Surveys that collect data on acquisition are a proxy for food consumption, as households may build food stocks or consume food stocks during the reference period, as compared to consumption-based surveys, which collect data on food consumed in a specified recall period ([Fiedler & Mwangi, 2016](#)). Both of these types (acquisition and consumption) collect information on food that is purchased, own-produced, or received as a transfer. A third type of [Household Consumption and Expenditure Survey \(HCES\)](#) collects a combination of acquisition and consumption data wherein households report what they acquired through purchases and what they consumed from own-production and transfers ([Smith, 2003](#)). This indicator provides information on the extent to which food acquisition or consumption depends on the marketed food supply, and to what extent the household relies on its own production as a source of calories.

### Method of Construction

Household food consumption data will most likely be obtained from an [HCES](#), but only from those that include information on the source of all foods consumed. The standardized food sources are from: (1) own production, (2) purchase, (3) gifts/aid, and (4) other. As stated earlier, a majority of [HCES](#) record this information.

$$\frac{\textit{Total kcals obtained from production}}{\textit{Total kcals consumed from}}$$

Consumption data are transformed into standard units of weight or volume, and then national or local food composition databases are used to estimate calorie content of the consumed foods ([Moltedo et al., 2014](#)). For each of the four sources, the total numbers of calories consumed are totaled, and the indicator is calculated in the following way:

This indicator is one of several indicators included in the [ADePT-FSM](#) (Food Security Module) software package, which is a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. The software download and corresponding documentation can be found on the [FAO](#) website.

Please also see the [Moltedo et al., 2014](#) book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data (Table 1.5 "Shares of Food Consumption by Food Source", page 80), and [Moltedo et al 2018](#), which offers instructions

for using ADePT-FSM to generate diet-related indicators from household data.

## Uses

This household-level indicator provides a picture of the relative importance, in terms of energy, of various food sources for a population. It can provide useful information on the vulnerability of populations to either market shocks (if they rely heavily on purchases) or climate shocks (if they rely heavily on their own production). Additionally, in the context of fortification projects, this indicator can provide information on the potential coverage of fortified foods (which must be derived from sources outside the household such as the market or via gifts/aid) and what types of households may be unlikely to access fortified goods based on their food sources ([Moltedo et al., 2014](#)). The contribution of other food sources such as public food distribution programs and food received as wages also have policy relevance.

## Strengths and Weaknesses

A strength of this indicator is that food source information has been included in about 85% of [HCES](#), making it possible to calculate this indicator for many countries and across time ([Fiedler & Mwangi, 2016](#)). Thus, the indicator can be used to assess the impact of national or sub-national changes in growing conditions, market conditions, or any other conditions that may affect how households obtain food. This indicator is derived from [HCES](#) data, and therefore can be updated only as frequently as a new [HCES](#) is conducted ([Fiedler & Mwangi, 2016](#)). One weakness of this indicator is that it is based on calories alone, and does not provide insight into the specific foods or food groups contributing to consumption, or the distribution of calories among household members. It also does not reveal the stability of the food sources or the relative costs a household must incur in order to obtain food from the various sources. Furthermore, one particular issue is estimation of quantities at the household level. [HCES](#) frequently rely on expenditure and/or non-standard units, which can be challenging to convert to precise quantities.

## Data Source

[HCES](#) data can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data. Otherwise, data can be accessed - often for a fee - from the National Statistics Office, though each country has its own policies and procedures. The International Household Survey Network ([IHSN](#)) is an informal network to promote data standards and dissemination. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the World Nutrient Databases for Dietary Studies ([WNDDS](#)), developed by the Agriculture and Food Systems Institute.

### Links to guidelines

- [Moltedo et al. \(2014\). Analyzing food security using household survey data. The World Bank.](#)
- [Moltedo et al. \(2018\). Optimizing the use of ADePT-Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)

## Food Security Dimensions

- Quantity
- Quality

## Food Composition Database Required?

Yes

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End of Indicator: Household Share of Food from Various Sources

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## Inadequacy of Specific Micronutrient Intake

### Overview

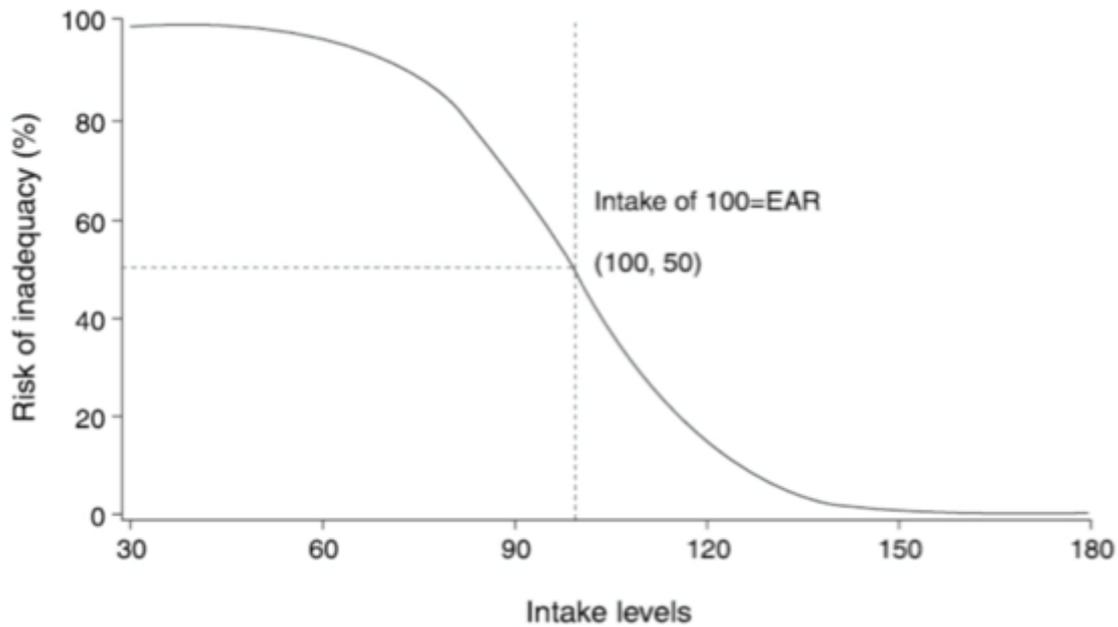
The Inadequacy of Specific Micronutrient Intake is an indicator that estimates the percent of a given population that is at risk of inadequate intake for a specific micronutrient. Two methods can be used to assess inadequacy: Estimated Average Requirement (EAR) fixed cut-point method, or the probability method. Both methods require nutrient intake data for a population that has been adjusted to represent the distribution of "usual" nutrient intakes. Micronutrients are of particular nutritional importance because malnutrition due to micronutrient deficiency continues to be a widespread problem in low- and middle-income countries. Micronutrients, such as iron, iodine, vitamin A, and zinc, are essential not just for infants and children to ensure proper growth and development, but are also necessary for adults for continued work productivity, healthy pregnancies, and overall cognitive and physical health (Bailey et al., 2015). It is important to note that the EAR fixed cut-point method cannot be used for iron in the case of menstruating women and young children due to a highly skewed requirement distribution as a result of increased iron needs. The other indicators that interpret individual dietary intake data in the Data4Diets platform include Mean Adequacy Ratio (MAR), total individual micronutrient intake, total individual macronutrient intake, and total individual energy intake.

### Method of Construction

Both methods of calculating this indicator require nutrient intake data for a population that has been adjusted to represent the distribution of "usual" nutrient intakes. The data used to estimate this distribution are collected using quantitative dietary assessment techniques, such as repeated 24-hour dietary recalls or multiple-day weighed food records, which are then translated into nutrient intakes using national or regional Food Composition Tables. To provide accurate estimates of the percent of a population at risk of inadequate intake, repeated intakes (either 24-hour Dietary Recall or Weighed Food Records) are required on at least a sub-sample of the population, in order to account for day-to-day variation.

The EAR fixed cut-point approach plots the EAR value onto the distribution of "usual" nutrient intakes to establish a cut-point, and calculates the percent of intakes that fall below that point to estimate the percent of the population at risk of inadequate intakes. The EAR for a nutrient is its estimated average requirement for a population (i.e. 50% of the population will have a requirement  $>$ EAR and 50% will have a requirement  $<$ EAR in relation to their usual nutrient intakes). See Figure 1 below for a visual representation of this method:

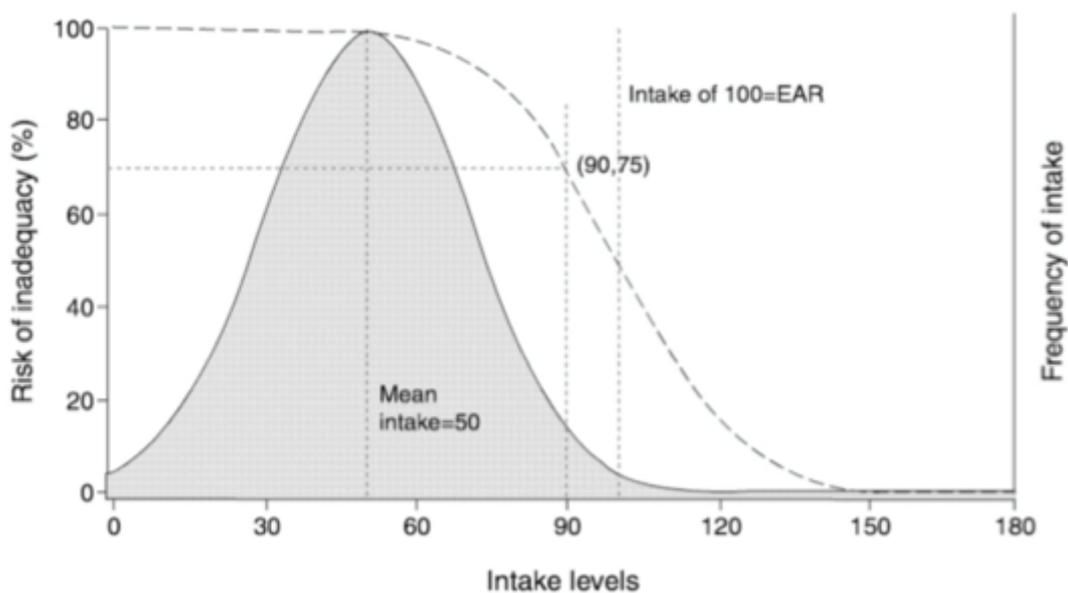
Figure 1



Source: Institute of Medicine, (2000). "Dietary Reference Intakes: Applications in DietaryAssessment."

The probability approach uses intake data from the study population to construct a distribution of intakes for that population, and uses this distribution of intakes along with the distribution of "usual" requirements to estimate the percent at risk of inadequate intakes in the population. See Figure 2 below for a visual representation of this method:

Figure 2



Source: Institute of Medicine, (2000). "Dietary Reference Intakes: Applications in DietaryAssessment."

The probability of inadequacy can be manually calculated as a weighted average of the risk of inadequacy at each potential level of intake. To perform this calculation, the requirement distribution is divided into categories based on gender and age, and the number of people from the population with nutrient intakes falling into each category is determined and multiplied by the probability of inadequacy for that category. These values are summed across all categories and then divided by the total population and multiplied by 100 to estimate the percent at risk of inadequate intake in the population.

For an explanation of situations in which the EAR fixed cut-point method can be used, refer to Box 4-2 in the Dietary Reference Intakes (DRI) document ([Institute of Medicine \[IOM\], 2000](#)). For a list of nutrients for which the probability approach can be used, refer to Table 4-1 in the same document ([IOM, 2000](#)).

For more detail on using both the probability and cut-point methods for estimating inadequacy, refer to Chapter 4 of the DRI document ([IOM, 2000](#)). To read about DRIs and their appropriate uses, refer to the following paper published in *Public Health Nutrition* ([Murphy & Poos, 2002](#)).

## Uses

This indicator is used to estimate the percent of a given population that is at risk of inadequate intakes of individual nutrients, so it can be used to identify the need for nutrient-specific interventions such as fortification or supplementation.

## Strengths and Weaknesses

The main strength of this method is that it provides an estimate of the percent of a population that is at risk of inadequate intake of specific nutrients. Although this indicator does not provide a measure of overall dietary adequacy in a single index, it does provide a measure of overall dietary adequacy when the percent at risk of inadequate intakes is calculated for multiple nutrients separately. A weakness, however, is that this indicator requires an EAR, which is unknown for certain nutrients, and is unknown for most nutrients during infancy. In addition, the DRIs for many nutrients, such as iron and zinc, vary depending on the assumed absorption, which can differ depending on the type of food consumed. Therefore, this indicator (and any others that rely on nutrient requirements) can only estimate the risk of inadequate nutrient intake, rather than confirming deficiency. Although this indicator uses individual-level dietary data, it can only be used to estimate risk of inadequate intake at the population level, and cannot be used to identify individuals who are deficient or at risk of inadequacy ([Yates et al., 1998](#)).

## Data Source

The data used to estimate the "usual" distribution of intakes for a nutrient are collected using quantitative dietary assessment techniques, such as repeated [24-hour Dietary Recalls](#), multiple-day [Weighed Food Records](#), or quantitative [Food Frequency Questionnaires](#), which are then translated into nutrient intakes using national or regional Food Composition Tables. As noted above, repeated intakes are required on at least a sub-sample of the population.

[The Food and Agriculture Organization/World Health Organization Global Individual Food consumption data Tool \(FAO/WHO GIFT\)](#)

) is one source of individual-level quantitative dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. Food Composition Tables can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the World Nutrient Databases for Dietary Studies ([WNDDS](#)), developed by the Agricultural and Food Systems Initiative, now known as the Agriculture and Food Systems Institute. EARs can be obtained from the Institute of Medicine ([IOM, 2006](#)), or other country-specific national sources.

#### Links to guidelines

- [National Academies of Sciences, Engineering and Medicine \(1986\). Nutrient Adequacy.](#)
- [Institute of Medicine \(2006\). Dietary Reference Intakes: The essential guide to nutrient requirements."](#)
- [Institute of Medicine \(2000\). Dietary Reference Intakes: Applications in dietary assessment.](#)
- [Lindsay et al. \(2020\). Perspective: Proposed Harmonized Nutrient Reference Values for Populations.](#)

#### Links to validation studies

- [Murphy & Poos \(2002\). Dietary Reference Intakes: Summary of applications in dietary assessment. Public Health Nutrition.](#)

#### Food Security Dimensions

- Quality

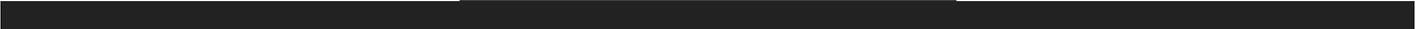
#### Food Composition Database Required?

Yes

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End of Indicator: Inadequacy of Specific Micronutrient Intake

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## Latin American and Caribbean Food Security Scale (ELCSA)

### Overview

The Latin American and Caribbean Food Security Scale (ELCSA) is one of the four experience-based food insecurity scales included in the Data4Diets platform, which also contains the Household Hunger Scale (HHS), the Household Food Insecurity Access Scale (HFIAS), and the Food Insecurity Experience Scale (FIES). The ELCSA was released in 2010 during a United Nations-sponsored summit to create an experience-based scale specifically for the Latin America and Caribbean context (Ballard et al., 2013). It was adapted from two existing scales used in Brazil (Perez-Escamilla et al., 2004) and Colombia (Alvarez et al., 2006), as well as from the US Household Food Security Survey Module (US HFSSM) and the HFIAS (Coates et al. 2007). It has subsequently been used by the Food and Agriculture Organization (FAO) in the Latin American and Caribbean region and served as one basis for developing the FIES.

### Method of Construction

This scale uses a set of 15 questions, with yes/no response categories, seven of which are for households with children. Each question asks the respondent whether he/she or any other household member has experienced a certain manifestation of food insecurity in the previous three months. A raw score is constructed by assigning a weight of '1' to each question with an affirmative answer ('yes'). Total raw scores range from 0 to 8 (for households without children) or 0 to 15 (for households with children).

Households can be classified as mildly, moderately, or severely food insecure according to the following categorization algorithm (FAO, 2012):

- *For households with minors*: 'household food secure' (score=0), 'mild household food insecurity' (score=1-5), 'moderate household food insecurity' (score=6-10), 'severe household food insecurity' (score=11-15).
- *For households with members above the age of 18*: 'household food secure' (score=0), 'mild household food insecurity' (score=1-3), 'moderate household food insecurity' (score=4-6), 'severe household food insecurity' (score=7-8) (Shamah-Levy et al., 2016).

A detailed manual on the construction and use of ELCSA is available in Spanish from FAO (2012). To view the questionnaire in English, refer to Table 1 in the following paper published in the *Journal of Nutrition* (Perez-Escamilla et al., 2009).

### Uses

This indicator can be used to provide information about the distribution and severity of insecure food access in the population. If additional demographic and socioeconomic data are collected along with the ELCSA, it can be used to better understand the location and characteristics of those who are most affected by food insecurity (Dallmann et al., 2015). This information can be used to

develop targeted policies, inform the allocation of resources, evaluate programmatic impacts, and build political will to combat food insecurity. Additionally, validation studies have shown ELCSA's effectiveness for use in various Latin American and Caribbean countries ([Perez-Escamilla et al., 2008](#); [Munoz-Astudillo et al., 2010](#)), making it an obvious choice to use in these contexts.

Like the other experience-based food insecurity scales, ELCSA does not quantify food consumption or assess diet quality; doing so requires other methods and indicators, such as a quantitative [24-hour Dietary Recall](#) to quantify food consumption to calculate the [Mean Adequacy Ratio \(MAR\)](#) or a diet diversity index to determine the [Minimum Dietary Diversity Score for Women \(MDD-W\)](#) in order to gain a picture of the 'adequacy' aspect of diet quality.

## Strengths and Weaknesses

One strength of ELCSA, and other experience-based food insecurity scales, is that it is uniquely able to detect aspects of food insecurity involving decreased access to a sufficient quantity or quality of food and also the psychosocial manifestations of anxiety and uncertainty around food access, which can also affect health and wellbeing ([Ballard et al., 2013](#)). It is also relatively short and can easily be added as a module to other household surveys.

On the other hand, when data are collected at the household level, the selected respondent, usually the primary food preparer, may not always be in a position to accurately represent the experience of all household members in considering responses to the questionnaire. That said, if any member of the household is reported as experiencing a food insecurity condition on the questionnaire, the entire household is classified as having experienced it too. This means that the indicator could potentially overestimate the number of *individuals* in households that are food insecure while providing an accurate count of households with at least one member experiencing food insecurity. Relatedly, bias may be introduced from the fact that the selected respondent's perception of their household's experience is not representative of all other household members ([Coates et al., 2010](#)).

## Data Source

The source of data for this indicator is household survey data collected via interviews with the household member who is primarily responsible for the household's food provisioning.

### Links to guidelines

- [Perez-Escamilla et al., \(2011\). Are the Latin American and Caribbean Food Security Scale \(ELCSA\) items comparable across countries?. The FASEB Journal.](#)
- [United Nations Food and Agriculture Organization \(FAO\) and the Latin American and Caribbean Food Security Scale \(ELCSA\) Scientific Committee, \(2012\). Escala Latinoamericana y Caribeña de Seguridad Alimentaria \(ELCSA\): Manual de uso y aplicación.](#)

### Links to validation studies

- [Gaitán-Rossi et al. \(2021\). Food insecurity measurement and prevalence estimates during the COVID-19 pandemic in a repeated cross-sectional survey in Mexico. Public Health Nutrition.](#)
- [Munoz-Astudillo et al. \(2010\). Validating Latin-American and Caribbean Latin-American food security scale on pregnant adolescents. Revista de Salud Publica.](#)
- [Perez-Escamilla et al. \(2008\). Validity of the Latin American and Caribbean Household Food Security Scale \(ELCSA\) in South Haiti". The FASEB Journal.](#)
- [Perez-Escamilla et al. \(2008\). Validity of the Latin American and Caribbean Household Food Security Scale \(ELCSA\) in Guanajuato, Mexico.](#)

## Food Security Dimensions

- Quantity

## Food Composition Database Required?

No

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End of Indicator: Latin American and Caribbean Food Security Scale (ELCSA)

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## Market-Level Food Diversity Score

### Overview

Food markets, rural or urban, are significant in determining access to, and consumption of, diverse foods. Food (or dietary) diversity can be captured at different levels of the food supply chain: in production, through on-farm diversity scores, in consumption, through metrics like the Household Dietary Diversity Score (HDDS), and in food markets, through market-level food diversity scores that represent the range of foods or food groups available for purchase.

Market-level food diversity is often defined as an index of the number of distinct foods or food groups available in a local market at a given point in time (Pingali & Ricketts, 2014) or across seasons and agroecological zones (Ambikapathi et al., 2019).

Metrics of market diversity present an opportunity to understand and quantify a key aspect of the food environment that influences household and individual purchasing decisions and, ultimately, diets. Such metrics are considered here to be 'emerging' because most of them are not yet widely used or validated outside a few localized research contexts.

### Method of Construction

There is not one accepted approach to calculating a market diversity score, though most researchers have approached the task similarly, modeling it after the way that consumption diversity scores have been constructed. For instance, Pingali and Ricketts (2014) generated a market-level food diversity score using the same basic method as the household dietary diversity score (HDDS). That is, the same 12 food groups that are used in the HDDS (Swindale et al., 2006) were used to count the number of food groups available in a local marketplace and develop an unweighted score. Ambikapathi et al., (2019) used a survey method where they asked vendors and agents, at the village level in Ethiopia, to collect data on monthly food availability and food prices for nine food groups similar to the MDD-W indicator. They classified low market food diversity as the availability of four or fewer food groups in the market. Bellon et al., (2016) took a different approach in calculating market diversity through a 7-day food frequency questionnaire to identify the foods that were purchased from the market, which offers a picture of 'purchase diversity' rather than market diversity, per se.

### Uses

The market-level food diversity score can strengthen assessments of food availability by integrating the availability of a wide variety of foodstuffs into a single metric. Coupled with other data, it can provide a snapshot of whether households with market access consume diverse diets or not, or why production diversity and dietary diversity are not always correlated in circumstances where market access and food diversity in markets are ample. Household market access has been shown to be positively associated with household diet diversity, but this relationship depends on properly functioning markets (see Sibhatu et al., 2015). This metric could be used to identify

markets that are lacking in diverse foods, which could prompt further analysis and identification of areas of agricultural production and market-level mechanisms that need greater investment to improve market function (Pingali & Ricketts, 2014). A market-level food diversity score could also be used to monitor and evaluate interventions that aim to improve market function and availability of diverse foods.

## Strengths and Weaknesses

The market data are relatively straightforward to obtain and the scores are typically constructed as a simple, unweighted count of food groups that is mathematically simple to calculate and report.

A feature of market-level food diversity, in certain contexts like remote rural areas, is the seasonality of agricultural production and the variability in the availability of foods across seasons (Nandi & Nedumaran, 2022). In such contexts, the score would need to be re-measured seasonally to obtain an accurate picture of these dynamics.

A consideration in using the market-level food diversity indicator is that it provides insights into what foods are available in the local markets but is not a proxy for the diet quality of the individuals who purchase food from the market since what is purchased may not always be consumed and not all foods consumed are purchased. It is also challenging to apply the food market diversity score to online food environments that cater to individuals beyond physical markets' catchment areas.

While the metric of market-level food diversity has a range of uses, there is still plenty of opportunity to innovate in the construction and application of this type of metric. For instance, such metrics could be combined with metrics of the cost and affordability of foods and diets to obtain a more comprehensive picture of both the availability and affordability aspects of food environments.

## Data Source

Data to construct market diversity scores can be collected through purposely designed tools integrated into primary market surveys or derived from repositories of market monitoring data, such as those maintained by many ministries of agriculture. These data are not always reflective of very small or localized markets - if such markets are the focus then primary data collection might be necessary. To make use of this information in relation to food consumption, additional information is needed related to where individuals or households purchase food and how much of what is purchased is eventually consumed.

### Food Security Dimensions

- Quantity
- Quality
- Stability

Food Composition Database Required?

No

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End of Indicator: Market-Level Food Diversity Score

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## Mean Adequacy Ratio (MAR)

### Overview

The Mean Adequacy Ratio (MAR) is a member of the class of indicators that are used to evaluate individual intake of nutrients. This index quantifies the overall nutritional adequacy of a population based on an individual's diet using the current recommended allowance for a group of nutrients of interest (Hatloy et al., 1998). It was first developed in the 1970s as a way to evaluate the effectiveness of food stamps in rural Pennsylvania (Madden & Yoder, 1972). The MAR has gained in popularity and is now increasingly used as a summary indicator of adequacy across multiple nutrients (Akter et al., 2021; Beydoun et al., 2018; Lepicard et al., 2017). The MAR is based on the Nutrient Adequacy Ratio (NAR), a measure that expresses an individual's intake of a nutrient as a percentage (capped at 100%) of the corresponding recommended allowance for that nutrient, given the respondent's age and sex. The MAR is then calculated by averaging the NAR. The other indicators in the Data4Diets platform that measure individual nutrient intake include total macronutrient intake, probability of inadequate intake, total individual micronutrient intake, and total individual energy intake. Rather than quantifying caloric intake, the MAR scales data on total nutrient intake to derive a comprehensive indicator of overall dietary adequacy, although it does not capture issues related to overconsumption or under-consumption.

### Method of Construction

The first step to estimating the MAR is to estimate the NAR for all nutrients of interest. The NAR is equal to the ratio of an individual's nutrient intake to the current recommended allowance of the nutrient for his or her age and sex and can be represented as a ratio or as a percentage. In the United States, the recommended allowance is referred to as the Recommended Dietary Allowance (RDA) - the average daily level of intake sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals. In many other countries, it is referred to as the Reference Nutrient Intake (RNI) (NIH, 2022).

If the intake of a nutrient exceeds the RDA/RNI, the NAR is capped at 100% or 1, depending on whether it is expressed as a percentage or ratio. This prevents nutrients with very high intake (NAR value > 1) from masking nutrients with very low intake (low NAR value) when they are averaged to calculate the MAR (Hatloy et al., 1998).

Once the NAR is calculated for each nutrient, the MAR is calculated by averaging all the NAR values together, as demonstrated in the equation below:

$$\text{MAR} = \frac{\text{Sum of NAR}}{\text{Number of nutrients}} \times 100 \text{ (if } \dots)$$

The MAR is reported on a scale from 0 to 100% (or 1), where 100% (or 1) indicates the requirements for all the nutrients were met.

When repeated measurements of nutrient intake are available for at least a subsample of individuals, the "probability approach" can be calculated. The repeated days are required to adjust the population nutrient intake distribution to take account of the intra-subject variability. This process allows for the usual intake distribution to be calculated allowing measurement of the individual probability of inadequacy for each nutrient and a mean probability of adequacy (MPA) over a range of nutrients (Arimond et al., 2010).

For more information on how to calculate this indicator, please see the highly detailed Methods section of the following paper published in the *European Journal of Clinical Nutrition* (Hatloy et al., 1998)

## Uses

Data are collected at the individual level to assess the nutrient adequacy of populations and can be calculated to include or exclude nutrients depending on programmatic or research priorities. The MAR has been used to validate dietary diversity indicators and can provide additional context when examined in conjunction with standard individual dietary diversity scores (Acham et al., 2012 ; Steyn et al., 2014; Tavakoli et al., 2016; Hjertholm et al., 2019). As an index, it does not reveal which micro- or macronutrients are or are not consumed in adequate amounts and instead provides a general picture of adequacy aspects of an individual's diet quality within a population. Total intake for an individual micronutrient or macronutrient may be more appropriate if disaggregated information on specific nutrients is needed. In addition, data on individual intake can be paired with findings on individual health outcomes or demographic information, such as religion, income, education, or other characteristics of interest in order to assess differences between sub-population groups based on various other demographic characteristics.

## Strengths and Weaknesses

One strength of this indicator is that it allows researchers to consider and communicate a population's overall nutritional adequacy, rather than focusing on specific nutrients that may not alone indicate healthy diet composition (for example the NAR only investigates one nutrient at a time). However, this indicator is based on RDAs or RNIs, which are estimates of the necessary nutrient intake to meet the requirement of 97-98% of healthy people, and may vary for some nutrients (like zinc and iron) depending on the assumed absorption, which can differ depending on the type of food consumed (Institute of Medicine, 2006). Thus, even a MAR of 1 (meaning requirements of all nutrients are met) does not guarantee that a population's needs are met nor that individuals within the population can properly absorb and use the nutrients. Additionally, a MAR below 1 does not necessarily indicate that a population suffers from nutritional deficiencies. Inherent in the way that the RDAs/RNIs are defined, the cut-off amount is actually above the required intake for all but 2-3% of the population (Institute of Medicine, 2000). These limitations must be kept in mind when using the MAR to infer a population's nutritional status (Institute of Medicine, 2000).

## Data Source

Individual-level dietary data can be obtained from [Weighed Food Records](#), quantitative [24-hour Dietary Recalls](#), or quantitative [Food Frequency Questionnaires](#).

The [Food and Agriculture Organization/ World Health Organization Global Individual Food consumption data Tool \(FAO/WHO GIFT\)](#) is a source for individual-level quantitative dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the World Nutrient Databases for Dietary Studies ([WNDDS](#)), developed by the Agricultural and Food Systems Initiative, now known as the Agriculture and Food Systems Institute. RDAs/RNIs can be obtained from the Institute of Medicine for the United States ([Institute of Medicine, 2006](#)), from the British Nutrition Foundation for the United Kingdom ([British Nutrition Foundation, 2016](#)), or the European Food Safety Authority of the European Union ([EFSA, 2017](#)). As an alternative to country-specific RDAs/RNIs (e.g. if they do not exist for the country of interest), the FAO/WHO global RNIs can be used ([FAO/WHO, 2004](#)).

### Links to guidelines

- [Hatloy et al., \(1998\). Food variety—a good indicator of nutritional adequacy of the diet? A case study from an urban area in Mali, West Africa. European journal of clinical nutrition.](#)

### Links to validation studies

- [Steyn et al. \(2014\). Which dietary diversity indicator is best to assess micronutrient adequacy in children 1 to 9 y?. Nutrition.](#)

### Food Security Dimensions

- Quality

### Food Composition Database Required?

Yes

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End of Indicator: Mean Adequacy Ratio (MAR)

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## Meat Available for Human Consumption

### Overview

The quantity of meat available for human consumption is a dietary indicator that can be used to understand trends in dietary patterns, dietary quality, and environmental sustainability of national diets. Animal source proteins are more readily used by the human body compared to plant proteins, and provide all the essential amino acids that cannot be synthesized by the body and must be consumed in diets (Ghosh et al., 2012). Inadequate protein consumption is associated with severe and chronic infections and fatty degeneration of organs, disease burdens for which women and children in developing countries are particularly at risk (Muller & Krawinkel, 2005). However, from an environmental perspective, meat produces more greenhouse gas per kilogram than plant-source proteins (Scarborough et al., 2014; Manary et al. 2013). In addition, from a broader food security perspective, livestock consumes about one-third of global cereal production and uses about 40% of arable land (Mottet et al., 2017). It is important to note that different types of meat have various impacts on health, also depending on the quantity consumed. For example, higher consumption of red meat is associated with an increased risk of cardiovascular disease and cancer mortality (Pan et al., 2012). More generally, animal source proteins are more likely than plant proteins to be highly digestible and more easily utilized by the human body, in addition to having all of the essential amino acids, which cannot be synthesized by the body and must be acquired through the diet (Ghosh et al., 2012). This indicator does not include other animal source foods such as eggs, fish, or dairy. They are excluded in part because they have a lower impact on greenhouse gas emissions, a primary measurement of a food's environmental impact.

Whereas meat available for human consumption can be estimated directly from individual-level dietary surveys such as food frequency questionnaires, 24-hour recalls, screeners like MDD-W, and from household consumption and expenditure surveys (HCES), this indicator profile describes a method of assessing the amount of meat available for human consumption in a country's food supply using food balance sheet (FBS) data.

### Method of Construction

Currently, the most straightforward way to find data for this indicator is to download the food supply quantity by type of meat directly from the Food and Agriculture Organization (FAO) on the [FAOSTAT](#) website. These data can then be summed across types of meat to come up with the total kilograms per capita per year. The food supply quantity is based on the following formula:

**Food supply = starting stocks + (quantity imported + quantity produced) - (quantity exported + seed + animal feed + waste + other non-food uses) - ending stocks (FAO, 2001)**

The food supply quantity is essentially the food available for consumption in a given country.

### Uses

This indicator can be used to proxy meat available for consumption in the 245 countries and territories that FAOSTAT tracks. Meat production (poultry, beef, veal, pork, lamb, mutton, goat, offal, and others) results in more greenhouse gas per kilogram than plant source proteins, and rising meat available consumption in a country increases the carbon footprint of food production ( [Scarborough et al., 2014](#); [Shafiullah et al., 2021](#)).

Therefore, tracking the meat supply available at the national level may be important in light of the [Sustainable Development Goals](#), particularly 12 and 13, which focus on responsible consumption, production, and actions to slow climate change. This indicator can illustrate trends in meat-available consumption, which may be of increasing importance as countries continue to develop since higher meat-available consumption is associated with increasing incomes ([Milford et al. 2019](#) ). The [FBS](#) permits disaggregation by type of meat but provides supply data only at the national level. For more disaggregated information and sub-group analysis, household- or individual-level survey data are needed, and an analysis based on food groups and meat available consumption must be conducted. Indicators such as the [household share of animal protein in total protein consumption](#), [total individual macronutrient intake](#), or [total individual micronutrient intake](#) could also be calculated.

## Strengths and Weaknesses

One strength of this indicator is that it is easily constructed using [FBS](#) data, and the data used for the indicator are regularly updated by national governments and are centrally located in [FAOSTAT](#) in a standard format. This approach allows users to filter for various kinds of meat. Different types of meat have varying levels of environmental impact based on their animal source. For example, one kilogram of beef produces greenhouse gas emissions seven times as large as the same quantity of poultry ([Scarborough et al., 2014](#)).

However, a downside of this indicator is that it does not reflect actual meat available for human consumption but meat availability in a given country. In addition, since the indicator is a national-level estimate, it cannot be disaggregated by age, sex, or by any geographic scale smaller than the national level, nor can it detect disparities in protein consumption across population groups or seasons, as is possible with individual-level dietary data. Although the [FBS](#) accounts for food losses incurred at the distribution and processing level, it does not account for plate waste at the household or individual level ([Lele et al., 2016](#)).

## Data Sources

The main source of data for this indicator is the [FBS](#) data on the [FAOSTAT](#) website, which disaggregates elements of utilization and supply and estimates the total food available for human consumption. FAO pairs this information with food composition data to produce information on the national supply of energy and macronutrients (per capita/day). In addition, [Household Consumption and Expenditure Surveys \(HCES\)](#) could be used to calculate a similar indicator, such as the [household share of animal protein in total protein consumption](#). Alternatively, data from a [24-hour Dietary Recall](#) or [Food Frequency Questionnaire \(FFQ\)](#) could be used to allow for the calculation of individual intake of specific food groups (e.g. animal source foods).

## Links to guidelines

- [Lele et al. \(2016\). Measuring food and nutrition security: An independent technical assessment and user's guide for existing indicators. Food Security Information Network.](#)
- [OECD \(2017\). Meat Consumption.](#)

## Links to case studies

- [Using Food Records to Assess Excessive Meat Intake in Brazil and Its Environmental Impact](#)

## Food Security Dimensions

- Quantity
- Quality
- Sustainability

## Food Composition Database Required?

No

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End of Indicator: Meat Available for Human Consumption

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## Minimum Acceptable Diet (MAD-IYCF)

### Overview

The Minimum Acceptable Diet (MAD) for children 6-23 months old is part of the suite of indicators of infant and young child feeding (IYCF) practices developed by UNICEF and WHO. The Indicators for Assessing IYCF Practices guidelines were revised in 2021, culminating in 17 indicators grouped under 'breastfeeding indicators', 'complementary feeding indicators', and 'other indicators'.

The MAD indicator is a composite of three indicators composed of the Minimum Dietary Diversity (MDD), Minimum Meal Frequency (MMF), and Minimum Milk Feeding Frequency (MMFF). MAD is defined as the percentage of children 6-23 months of age who consumed a minimum acceptable diet during the previous day (WHO/UNICEF, 2021).

### Method of Construction

According to the revised WHO/UNICEF 2021 guidelines, the MAD indicator is calculated as follows:

**Numerator:** Children 6-23 months of age who consumed at least the minimum dietary diversity (MDD) and minimum meal frequency (MMF) during the previous day AND are either breastfed or consumed the minimum milk feeding frequency (MMFF) during the previous day.

**Denominator:** Children 6-23 months of age.

The calculation is done in two steps:

#### First step

Calculate the three indicators (MDD, MMF, and MMFF) and code "1" for "Yes, achieved" and "2" for "No".

#### Second step

Estimate MAD using the following formula.

$$MAD = \frac{\text{Age in days} \geq 183 \text{ AND Age in days} < 730 \text{ AND } MDD = 1 \text{ AND } MMF = 1}{\text{Age in days} \geq 183 \text{ AND Age in days} < 730}$$

For breastfed infants, if MDD and MMF are both achieved then MAD is achieved. For non-breast infants, if MDD, MMF, and MMFF are all achieved, then MAD is achieved.

Minimum Dietary Diversity (MDD): To achieve minimum dietary diversity, breastfed children must have consumed foods and beverages from at least 5 out of 8 of the food groups during the previous day. Non-breastfed children must have done the same, with the additional requirement of consuming at least two milk feeds the previous day. See the MDD indicator for infants and young children for more information on the food groups and how the indicator is calculated.

Minimum Meal Frequency (MFF): To achieve minimum meal frequency, the child must have received solid, semi-solid, or soft foods (including milk for non-breastfed children) the minimum number of times or more over the previous day.

Minimum Milk Feeding Frequency (MMFF): To achieve minimum milk feeding frequency, the child must have consumed at least two milk feeds the previous day.

## Uses

The MAD, along with the other IYCF indicators, was developed to make comparisons across and within countries, to describe trends over time, to target/identify populations at risk, target interventions, inform policy decisions, and serve as an impact measure when monitoring and evaluating programs, all at the population level. Because the MAD indicator captures multiple dimensions of feeding, it can be used to compare populations with different rates of continued breastfeeding or compare breastfed and non-breastfed children (WHO/UNICEF, 2021).

## Strengths and Weaknesses

One advantage of this indicator is that it is relatively simple to calculate and interpret and is applicable across sociocultural contexts. It is also applicable to both breastfed and non-breastfed children. A weakness of this indicator is that it does not provide quantitative information about children's food and nutrient intake. The indicator was designed to capture optimal complementary feeding patterns to achieve energy and nutrient adequacy (based on WHO recommendations). Still, it was not designed to capture excessive intake of energy, sugar, or fat that would yield information about risks for overweight and obesity (Lele et al., 2016). Other indicators in the suite of IYCF indicators for infants and children 6-23 months are focused on capturing moderation of unhealthy foods, namely "sweet beverage consumption" and "unhealthy food consumption". Guidance on the calculation of these other indicators can be found in the guidance document on indicators for assessing feeding practices for infants and young children (WHO/UNICEF 2021).

## Data Source

The MAD indicator is usually constructed from a short Food Frequency Questionnaire (FFQ) administered to the child's caretaker as part of the standard IYCF module. Example questionnaires can be found in the UNICEF 2021 guidance on Indicators for Assessing Feeding Practices for Infants and Young Children. MAD data are also available for many countries in the UNICEF Infant and Young Child Feeding Database and are collected as part of many Demographic and Health Surveys (DHS).

## Links to guidelines

- [World Health Organization \(WHO\) and the United Nations Children's Fund \(UNICEF\), \(2021\). Indicators for assessing infant and young child feeding practices: definitions and measurement methods.](#)
- [WHO/UNICEF \(2017\). Global Nutrition Monitoring Framework: Operational guidance for tracking progress in meeting targets for 2025.](#)

## Links to validation studies

- [Dewey \(2006\). Developing and validating simple indicators of complementary food intake and nutrient density for breastfed children in developing countries.](#)

## Food Security Dimensions

- Quantity
- Quality

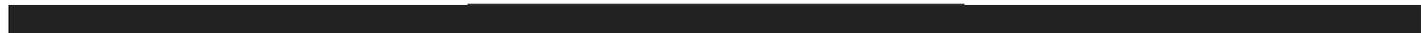
## Food Composition Database Required?

No

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End of Indicator: Minimum Acceptable Diet (MAD-IYCF)

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## Minimum Dietary Diversity (MDD-IYCF)

### Overview

The minimum dietary diversity (MDD) score for children 6-23 months old is a population-level indicator to assess diet diversity as part of infant and young child feeding (IYCF) practices. This indicator is part of the suite of complementary feeding indicators for IYCF developed by WHO and UNICEF to provide simple, valid, and reliable metrics for assessing IYCF practices at the population level (WHO/UNICEF, 2021). The MDD is also a component of the Minimum Acceptable Diet (MAD) indicator, which is a composite indicator described in the same 2021 guidelines.

### Method of Construction

MDD is measured as a percentage of children 6-23 months of age who consumed foods and beverages from at least five out of eight defined food groups during the previous day (WHO/UNICEF, 2021).

Data are gathered from a questionnaire administered to the child's caregiver, usually as part of the IYCF module. Respondents are asked to indicate whether or not their child consumed any food over the previous 24 hours from each of the eight food groups. The eight food groups included in the questionnaire are:

**MDD-IYCF Food Groups**

1	Breast milk
2	Grains, white/pale starchy roots, tubers and plantains
3	Beans, peas, lentils, nuts and seeds
4	Dairy products (milk, infant formula, yogurt, cheese)
5	Flesh foods ((meat, fish, poultry, organ meats)
6	Eggs
7	Vitamin-A rich fruits and vegetables
8	Other fruits and vegetables

The total number of food groups consumed is summed. The population-level indicator is calculated based on the following formula:

Please refer to the [WHO/UNICEF guidelines](#) for more information on calculating this indicator.

## Uses

Minimum dietary diversity has been shown to be positively associated with the mean micronutrient adequacy of the diet (see [Steyn et al., 2014](#)). The MDD can be used to monitor and assess the dietary quality of infants and young children and the appropriateness of complementary feeding practices at the population level ([WHO/UNICEF, 2021](#)). As a simple and easy-to-interpret indicator, the MDD is appropriate for identifying high-need populations, setting national-level targets, and monitoring and assessing interventions.

The previous version of the MDD indicator guidance (WHO 2008) measured up to 7 food groups and did not capture breastmilk as a food source, thereby 'penalizing' breastfed children in comparison to formula-fed children in assessing their diet quality. The 2021 guidance includes breast milk as one of the 8 food groups, which makes the comparison of MDD for breastfed and non-breastfed infants more accurate. This means, though that indicators calculated using the 'old' method are not comparable to those calculated using the 'new' method (see [Roy et al., 2022](#)); and must be recalculated using a single method for the purpose of comparability.

## Strengths and Weaknesses

One advantage of the MDD is that it is simple to collect, tabulate, and interpret, and is applicable across sociocultural contexts.

A limitation of the indicator is the lack of information on the type of diets consumed amongst children meeting or not meeting MDD. Since the minimum diet diversity threshold of five food groups can be achieved by consuming with any combination of the eight possible food groupings, the same MDD value amongst children could be due to different dietary combinations ([Beckerman-Hsu et. al., 2020](#)).

## Data Source

The MDD indicator can be constructed, like other [dietary diversity measures](#), from a standard module administered to the child's caretaker. Example questionnaires can be found in the [WHO/UNICEF, 2021 guidelines](#). This indicator is also available for many countries in the [UNICEF Infant and Young Child Feeding Database](#) and is collected as part of many [Demographic and Health Surveys \(DHS\)](#).

### Links to guidelines

- [WHO, UNICEF. \(2021\) Indicators for assessing infant and young child feeding practices: definitions and measurement methods.](#)

- [WHO/UNICEF \(2017\). Global Nutrition Monitoring Framework: Operational guidance for tracking progress in meeting targets for 2025](#)

#### Links to validation studies

- [Jones et al., \(2013\). "World Health Organization infant and young child feeding indicators and their associations with child anthropometry: A synthesis of recent findings"](#)
- [Moursi, M. M., Arimond, M., Dewey, K. G., Trèche, S., Ruel, M. T., & Delpeuch, F. \(2008\). Dietary Diversity Is a Good Predictor of the Micronutrient Density of the Diet of 6- to 23-Month-Old Children in Madagascar. The Journal of Nutrition](#)
- [Working Group on Infant and Young Child Feeding Indicators. Developing and Validating Simple Indicators of Dietary Quality and Energy Intake of Infants and Young Children in Developing Countries: Summary of findings from analysis of 10 data sets. Report](#)
- [Beckerman-Hsu, J. P., Kim, R., Sharma, S., & Subramanian, S. \(2020\). Dietary Variation among Children Meeting and Not Meeting Minimum Dietary Diversity: An Empirical Investigation of Food Group Consumption Patterns among 73,036 Children in India.](#)

#### Food Security Dimensions

- Quality

#### Food Composition Database Required?

No

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End of Indicator: Minimum Dietary Diversity (MDD-IYCF)

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## Minimum Dietary Diversity for Women (MDD-W)

### Overview

The Minimum Dietary Diversity for Women (MDD-W) is a population-level indicator of diet diversity validated for women aged 15-49 years old. The MDD-W is a dichotomous indicator based on 10 food groups and is considered the standard for measuring population-level dietary diversity in women of reproductive age. The MDD-W was preceded by the Women's Dietary Diversity Score (WDDS), which was a validated continuous measure based on the reported intake of 9 food groups.

The MDD-W was developed after additional validation using new data sets was carried out to create a dichotomous indicator (FAO & FHI, 2016).

According to the MDD-W, women who have consumed at least five of the 10 possible food groups over a 24-hour recall period are classified as having minimally adequate diet diversity. The Food and Agriculture Organization (FAO) and the United States Agency of International Development (USAID) both recommend the use of the MDD-W when a categorical indicator of individual dietary diversity for women is needed. These organizations also recommend using the 10-food group dietary diversity indicator if a continuous variable is desired. To further understand the differences between the dichotomous dietary diversity indicator and the continuous dietary diversity indicator, both based on 10 food groups, please see [FAO & FHI \(2016\)](#).

### Method of Construction

Data are gathered from a questionnaire administered to a female respondent aged 15-49 years. Respondents are asked to recall the food groups that they consumed over the previous 24 hours using either a list-based method (which asks about the consumption of each of the 10 food groups in order), or an open recall (where respondents recall all foods they ate during the previous day and the enumerator determines to which food groups these foods belong). Although the MDD-W guidelines present both recall methods, they recommend the use of the open-recall method ([FAO & FHI, 2016](#)). The 10 food groups required for the MDD-W are:

MDD-W Food Groups	
1.	Grains, roots, and tubers
2.	Pulses

3.	Nuts and seeds
4.	Dairy
5.	Meat, poultry, and fish
6.	Eggs
7.	Dark leafy greens and vegetables
8.	Other Vitamin A-rich fruits and vegetables
9.	Other vegetables
10.	Other fruits

The enumerators should record whether the respondent did, or did not, consume foods within each food group. The total number of food groups consumed is summed and all foods are equally weighted. The population-level indicator is calculated based on the following formula:

$$\frac{\text{Women 15-49 years of age who consume at least one food from each food group}}{\text{Total number of women 15-49 years of age}}$$

For more information on calculating this indicator, refer to FAO's measurement guidelines ([FAO & FHI, 2016](#)).

## Uses

Indicators of women's diet diversity have been shown to be strongly and positively correlated with

micronutrient adequacy of the diet in cross-country analyses using data from several low-income countries ([Arimond et al., 2010](#); [Chakona et al., 2017](#); [Rodriguez-Ramirez et al., 2022](#))

Micronutrient adequacy is one important element of diet quality, thus, the MDD-W can be used as a proxy for this aspect of diet quality. The survey is administered on an individual level, but the resulting indicator is appropriate only for population-level (not individual-level) targeting. It can be used to monitor and evaluate programs that seek to improve diet quality in resource-constrained settings. The MDD-W can be used to calculate and report prevalence, making it a simple and easy-to-understand tool that is useful for communication and advocacy materials, particularly for non-nutrition audiences ([Arimond, 2016](#); [FAO & FHI, 2016](#)).

## Strengths and Weaknesses

One advantage of MDD-W is that it is simple to collect, tabulate, and interpret. The results are easy to communicate (i.e. minimally adequate diversity is either achieved or not).

Additionally, the threshold for adequacy is standardized which enables comparisons across time and space. However, the tool must be adapted to include culturally relevant examples of foods for each of the 10 food groups. Enumerators must be properly trained to correctly categorize meals containing a mix of different food groups and to record only food groups where more than 15 grams of food in that group was consumed, in order to exclude nutritionally less relevant foods used as condiments or seasonings from the total score ([FAO & FHI, 2016](#)). A strength of the MDD-W is its simplicity as a measure of a key aspect of diet quality, but it remains only a rough proxy for nutrient adequacy. Individuals interested in a more precise estimate of nutrient intake and adequacy should consider conducting a quantitative [24-hour Dietary Recall](#) instead.

## Data Source

The MDD-W is based on the recall of food groups consumed in the previous 24 hours by the respondent. Quantitative [24-hour recall](#) data, in which the respondent describes everything that was eaten during the previous day along with the amount consumed, can also be used though it provides much more detailed information than is needed to calculate the MDD-W. Therefore, it can be useful, but not essential, for constructing the MDD-W.

### Links to guidelines

- [FAO and FHI, \(2016\). "Minimum dietary diversity for women: a guide for measurement."](#)

### Links to validation studies

- [Arimond et al. \(2010\). Simple food group diversity indicators predict micronutrient adequacy of women's diets in 5 diverse, resource-poor settings. The Journal of Nutrition.](#)
- [Martin-Prevel et al. \(2015\). Moving forward on choosing a standard operational indicator of women's dietary diversity. Food and Agricultural Organization.](#)

## Food Security Dimensions

- Quality

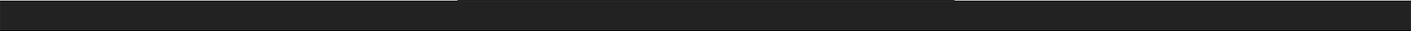
## Food Composition Database Required?

No

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End of Indicator: Minimum Dietary Diversity for Women (MDD-W)

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## Modified Functional Attribute Diversity (MFAD)

### Overview

The Modified Functional Attribute Diversity (MFAD) indicator is one of the two entropy-based indicators included in the Data4Diets platform. MFAD and the [Shannon Entropy Diversity Metric](#) both measure dietary diversity by calculating the deviation from a perfectly equal distribution of all food groups in the diet. The MFAD is derived from the Functional Attribute Diversity (FAD) approach, which is a metric used in the biological sciences to measure the diversity of plant and animal communities based on functional traits, or characteristics that group species together based on their function within the community ([Petchey & Gaston, 2006](#)). MFAD adds to this method by weighting FAD by the number of functional traits, thus measuring the dispersion of species by these functional units rather than by the individual species themselves, which in turn allows for comparison of the metric across ecological communities ([Schmera et al., 2009](#)). In the case of dietary diversity, the functional unit is defined as the nutritional components of the diet, and MFAD measures the variety of nutrients based on both the number of different food items, as well as the amount of each item present ([Remans et al., 2014](#)). For example, two food items that are nutritionally similar, but are in different food groups, would not be counted twice in this metric.

### Method of Construction

As mentioned previously, the main difference between FAD and MFAD is that MFAD weighs species, or foods in this case, included in the calculation by their functional traits. Functional traits are attributes of food that are functionally similar, which in the case of diet means nutritional composition, even though the foods themselves may not be categorized into the same food group. This is to prevent an increase in measured dietary diversity when functional (or nutritional) diversity does not exist. For example, adding potatoes to a starch-heavy diet would increase a metric such as the [Household Dietary Diversity Score \(HDDS\)](#), but would not increase the MFAD, as staples and potatoes tend to provide the same nutrients.

$$\text{MFAD} = \frac{\sum_{i=1}^N \sum_{j=1}^N d_{ij}}{N}$$

Where  $n$  is the number of individual food items,  $d$  is the dissimilarity between food items  $i$  and  $j$ , which is defined by nutritional composition, and  $N$  is the number of functional units defined, such that foods that are identical in their nutritional composition are considered as the same functional unit ([Ricotta et al., 2005](#)). MFAD can take on a value between 0 and 100, and as the value increases it signifies a diet composed of more nutritionally dissimilar, and thus more diverse, foods.

### Uses

Adapting MFAD for use in nutrition and food security research has been a relatively new development ([Remans et al., 2014](#)). Since foods are divided by their functional (nutritional) characteristics, the indicator measures the diversity of nutritive values within national food supplies or of national crop production ([Lele et al., 2016](#)). It has been suggested as a main way to measure food nutrient adequacy, which is one of the seven indicators chosen to best assess sustainable nutrition security ([Gustafson et al., 2016](#)).

## Strengths and Weaknesses

A strength of this indicator is that it highlights the nutritional components of food, rather than relying on a simple count of diversity to represent quality. Additionally, as a scale-invariant indicator, it can be compared across countries and timeframes to assess relative diet quality, such as was done by Remans et al. on a global level ([2014](#)). However, a weakness is that MFAD calculations rely on [Food Balance Sheets \(FBS\)](#), which means data are not based on actual consumption but on availability, and thus national-level data could obscure regional-level differences in diversity. The data source also limits the foods included in the analysis to those reported on the [FBS](#) ([Lele et al., 2016](#)). Additionally, as a composite index, the MFAD cannot distinguish between the specific nutrients that are in abundance and those that are lacking in the diet, such as a metric like individual intake of micronutrients or the individual intake of macronutrients, nor has it been adapted to use with expenditure data, such as the [Shannon Entropy Diversity Metric](#) ([Wang et. al, 2017](#)).

## Data Source

MFAD can be calculated using [FBS](#) data in conjunction with a Food Composition Table to identify the nutritional values of the foods included in the analysis. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at Food and Agriculture's (FAO) International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and [Food Systems Initiative World Nutrient Databases for Dietary Studies \(WNDDS\)](#).

### Links to guidelines

- [Schmera et al., \(2006\). A measure for assessing functional diversity in ecological communities. Aquatic Ecology.](#)

### Food Security Dimensions

- Quality
- Sustainability

### Food Composition Database Required?

Yes

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## National Average Supply of Protein

### Overview

The indicator of average protein supply provides a national-level estimate of the availability of protein and offers insight into the nutritional quality of the food supply. For example, in countries where malnutrition is prevalent, increased consumption of protein-rich foods is an important sign of improved diet quality. Consumption of protein from animal-source foods has been shown to protect children against stunting ([Lancet Series, 2008](#)). This indicator does not yield any information on the affordability, access, or consumption of such foods by different population groups within a given country, meaning that a sufficient national supply does not ensure sufficient protein consumption by nutritionally vulnerable groups. Nonetheless, it can be useful for determining whether a country's food supply contains enough protein to meet aggregate population needs. If it does not, then measures should be taken, such as promoting production or increased imports of protein-rich foods.

In addition to indicators of the total supply of all protein, a similar indicator can be constructed on [FAOSTAT](#) that distinguishes between the availability of animal-source protein and non-animal-source protein. This more nuanced indicator can be useful, as it disaggregates animal source proteins from plant-based proteins, and as such, can be considered a proxy for diet quality.

Additional indicators of the quality of the food supply using [Food Balance Sheet](#) (FBS) data that are covered in the Data4Diets platform include [meat consumption](#), [national energy available from non- staples](#), and [national fruit and vegetable availability in food supply](#), among others. Other related indicators at the household and individual levels include [household share of animal protein in total protein consumption](#) and [total individual macronutrient intake](#).

### Method of Construction

This indicator is part of the [Food and Agriculture Organization \(FAO\) Suite of Food Security Indicators](#) and can be accessed on the [FAOSTAT](#) website by selecting 'suite of food security indicators' under the 'data' tab. Users can produce this indicator for a given country and year (or span of years) by selecting 'Average protein supply (g/capita/day) (3-year average)' under the 'items' section. A related indicator reflecting protein from animal-source foods, called 'Average supply of protein of animal origin (g/capita/day) (3-year average),' is also available.

FAO calculates the national estimate of total food availability using data from a number of sources, including government agencies, marketing authorities, and industrial/manufacturing surveys, among others ([FAO, 2001](#)). This national estimate is calculated as the sum of the elements of supply (production quantity, import quantity, and stock variation [i.e. net increase or decrease]) minus the elements of utilization (export quantity, food manufacturing, feed, seed, waste, and other uses). Using Food Composition Tables, [FAOSTAT](#) calculates the protein content (in grams) of the edible portion of each type of food available for human consumption (e.g. eggs, wheat, beans), and then these values are added to compute the total national protein supply ([FAO, 2001](#)).

This value is then divided by the population size and by 365 days to calculate the per capita daily average protein supply. This calculated value (grams/capita/day) is available in FAOSTAT for the total food supply, as well as for individual food items and food groups.

## Uses

When data from individual dietary surveys or household surveys are unavailable, this indicator serves as a proxy for protein consumption levels at the population level (FAO, 2016). Because the data are available annually, with a 2-3-year lag, for nearly all countries, this is a useful indicator for cross-country comparisons of protein consumption, as well as for analysis of trends over time within a country. This indicator and the average supply of animal source protein, are both part of the [FAOSTAT Suite of Food Security Indicators](#).

## Strengths and Weaknesses

One strength of this indicator is that it is easily constructed using [FBS](#) data, and the data used for the indicator are regularly updated by national governments and are centrally located in FAOSTAT in a standard format. The indicator is also simple to interpret and lacks sampling and reporting biases associated with dietary recall data (Lele et al., 2016).

However, a downside of this indicator is that it does not reflect actual consumption of protein but rather protein availability in a given country. In addition, since the indicator is a national-level estimate, it cannot be disaggregated by age, sex, or by any geographic scale smaller than the national level, nor can it detect disparities in protein consumption across population groups or seasons, as is possible with individual-level dietary data. The indicator is limited to the foods that appear in the FBS food list and therefore does not capture all possible sources of protein in the diet (e.g. insects or wild foods). Although the FBS accounts for food losses incurred at the distribution and processing levels, it does not account for plate waste at the household or individual level (Lele et al., 2016).

## Data Source

The main source of data for this indicator is the FAO [FBS](#) database, which disaggregates elements of utilization and supply, and estimates total food available for human consumption. FAO pairs this information with food composition data to produce information on the national supply of macronutrients (per capita/day). In addition, [Household Consumption and Expenditure Surveys \(HCES\)](#) could be used to calculate a similar indicator, such as [household share of dietary energy consumption from different macronutrients](#). Alternatively, [24-hour Dietary Recall](#) or [Weighed Food Records](#) could be used to calculate [total individual macronutrient intake](#).

### Links to guidelines

- [Food and Agricultural Organization \(2001\). Food Balance Sheets: A Handbook.](#)

### Food Security Dimensions

- Quantity
- Quality

Food Composition Database Required?

Yes

---

End of Indicator: National Average Supply of Protein

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## National Energy Available from Non-Staples

### Overview

The energy available from non-staples is an indicator calculated at the national level that estimates the percentage of all calories that come from non-staple goods in the food supply (i.e. all food items, excluding tubers and grains). Staple foods are generally the least expensive food items available and are also the least nutrient-dense, and diets based predominantly on staple foods have been associated with micronutrient deficiencies and low dietary diversity (Arimond et al., 2010 ; Ruel, 2003). This indicator does not yield any information on the affordability, accessibility, or consumption of non-staple foods by different population groups within a given country, meaning that a sufficient national supply does not ensure sufficient consumption by nutritionally vulnerable groups. Additional indicators that are covered in the Data4Diets platform could be used as proxies for diet quality and rely on Food Balance Sheet (FBS) data including the national average supply of protein and national fruit and vegetable availability in food supply.

### Method of Construction

This indicator can be accessed through the FAOSTAT website by selecting the 'Food Balance Sheets' option under the 'Data' tab. The Food and Agriculture Organization (FAO) calculates the national estimate of total food availability using data from a number of sources, including government agencies, marketing authorities, and industrial/manufacturing surveys, among others (FAO, 2001). This national estimate is calculated as the sum of the elements of supply (production quantity, import quantity, and stock variation [i.e. net increase or decrease]) minus the elements of utilization (export quantity, food manufacturing, feed, seed, waste, and other uses). Using food composition tables, FAOSTAT calculates the energy content (kcal) of the edible portion of each type of food available for human consumption. This value is then divided by the population size and by 365 days to calculate the per capita daily average supply of energy from each type of food (or from the total food available if these food groups are added together).

To calculate this indicator, the food supply (kcal/capita/day) must first be calculated for non-staple goods. In the FAOSTAT food balance sheets, the 'Food supply (kcal/capita/day)' option can be selected under the 'Elements' heading, and food groups can be selected under the 'Items Aggregated' heading to produce a total food supply (kcal) for non-staple goods. After calculating the food supply for non-staples, the food supply for all goods is calculated by selecting 'Grand Total + (Total)' under the 'Items Aggregated' heading. The indicator for energy available from non-staples (% kcals non-staples) can then be calculated using the following fraction:

$$\frac{\text{Food supply of all non-staple foods (kcal/capita/day)}}{\text{Food supply of all foods (kcal/capita/day)}}$$

For more information on the FAO food balance sheet methodology, see [FAOSTAT](#). For more details on using FAO data to calculate available energy, refer to the [Food Security Information Network's \(FSIN\) guide to food security indicators \(Lele et al., 2016\)](#).

## Uses

This indicator can be used to gain an overview of the overall quality of the food supply by measuring the percentage of the food supply that is coming from non-staple foods. When the preferred data from individual or household surveys are unavailable, this indicator using [FBS](#) data can serve as a proxy for relative diet quality trends based on food supply at the population level ([FAO, 2016](#)).

Because the data are available annually for nearly all countries (with a 2-3-year lag), this is a useful indicator for cross-country comparisons of food supply, as well as for analysis of trends over time within a country. Non-staple items are of particular interest because they tend to be more nutrient-dense than staple goods, and previous research has found an association between the diversity of the national-level food supply (of which this is an indicator) and health outcomes ([Remans et al., 2014](#)). This indicator has also been identified as one of a suite to be used in measuring the nutrient adequacy component of 'sustainable nutrition security' ([Gustafson et al., 2016](#)). The inverse of this indicator (energy available from staple foods) is part of the [FAO Suite of Food Security Indicators](#).

## Strengths and Weaknesses

Due to the availability and comprehensiveness of [FBS](#) data, this indicator is easily calculated and compared across time and place ([FAOSTAT](#)). Another strength of this indicator is that it is simple to interpret and lacks sampling and reporting biases associated with dietary recall data ([Lele et al., 2016](#)).

However, a downside of this indicator is that it does not reflect actual consumption of non-staple foods, but rather the availability of these foods in a given country. In addition, as a national-level estimate, it cannot be disaggregated by sex, age, or by any geographic scale smaller than the national level, nor can it detect disparities in consumption of non-staples across population groups or between seasons, as is possible with individual-level dietary data. Although the FBS accounts for food losses incurred at the distribution and processing levels, it does not account for plate waste at the household or individual level ([Lele et al., 2016](#)). It is also important to confirm the definition of non-staple goods, which may vary by context.

## Data Source

The main source of data for this indicator is the [FAO FBS database](#), which disaggregates elements of utilization and supply, and estimates total food available for human consumption. FAO pairs this information with food composition data to produce information on the national supply of macronutrients (per capita/day). In addition, [Household Consumption and Expenditure Surveys \(HCES\)](#) could be used to calculate a similar indicator, such as the [household share of energy consumed from non-staples](#). Alternatively, [24-hour Dietary Recall](#), a [Food Frequency Questionnaire \(FFQ\)](#), or [Weighed Food Records](#) could also be used to calculate an analogous

indicator.

#### Links to guidelines

- [Food and Agriculture Organization \(2001\). Food balance sheets: A handbook.](#)

#### Links to validation studies

- [Del Gobbo et al., \(2015\). "Assessing global dietary habits: a comparison of national estimates from the FAO and the Global Dietary Database."](#)
- [Serra-Majem et al., \(2003\). "Comparative analysis of nutrition data from national, household, and individual levels: results from a WHO-CINDI collaborative project in Canada, Finland, Poland, and Spain."](#)

#### Food Security Dimensions

- Quality

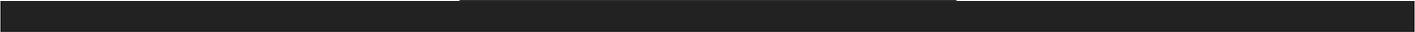
#### Food Composition Database Required?

No

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End of Indicator: National Energy Available from Non-Staples

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## National Fruit and Vegetable Availability

### Overview

This indicator is a national-level estimate of the availability of fruits and vegetables and is an indirect measure of the nutritional quality of the food supply. Low fruit and vegetable consumption is one of the leading contributors to the global burden of non-communicable disease and death ( [Lim et al., 2013](#)). A [2003 Food and Agriculture Organization/World Health Organization \(FAO/WHO\) joint report](#) recommends a minimum individual intake of 400g (or the equivalent of 5 servings) of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease, cancer, diabetes, and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies ([Afshin et al., 2019](#)). This indicator does not yield information on the affordability, access, or consumption of fruits and vegetables by different population groups within a given country, but it can be useful for determining whether a country's food supply contains enough fruits and vegetables to meet aggregate population needs. This indicator uses Food Balance Sheet (FBS) data that can be accessed through FAO's [FAOSTAT website](#). Additional indicators of dietary quality that use FBS data and are covered in this Data4Diets platform include the [national average supply of protein](#) and [national energy available from non-staples](#), among others.

### Method of Construction

This indicator can be calculated using [FBS](#) data, which can be found on the [FAOSTAT website](#) by selecting the 'Food Balance Sheets' option under the 'Data' tab. FAO calculates the national estimate of total food availability using data from a number of sources, including government agencies, marketing authorities, and industrial/manufacturing surveys, among others ([FAO, 2001](#)). This national estimate is calculated as the sum of the elements of supply (production quantity, import quantity, and stock variation) minus the elements of utilization (export quantity, food manufacturing, feed, seed, waste, and other uses).

This indicator can be constructed for a given country and year (or range of years) by selecting 'Food supply quantity (kg/capita/year)' under the 'Elements' heading, and then 'Vegetables + (Total)' and 'Fruits Excluding Wine + (Total)' under the 'Items Aggregated' heading on the FBS page of [FAOSTAT](#). The total value for fruits and vegetables must then be multiplied by 1000 (to get grams from kilograms) and divided by 365 days (to get the year from days).

### Uses

The National fruit and vegetable availability is used to gain an overview of the food availability and food quality available in a country. When data from individual or household surveys are unavailable, this indicator serves as a rough proxy for fruit and vegetable consumption at the population level ([FAO, 2016](#)). Because the data are available annually for nearly all countries, this is a useful indicator for cross-country comparisons of fruit and vegetable availability, as well as for analysis of trends over time within a country. This indicator can help determine whether the

availability of fruits and vegetables is enough to meet population needs, and can be useful for decision-makers at the national level to inform policy action in order to increase fruit and vegetable availability through production or imports ([Siegel et al., 2014](#)).

## Strengths and Weaknesses

One benefit of this indicator is that it can be calculated for nearly all countries (since it relies on [FBS](#) data) and can be compared across time and space. Another strength is that it is simple to interpret and lacks sampling and reporting biases associated with dietary recall data ([Lele et al., 2016](#)). However, a downside of this indicator is that it does not reflect the actual consumption of fruits and vegetables, but rather the availability of these foods. In addition, as a national-level estimate, it cannot be disaggregated by sex, age, or any geographic scale smaller than the national level, nor can it detect disparities in consumption of fruits and vegetables across population groups or between seasons, as is possible with individual-level dietary data.

This can be a problem in countries with extreme economic inequality, where high levels of availability in a handful of locations may mask the scarcity in other areas. Although the [FBS](#) accounts for food losses incurred at the distribution and processing levels, it does not account for plate waste at the household or individual level ([Lele et al., 2016](#)).

## Data Source

The main source of data for this indicator is the FAO [FBS](#) data on the [FAOSTAT](#) website, which disaggregates elements of utilization and supply and estimates total food available for human consumption. In addition, [Household Consumption and Expenditure Survey](#) (HCES) data could be used to calculate a similar indicator, such as [household adequacy of fruit and vegetable consumption](#). Alternatively, market data such as [Euromonitor](#) could be used to calculate the [fresh food retail volume](#), or individual-level data such as [24-hour Dietary Recall](#) or a [FoodFrequency Questionnaire](#) (FFQ) could be used to calculate the consumption of specific food groups (e.g. fruits and vegetables).

### Links to guidelines

- [WHO, \(2003\). "Promoting fruit and vegetable consumption around the world."](#)

### Food Security Dimensions

- Quality

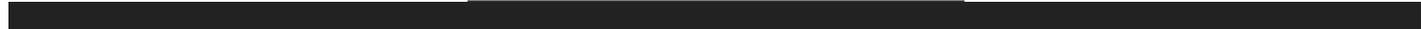
### Food Composition Database Required?

No

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End of Indicator: National Fruit and Vegetable Availability

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## Packaged Food Retail Volume

### Overview

Packaged food retail volume refers to a broad range of packaged foods including baby food, snacks, processed fruits and vegetables, and ready meals ([Euromonitor, 2018](#)). This is an indicator that can be used to understand trends in shifting dietary patterns and changing dietary quality. Low- and middle-income countries have rapidly been undergoing a nutrition transition characterized by increased consumption of processed foods coupled with decreased consumption of fresh foods ([Baker et al., 2020](#), [Popkin et al., 2022](#)). This comes with serious health implications, as packaged and processed foods tend to be less nutrient-dense, more energy-dense, and linked with poorer diet quality ([Poti et al., 2017](#)). The packaged food retail volume is a national-level indicator that quantifies the volume of packaged foods sold at markets - including supermarkets, wet markets, convenience stores, and online purchases-reported in kilograms per capita. When used in conjunction with fresh food retail volume, this indicator can contribute to a better understanding of the food system and provide a picture of the ongoing dietary transition ([Global Nutrition Report, 2021](#)).

### Method of Construction

The total amount of packaged foods sold in various retail outlets of interest (e.g. supermarkets, wet markets, convenience stores) should be converted into kilograms and summed. This figure is divided by the total population of interest to determine the amount of packaged food retail volume (kg/capita). If calculating this indicator from primary data, it is necessary to clearly define what is meant by packaged foods and what is meant by markets. For example, the NOVA Food Classification system could be used as an alternative to group foods into unprocessed/minimally processed, processed, and ultra-processed categories ([Monteiro et al., 2016](#)). Alternatively, the [Euromonitor](#) definition could be used ([Euromonitor, 2018](#)). Currently, data for this indicator are collected for a subset of countries (none of which is low-income) and available for purchase from Euromonitor ([Euromonitor, 2016](#)). Government ministries may also collect data related to market-level retail sales and/or volume.

### Uses

This indicator, in combination with the retail volume of fresh foods, has been recommended by the Global Nutrition Report (GNR) to assess national food consumption diversity ([Global Nutrition Report, 2015](#)). When used in conjunction with other market-level data on production and/or consumption, it can also be used to capture the extent to which foods are being processed versus sold fresh within national markets.

### Strengths and Weaknesses

One strength of this indicator is that it allows for an analysis of an important aspect of the food

environment and is comparable across many countries. However, if using [Euromonitor](#) data, it only provides information at the aggregate level for the quantity of all packaged foods and for a select subset of high- and middle-income countries. Therefore, anyone interested in more detailed information on packaged foods, or identifying the quantity of packaged food retail volume for low-income countries, should consider other data sources or indicators ([Euromonitor, 2016](#)).

The breadth that comes from combining foods of all levels of processing also means that this indicator does not provide specific insight into ultra-processed foods, which are foods that have undergone industrial processes that extend shelf life and which have been shown to have, particularly detrimental health and nutritional implications ([Hall et al., 2019](#)). [Percent of energy comprised of ultra-processed foods](#) would be a more effective indicator for capturing the consumption of this food group. Another weakness is that, as a national-level indicator, packaged food retail volume does not capture any measurement of distribution among regional, socioeconomic, or age/sex groups. An indicator like individual intake of certain food groups, such as processed meats, would be a more appropriate proxy for examining packaged food consumption on a finer scale or potentially across sub-populations or groups; however, this would require individual-level dietary data from [24-hour Dietary Recalls](#) or [Food Frequency Questionnaires](#).

## Data Source

One potential data source for this indicator is [Euromonitor](#), which collects and compiles data on fresh food retail volume in 54 countries. However, none of these are low-income countries, and access to the data must be purchased ([Euromonitor, 2016](#)). Other related indicators, for example, include the [percentage of energy comprised of ultra-processed foods](#).

### Links to guidelines

- [International Food Policy Research Institute \(2015\). Global Nutrition Report 2015: actions and accountability to advance nutrition and sustainable development.](#)

### Food Security Dimensions

- Quality

### Food Composition Database Required?

No

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End of Indicator: Packaged Food Retail Volume

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## Per Capita Food Supply Variability

### Overview

This indicator uses the data on dietary energy supply from the Food Balance Sheet (FBS) to measure annual fluctuations in the per capita food supply (kcal), represented as the standard deviation over the previous five years per capita food supply. Food supply variability results from a combination of instability and responses in production, trade, consumption, and storage, in addition to changes in government policies such as trade restrictions, taxes and subsidies, stockholding, and public distribution (Lele et al., 2016).

### Method of Construction

This indicator is part of the Food and Agriculture Organization (FAO) Suite of Food Security Indicators and can be accessed on the FAOSTAT website by selecting "Suite of Food Security Indicators" under the "Data" tab. Users can produce this indicator for a given country and year (or years) by selecting "Per capita food supply variability (kcal/capita/day)" under the "Items" section.

### Uses

Volatility in the food supply, presumably reflected in price volatility, affects vulnerable household's ability to plan effectively within their resource constraints. Understanding the degree of instability or volatility within a food system can help researchers, project managers, and policymakers advocate for measures to be taken to improve the food system's (and population's) resiliency to shocks.

### Strengths and Weaknesses

One benefit of this indicator is its usefulness for observing trends in the stability of a food supply over time and its comparability across regions and countries. As this indicator is derived from the dietary energy supply, which is a national-level aggregate indicator, it does not measure the effect of changes in the food supply on individual or overall food prices or consumption. Nor does it measure the impact on households bearing the risk of shocks due to instability in the food supply or of the shocks themselves. Furthermore, since this indicator reflects annual data, it cannot be used to assess the results of short-term shocks to the food system in a country and is therefore more valuable for assessing long-term trends in a country.

### Data Source

The main source of data for this indicator is the FAO FBS data on the FAOSTAT website. FAO disaggregates elements of utilization and supply, estimates total food available for human consumption, and pairs this information with food composition data to produce information on the national supply of energy and macronutrients (per capita/day).

## Food Security Dimensions

- Stability

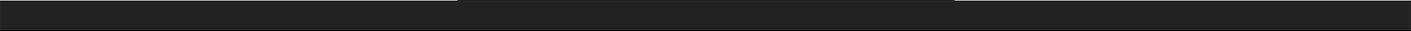
## Food Composition Database Required?

No

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End of Indicator: Per Capita Food Supply Variability

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## Percent of Energy Comprised of Ultra-Processed Foods

### Overview

The percent of energy from ultra-processed foods in the diet is an indicator that provides an understanding of changing dietary patterns, cultural preferences, and diet quality. Low- and middle-income countries are rapidly undergoing a nutrition transition that is characterized by changes in dietary patterns and nutrient intakes, resulting in higher consumption of energy-dense and processed foods (Popkin et al., 2004). Ultra-processed foods are foods that undergo industrial processes (e.g. salting, sugaring, frying, and curing) that extend shelf life, make food extremely palatable, and make food that is designed to be ready-to-consume (Monteiro et al., 2018).

Diets rich in ultra-processed foods may promote obesity and chronic disease because these foods typically have high energy density, they are low in fiber, micronutrients, and phytochemicals; and are high in unhealthy fats and sugars (Ludwig, 2011). In addition, they are highly palatable and come in large portion sizes (Ludwig, 2011).

### Method of Construction

Data used to construct this indicator should come from food consumption surveys of individuals, such as quantitative 24-hour Dietary Recalls, Weighed Food Records, and quantitative Food Frequency Questionnaires (FFQs) designed specifically for this purpose. See the table below for a more detailed explanation of the classification based on the level of food processing (Monteiro et al., 2018). A food composition table is used to estimate the total energy (kcal) intake over the day from all foods and beverages recalled in the survey, including the energy provided by ultra-processed foods. The indicator is then constructed using the formula below:

$$\frac{\text{Total energy from ultra-processed foods}}{\text{Total energy from all foods consumed}}$$

Food classification by the level of processing (Monteiro et al., 2018)

#### **Group 1. Unprocessed or minimally processed foods:**

Definition: Unprocessed foods (*in nature*) are edible parts of plants, animals, fungi, algae, and water. Minimally processed foods are unprocessed foods altered by certain (Monteiro et al., 2018).

Processes: Cleaning, drying, crushing, grinding, fractioning, filtering, roasting, boiling, non-alcoholic fermentation, pasteurization, refrigeration, chilling, freezing, placing in containers and vacuum-packaging (Monteiro et al., 2018).

Goal of processing: Preservation, safety, and palatability. Unprocessed or minimally processed

foods are often prepared and cooked in combination with processed culinary ingredients at home and in restaurants ([Monteiro et al., 2018](#)).

### **Group 2. Processed culinary ingredients:**

Definition: Processed culinary ingredients, such as oils, butter, sugar, and salt, are substances produced from Group 1 foods or from nature ([Monteiro et al., 2018](#)).

Processes used to produce culinary ingredients: Pressing, refining, grinding, milling, and drying ([Monteiro et al., 2018](#)).

Goal of its use: To prepare, season, and cook hand-made dishes and meals of Group 1 food ([Monteiro et al., 2018](#)).

### **Group 3. Processed foods:**

Definition: Processed foods are made by adding culinary ingredients to unprocessed and minimally processed foods ([Monteiro et al., 2018](#)).

Processes: Preservation, cooking, and, non-alcoholic fermentation ([Monteiro et al., 2018](#)).

Goal of processing: To increase the durability of unprocessed or minimally processed foods, or to change and improve their sensory qualities ([Monteiro et al., 2018](#)).

### **Group 4. Ultra-processed foods:**

Definition: Ultra-processed foods are formulations made from substances derived from foods and additives, with little if any intact Group 1 food ([Monteiro et al., 2018](#)).

Processes: A series of processes with no domestic equivalent is required to make ultra-processed foods, for example, hydrogenation, extrusion, and molding. These foods are made with culinary ingredients and other substances not used in culinary preparations such as hydrogenated or interesterified oils, soya protein, maltodextrin, and inverted sugars. The additives include preservatives, antioxidants, and stabilizers also used in processed foods, and dyes, stabilizers, flavor enhancers, non-sugar sweeteners, glazing agents, etc, that imitate or enhance the sensory qualities of foods ([Monteiro et al., 2018](#)).

Goal of processing: To create durable, convenient, ready-to-consume, hyper-palatable, and branded low-cost products ([Monteiro et al., 2018](#)).

## **Uses**

This indicator has been proposed by the International Network for Food and Obesity/Non-Communicable Disease Research, Monitoring and Action Support (INFORMAS) as an indicator that can be used globally to monitor changes in population diet quality over time and across countries ([Vandevijvere et al., 2013](#)). This indicator enables an analysis of the relative contribution of ultra-processed foods to overall dietary energy intakes based on data from individuals and therefore can be used to assess differences between sub-population groups based on geographic location, income group, and various other demographic characteristics.

## Strengths and Weaknesses

This indicator measures the relative contribution of ultra-processed foods to overall dietary energy intakes; it does not provide information on the consumption of individual nutrients or specific foods. Since ultra-processed foods can often be consumed outside of the home, survey data used for this indicator that do not include detailed information about food consumed outside of the home will underestimate the percent of energy from ultra-processed foods. It should also be noted that this indicator has not yet been thoroughly tested ([Vandevijvere et al., 2013](#)).

## Data Source

Data from individual quantitative [24-hour Dietary Recalls](#), [Weighed Food Records](#) and [FFQs](#) designed for this purpose can be used to construct this indicator. This indicator could also be constructed at the household level using [Household Consumption and Expenditure Surveys](#) (HCES) that have an appropriate level of disaggregation of foods and include detailed information on foods consumed away from home ([Smith et al., 2014](#)).

The Food and Agriculture Organization/World Health Organization's Global Individual Food Consumption Data Tool ([FAO/WHO GIFT](#)) is a source for individual-level quantitative dietary data. FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. National or regional Food Composition Tables should be used to identify the energy content of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies ([WNDDS](#)).

### Links to guidelines

- [Vandevijvere et al., \(2013\). Monitoring and benchmarking population diet quality globally: a step?wise approach. Obesity Reviews.](#)
- [Monteiro et al., \(2018\). The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. Public Health Nutrition.](#)

### Food Security Dimensions

- Quantity
- Quality

Food Composition Database Required?

Yes

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End of Indicator: Percent of Energy Comprised of Ultra-Processed Foods

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## Population Share with Adequate Nutrients

### Overview

This indicator of diet quality estimates the nutrient intake adequacy of a population by using both individual-level dietary intake data and Food Balance Sheet (FBS) data. Rather than only focusing on the availability of energy, this indicator seeks to better understand the level of consumption of key nutrients within a population. This indicator is also included in a suite of indicators used to assess the environmental and nutritional sustainability of food systems developed by Gustafson et al., 2016. This indicator is considered an 'emerging indicator' because it has not been fully validated and is not in common use.

### Method of Construction

The Population Share with Adequate Nutrients requires the use of FBS data and food composition tables to derive an estimate of the quantities of key nutrients available in a country's food supply. FBS data can be accessed on the Food and Agriculture Organization's (FAO) FAOSTAT website. FAO calculates the national estimate of total food availability using data from a number of sources, including government agencies, marketing authorities, and industrial/manufacturing surveys, among others (FAO, 2001). This national estimate is calculated as the sum of the elements of supply (production quantity, import quantity, and stock variation) minus the elements of utilization (export quantity, food manufacturing, feed, seed, waste, and other uses).

Food composition tables from the country or region of study should be used (if available) in conjunction with FBS data to estimate nutrients that vary depending on local varieties, conditions of production (e.g. soil composition), or other factors. For each nutrient, a population distribution of intake is constructed around the mean per capita nutrient availability value (calculated with FBS and food composition table data) by using a coefficient of variation (CV) equal to the inter-individual CV of nutrient intakes obtained through a survey of a representative sample of individuals in the study population. The percentage of the population with intakes above an adequate level can then be calculated using the Estimated Average Requirement (EAR) fixed cut-point method. For more detailed information on how to construct this indicator, see (IOM, 2000; Meyers et al., 2006).

### Uses

This indicator is used to estimate the proportion of people within a population who are consuming key nutrients at or above an adequate level, such as the EAR, as defined by the US Institute of Medicine (IOM, 2000; Meyers et al., 2006). The information derived from this indicator can be used to identify gaps in nutrient availability in the food supply and population needs, reflecting nutrient availability in the food supply of a population, which can be used in targeted interventions to increase the consumption and availability of foods that are significant sources of certain nutrients in the food supply.

# Strengths and Weaknesses

One benefit of this indicator is its ability to provide a national-level estimate of diet quality that requires less cost and effort than a nationally representative individual-level dietary survey. However, this method may not be suitable for assessing iron intake, since requirements are not normally distributed, and determining iron bioavailability is difficult without information on the whole diet. In addition, this indicator requires the assumption that the per capita nutrient availabilities (calculated using FBS data) approximate the mean per capita intakes of the population (Arsenault et al., 2015). This assumption may not always be accurate, since FBS data represent availability, not consumption, and cannot detect disparities in nutrient consumption across population groups or seasons. Another drawback of this indicator is that it addresses meeting intake thresholds but does not address the overconsumption of nutrients at potentially dangerous or unhealthy levels (Gustafson et al., 2016).

## Data Source

This indicator uses data from FBS in combination with Food Composition Tables. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems (INFOODS) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies (WNDDS). The indicator also requires individual-level dietary intake data as well as inter-individual estimates of variation from surveys of the population to estimate the population distribution of intake.

### Links to guidelines

- Arsenault et al., (2015). Improving nutrition security through agriculture: an analytical framework based on national food balance sheets to estimate nutritional adequacy of food supplies
- Institute of Medicine (US) Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. (2000). DRI Dietary Reference Intakes: Applications in dietary assessment.
- Meyers et al., (2006). Dietary reference intakes: The essential guide to nutrient requirements. National Academies Press.
- FAO (2021). The State of Food Insecurity in the World.

### Food Security Dimensions

- Quality

### Food Composition Database Required?

Yes

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## Prevalence of Undernourishment

### Overview

The Prevalence of Undernourishment (PoU) is a national-level model-based indicator used to understand access to food in terms of dietary energy inadequacy. It measures the percentage of the population whose dietary energy intake is below the Minimum Dietary Energy Requirement (MDER). As one of the [Sustainable Development Goals \(SDGs\)](#) of Target 2.1 (End hunger, achieve food security, and improve nutrition), this indicator is produced yearly by the Food and Agriculture Organization (FAO). Given the lack of nationally representative individual dietary intake surveys available for all countries, it is produced using information on [dietary energy supply](#) from the [Food Balance Sheet \(FBS\)](#) data for global monitoring purposes.

### Method of Construction

The PoU is based on a probability distribution characterized by three parameters: (1) the mean of the distribution that represents the average amount of dietary energy consumed; (2) the coefficient of variation that represents the variability that exists within the population's usual consumption; and (3) a threshold that represents the minimum amount of energy needed by a hypothetical average individual of the population to be in good health and have a level of activity that is socially acceptable, also known as the Minimum Dietary Energy Requirement (MDER). The MDER of the population is used as a proxy of the threshold and it is estimated based on a weighted average of the minimum energy requirements for each sex-age group in the population ([Wanner et al., 2014](#)). The PoU is then calculated as the percentage of the population whose consumption falls below the MDER. The PoU indicator produced by the FAO in the context of the global monitoring based on the Dietary Energy Supply is a three-year moving average. For more detailed information on how data are collected, the assumptions, and how calculations are completed by FAO, please read [Cafiero \(2014\)](#), which explains the technical details.

In addition, this indicator is one of several indicators included in the [ADePT-FSM](#) (Food Security Module) software package, which is a free standalone software developed by FAO and the World Bank that allows users to easily derive food security indicators from [Household Consumption and Expenditure Survey \(HCES\)](#) data. The software download and corresponding documentation can be found on the [FAO website](#). Please also see the [Moltedo et al. \(2014\)](#) book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data. See pages 54-57 in the Moltedo et al. document for details about how the ADePT software calculates the PoU.

### Uses

The PoU is an internationally recognized indicator and is used by intergovernmental, non-governmental, and governmental agencies alike. As mentioned above, it is also one of the indicators for monitoring progress towards the second target of the [SDGs](#). It can help paint a picture of macro-level food access trends and, given its widespread use for the past five decades,

is useful in identifying national and global trends in population-level undernourishment ([Jones et al., 2013](#)). The PoU is also used to calculate the depth of food deficit indicator, which estimates the average per capita amount of additional energy (kcal) that undernourished individuals need to consume to reach their average dietary energy requirement (ADER). This indicator is part of the FAOSTAT Suite of Food Security Indicators and is published annually by FAO in the State of Food Insecurity (SOFI). The PoU is also one of the components of the International Food Policy Research Institute's (IFPRI) Global Hunger Index.

## Strengths and Weaknesses

The PoU data are publicly available and free to access on FAOSTAT. Along with ease of access, a clear strength of this indicator is that it has been calculated for almost every country in the world over decades, allowing for standardized comparisons over time and within and across countries. However, the PoU considers only dietary energy intake, and alone it is not an appropriate indicator of nutrient adequacy or dietary quality. This is an indicator of chronic hunger that spans one year and therefore is unable to capture trends in undernourishment over short reference periods that may be associated with seasonality, price spikes, or climate-related shocks to the food system ([Cafiero, 2014](#)).

A major criticism of the PoU is that it is based on the MDER and not on the ADER, but the strong correlation between intake and requirement made it impossible to use ADER. For example, using ADER in a healthy population where all people would eat according to their requirements, we would estimate that about 50% of the population is undernourished (as some people may still be healthy while consuming less energy than the average). In using the MDER the risk of misclassification is lower ([FAO Sixth World Food Survey, 1996](#)).

## Data Source

For global monitoring purposes, country-level prevalence of undernourishment is released each year by FAO using data from the Dietary Energy Supply from the FBS (after deducting losses at a retail level to the Dietary Energy Supply published in FAOSTAT). HCES can be used to generate national and sub-national PoUs using the ADePT-FSM software package. Finally, the PoU could also be estimated using individual dietary intake surveys (e.g. more than one 24-hour Dietary Recall) representative of national or sub-national population groups.

### Links to guidelines

- [Cafiero \(2014\). Advances in Hunger Measurement: Traditional FAO Methods and Recent Innovations.](#)
- [SOFI \(2015\). Annex 2: Methodology for Assessing Food Security and Progress towards the International Hunger Targets.](#)
- [FAO \(1996\). Sixth World Food Survey.](#)
- [FAO \(2018\). Prevalence of Undernourishment E-Learning Course.](#)

### Links to validation studies

- [Wanner et al. \(2014\). Refinements to the FAO Methodology for Estimating the Prevalence of Undernourishment Indicator. Food and Agricultural Organization.](#)
- [Cafiero et al., \(2014\). Validity and Reliability of Food Security Measures.](#)

## Food Security Dimensions

- Quantity

## Food Composition Database Required?

No

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End of Indicator: Prevalence of Undernourishment

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## Shannon Entropy Diversity Metric

### Overview

The Shannon Entropy Diversity Metric is one of the two entropy-based indicators included in the Data4Diets platform. The Shannon Entropy Diversity Metric and Modified Functional Attribute Diversity (MFAD) both measure diversity by calculating the deviation from a perfectly equal distribution in the diet. Whereas the Shannon Entropy Diversity Metric measures this in terms of the distribution of individual foods, MFAD measures this in terms of nutrients. As a measure of food availability, it provides a measure of the relative abundance of each food item within a given supply of food, capturing both evenness and abundance. This indicator was originally developed for use in the biological sciences, and only recently has been adapted for use in the food and nutrition disciplines (Remans et al., 2014).

### Method of Construction

This indicator is based on C.E. Shannon's diversity metric, which was developed to weigh both the richness and evenness of species within animal and plant communities (Shannon, 1948). The formula for calculating the metric is as follows:

$$H = \sum_{i=1}^S - (P_i \times \ln P_i)$$

Where:

**H** = Shannon

**P<sub>i</sub>** = fraction of the entire population made up of species i

**ln(P<sub>i</sub>)** = the natural log of above

**S** = number of species encountered

**∑** = sum from species 1 to species S

Although the Shannon Entropy Diversity Metric is not commonly used in the context of nutrition and food security assessment, there is a large body of literature on Shannon Entropy Diversity methodology in general, including Begon et al. (2006), Chao (2003), and Magurran (1988), who offer further guidance on construction.

### Uses

This indicator can be used to measure the diversity of food supplies on the national level in order

to understand trends in food availability (Remans et al., 2014 ). Because the indicator can be divided by a common factor, it is useful in comparing the availability of foods across time and sociocultural contexts, and has been suggested as a main method for measuring food nutrient adequacy, which is one of the seven indicators chosen to best assess sustainable nutrition security (Gustafson et al., 2016 ). Additionally, it has been adapted to be used with national-level expenditure data as well as availability data (Wang et al., 2017).

## Strengths and Weaknesses

One strength of the Shannon Entropy Diversity Metric is that it can be scaled from 0 to 1 for ease of comparison. However, a major weakness is that MFAD calculations rely on Food Balance Sheets (FBS), which means data are not based on actual consumption but on availability, and this national-level data could obscure regional-level differences in diversity. The data source also limits the foods included in the analysis to those reported in the FBS (Lele et al., 2016). Although diversity suggests a higher quality diet, the actual nutrient content or density is not captured by this metric. Indicators that measure the diversity of the food supply based on nutrient composition, such as the MFAD, would be more effective for understanding the availability of any nutrients of specific research or programmatic significance.

## Data Source

The Shannon Entropy Diversity Metric can be calculated from FBS data.

### Links to guidelines

- DeJong (1975). A comparison of three diversity indices based on their components of richness and evenness. Oikos.
- Gustafson et al., (2016). Seven food system metrics of sustainable nutrition security. Sustainability.

### Food Security Dimensions

- Quality
- Sustainability

### Food Composition Database Required?

No

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End of Indicator: Shannon Entropy Diversity Metric

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## Share of Food Consumed Away from Home of Total Food Consumption

### Overview

The share of food consumed away from home of total food consumed provides a glimpse into individual and household dietary quality at the population level and can highlight dietary trends over time and across countries. Food prepared or purchased outside of the home is becoming an increasingly important component of the diet in many countries, especially in urban areas ( [Smith & Subandoro, 2007](#); [Bezerra et al., 2013](#)). The quality and nutrient content of foods purchased or consumed outside of the home can vary significantly from food consumed in the home. Foods consumed outside of the home are more likely to be processed and higher in salt, sugar, and unhealthy fats ([Vandevijvere et al., 2013](#)). Studies have found that consuming food away from home is associated with higher energy and fat intake and lower micronutrient intake ( [Lachat et al., 2012](#)).

### Method of Construction

Data used to construct this indicator can be obtained from individual [Weighed Food Records](#) or [24-hour Dietary Recall](#) surveys and [Food Frequency Questionnaires](#) (FFQ) that include both the type and amount of each food consumed and the foods consumed outside of the home. It is important to note that the information about foods consumed outside the home is at the individual level and then aggregated up to the household if collected for all household members. After the quantities of reported foods have been determined, a Food Composition Table (preferably local or regional, if available) is used to estimate the energy (in kcal) composition of the foods recalled in the survey. The indicator can then be constructed using the fraction, below, and then multiplying it by 100:

$$\frac{\text{Total energy from foods consumed by } i}{\text{Total energy from all food}}$$

Data collected at the individual level should be used for this indicator. In addition, some [Household Consumption and Expenditure Surveys](#) (HCES) include individual-level data measuring food (or expenditure) consumed away from home in the household survey. If using individual data from the HCES, one can refer to the [ADePT-FSM](#) (Food Security Module) software package, which includes this indicator and is a free standalone software developed by the Food and Agriculture Organization (FAO) and the World Bank that allows users to easily derive food security indicators from household survey data. The software download and corresponding documentation can be found on the [FAO](#) website. Please also see the [Moltedo et al. \(2014\)](#) book published by the World Bank, which provides detailed instructions for analyzing food security using household survey data.

## Uses

This indicator can be used to assess dietary patterns with individual-level data and provide information that can inform strategies to promote healthy food consumption away from home ([Bezerra et al., 2013](#)).

## Strengths and Weaknesses

This indicator can be used to assess differences in eating patterns by sub-population groups based on geographic location, income group, and other sociodemographic characteristics of interest. Individual-level data, e.g. from [24-hour Dietary Recalls](#), should be used for this indicator. However, if [HCES](#) data are used, there are several constraints, including the fact that many [HCES](#) collect information only on the monetary value of food consumed away from home, making accurate energy estimations difficult, and requiring big assumptions as well as extra steps and calculations to derive an estimate of the energy (kcal) value ([Moltedo et al., 2014](#)).

## Data Source

The best data source for this indicator would use individual-level data from [Weighed Food Records](#), [24-hour Dietary Recalls](#), or [FFQs](#), which allow for quantification of food intake, both inside and outside the home. In addition, [HCES](#) data that include individual-level data (e.g. a Nutrition Dietary Survey module) can be used to calculate this indicator. The [World Bank Microdata Library](#) has the most comprehensive and publicly accessible repository of data. Otherwise, data can be accessed - often for a fee - from many National Statistics Offices, though each country has its own policies and procedures. The International Household Survey Network ([IHSN](#)) is an informal network to promote data standards and dissemination. However, only a limited number of countries collect information on food consumed outside of the home in [HCES](#) ([Fiedler et al., 2012](#)). For more detailed information on the limitations of the use of [HCES](#) data for food consumed outside of the home, refer to [Moltedo et al. \(2014\)](#) and [Smith et al. \(2014\)](#).

### Links to guidelines

- [Moltedo et al. \(2014\). Analyzing food security using household survey data: Streamlined analysis with ADePT software. World Bank Publications.](#)
- [Moltedo et al. \(2018\). Optimizing the use of ADePT-Food Security Module for Nutrient Analysis. Food and Agricultural Organization.](#)
- [Smith & Subandoro \(2007\). Measuring food security using household expenditure surveys. International Food Policy Research Institute.](#)

### Food Security Dimensions

- Quantity
- Quality

## Food Composition Database Required?

Yes

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End of Indicator: Share of Food Consumed Away from Home of Total Food Consumption

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## Total Individual Energy Intake

### Overview

Total individual energy intake quantifies calorie consumption. Prolonged insufficient energy intake results in undernutrition and impaired growth, development, and functioning, and as a result many developing countries still suffer from high rates of underweight among adolescents and adults, and stunting and/or wasting among young children ([Muller & Krawinkel, 2005](#)). This is the only indicator included in the Data4Diets platform that strictly measures caloric intake at an individual level; other indicators that measure caloric availability at the household or national level are [household average dietary energy acquisition or consumption](#) and [dietary energy supply](#). Examples of other indicators that use individual data to quantify nutrient intake include [total individual micronutrient intake](#), which is measured in absolute terms, as well as the [Mean Adequacy Ratio \(MAR\)](#), which uses a scaled system to measure the adequacy of individuals' nutrient intake.

### Method of Construction

To construct this indicator, an individual's intake must be recorded through a [24-hour Dietary Recall](#) or [Weighed Food Record](#). Population mean consumption can be estimated with a single survey, but the survey must be repeated on at least a subsample of the survey population for two non-consecutive days of intake to estimate "usual intake" ([Institute of Medicine, 2000](#)).

When repeated measurements are available for at least a subsample of individuals, the "probability approach", which accounts for day-to-day variability of food intakes at the individual level, allows to calculate the individual probability of inadequate intake for each nutrient, and a mean probability of adequacy (MPA) over a range of micronutrients. The final sample in the dietary survey should be representative of all days of the week.

A [Food Frequency Questionnaire \(FFQ\)](#) could also be used but would provide a less accurate estimate. A contextually relevant Food Composition Table (FCT) is used to determine the energy content in each food item consumed by the individual, and the caloric value of all food items is summed to calculate a daily total. For further information, please refer to Chapter 3 of this Food and Agriculture Organization (FAO) Food and Nutrition paper on calculating the energy content of foods ([FAO, 2003](#)).

### Uses

This indicator is used to assess the most basic element of dietary quality: intake of sufficient calories. It can provide information on the risk of both over- and undernutrition, particularly for vulnerable population subgroups, such as pregnant and lactating women, and for understanding the allocation of food resources within a household. However, this indicator does not provide information on the makeup of calories consumed, which has serious health implications. Indicators such as [total individual macronutrient intake](#) or [total individual micronutrient intake](#) are more

appropriate for assessing specific nutrient components of the diet.

## Strengths and Weaknesses

One strength of this indicator is that it can be paired with findings on individual health outcomes or demographic information, such as religion, age, sex, education, or any other characteristics of interest ([Ferro-Luzzi, 2002](#)). One challenge is that dietary intake data are fairly time-consuming to collect, even though the resulting data offer huge potential payoffs in terms of the types and number of indicators that can be generated. Additionally, consumption of a sufficient number of calories is not an indicator of diet quality, as the source of the calories also affects nutritional outcomes nor does it say anything about micronutrient intake. Other indicators such as [MAR](#) or [probability of inadequacy](#) may be more appropriate for using individual nutrient intake data to provide a picture of the nutritional adequacy of the diet as a whole, as they are calculated across several nutrients.

## Data Source

The intake data required for this indicator can be obtained through [24-hour Dietary Recall](#) surveys, weighed food records, or [FFQ](#) (even if less accurate). The Food and Agriculture Organization and World Health Organization's Global Individual Food Consumption Data Tool ([FAO/WHO GIFT](#)) is a source for quantitative individual-level dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world.

National or regional FCTs should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies ([WNDDS](#)). In addition, [Food Balance Sheet](#) (FBS) data could be used to calculate a similar indicator, such as [dietary energy supply](#). Alternatively, [Household Consumption and Expenditure Survey](#) (HCES) data could be used to calculate [household average dietary energy acquisition or consumption](#).

### Links to guidelines

- [Food and Agricultural Organization \(2003\). Chapter 3: Calculation of the Energy Content of Foods – Energy Conversion Factors.](#)

### Food Security Dimensions

- Quantity

### Food Composition Database Required?

Yes

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End of Indicator: Total Individual Energy Intake

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## Total Individual Macronutrient Intake

### Overview

Total individual macronutrient intake is a member of the class of indicators that measure individual intake of nutrients. It quantifies the percentage of caloric intake from the three major macronutrient groups: protein, fats, and carbohydrates. These three nutrients have distinct and important functions in the body, and all are necessary for proper growth, development, and cognitive and physical functioning. Both undernutrition and over-nutrition due to improper macronutrient intake, and the related health complications, continue to be a major health concern in the developing world (Muller & Krawinkel, 2005). Other indicators included in the Data4Diets platform that measure individual nutrient intake include Nutrient Adequacy Ratio (NAR), Mean Adequacy Ratio (MAR), probability of inadequacy of specific micronutrient intake or Mean Probability of Adequacy (MPA) across several micronutrients, total individual micronutrient intake, and total individual energy intake. For more discussion on the comparative uses of these indicators, refer to the 'Uses' section below.

### Method of Construction

To estimate an individual's caloric intake from the three macronutrients, survey data must be collected from a 24-hour Dietary Recall, a Weighed Food Record, or a Food Frequency Questionnaire (FFQ). Population mean consumption can be estimated with a single survey, but the survey must be repeated on at least a subsample of the survey population for two non-consecutive days of intake to estimate "usual intake" (Institute of Medicine [IOM], 2000). This should be completed in a way such that the final sample is representative of all days of the week. Using a Food Composition Table (FCT) and the weight (grams) of the foods consumed, an estimate of the amount of protein, fat, and carbohydrates consumed per subject is calculated (distinguishing between fiber and other forms of carbohydrates). The total grams of each macronutrient are added together, and the caloric value of each is calculated using the following equation:

$$\text{Calories (Kcal) = from Macronutrients} = [\text{Protein (g)} \times 4] + [\text{Fats (g)} \times 9] + [\text{Av. Carbohydrates (g)} \times 4] + [\text{Fiber 9g)} \times 2]$$

**\*Note in this equation, Total Carbohydrates = [Available Carbohydrates + Fiber]**

**\*\*To calculate total caloric intake, one would also need to factor in calories from alcohol [7 kcal/g]**

Finally, the proportion of calories from each macronutrient is calculated by dividing the calories from each by the total calories consumed. For more information on calculating this indicator, refer to the first method discussed in the 'New Methods Considered' section of the following paper published in the *Journal of Food Composition and Analysis* (Schakel et al., 2009).

# Uses

Individual macronutrient intake is a useful indicator for understanding the dietary intake and quality (especially balance) of population subgroups, such as pregnant and lactating women, and for understanding the allocation of food resources among household members ([Ferro-Luzzi, 2002](#)). These data can also contextualize the shifting diet composition that has been observed in conjunction with demographic and economic transition in low- and middle-income countries, as individuals consume a higher percentage of their calories from fat ([Popkin, 2001](#)). When expressed as percentages of total energy intake, the information provided is limited and should therefore be complemented by the total intakes in energy and the intake of each macronutrient in grams. In addition, since this indicator does not include information on micronutrient intake, it is not useful for capturing a full picture of dietary quality. More inclusive indicators such as the nutrient adequacy ratio (NAR), MAR, probability of inadequacy, or mean probability of adequacy (MPA) are more appropriate for using individual nutrient intake data to provide a picture of the diet as a whole.

## Strengths and Weaknesses

An advantage of this indicator is that it allows researchers to estimate an individual's intake of specific macronutrients and, in gathering data on individual intake, researchers are able to pair findings with individual health outcomes and demographic information, such as religion, age, sex, education, or any other characteristics of interest, assuming the study has been designed for these purposes ([Ferro-Luzzi, 2002](#)). However, a weakness of this indicator is that it does not provide information on the diet as a whole or whether intake levels are adequate and within a healthy range ([IOM, 2000](#)).

## Data Source

Intake data can be obtained from 24-hour Dietary Recall, Weighed Food Records, and FFQs. The Food and Agriculture Organization and the World Health Organization's Global Individual Food Consumption Data Tool ([FAO/WHO GIFT](#)) is a source for individual-level quantitative dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies ([WNDDS](#)). Recommended Daily Allowances can be obtained from IOM ([2006](#)). In addition, Food Balance Sheet (FBS) data could be used to calculate a similar indicator related to food available for human consumption in the food supply, such as the national average supply of protein. Alternatively, Household Consumption and Expenditure Survey (HCES) data could be used to calculate household share of dietary energy from different macronutrients.

### Links to guidelines

- [Schakel et al. \(2009\). Adjusting a nutrient database to improve calculation of percent of calories from macronutrients. Journal of Food Consumption and Analysis.](#)

- [Ferrari et al. 2020\). Anthropometry, dietary intake, physical activity and sitting time patterns in adolescents aged 15–17 years: An international comparison in eight Latin American countries. BMC Pediatrics.](#)

#### Links to validation studies

- [Basiotis et al. \(1987\). Number of days of food intake records required to estimate individual and group nutrient intakes with defined confidence. The Journal of Nutrition.](#)
- [Jackson et al. \(2007\). Reproducibility and validity of a quantitative food-frequency questionnaire among Jamaicans of African origin. Public Health Nutrition.](#)
- [Lanigan et al. \(2000\). Validation of food diary method for assessment of dietary energy and macronutrient intake in infants and children aged 6-24 months. European Journal of Clinical Nutrition.](#)

#### Food Security Dimensions

- Quantity
- Quality

#### Food Composition Database Required?

Yes

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End of Indicator: Total Individual Macronutrient Intake

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## Total Individual Micronutrient Intake

### Overview

Total individual micronutrient intake is in the class of indicators that measures individual intake of a single nutrient (e.g. vitamin A, thiamin, riboflavin, niacin, vitamin B6, folates, vitamin B12, vitamin C, calcium, iron, zinc). It quantifies the daily intake of individual micronutrients, and can also be paired with further data in order to calculate insufficient micronutrient intake or prevalence of (adequacy or) inadequacy.

Measuring micronutrient intake is important because malnutrition due to micronutrient deficiency continues to be a widespread problem in low-income countries. Micronutrients, especially iron, iodine, vitamin A, and zinc, are essential to ensure proper growth and development for infants and children and work productivity, healthy pregnancies, and overall cognitive and physical health of adults ([Muller & Krawinkel, 2005](#)). Some of the other indicators that measure individual intake include Nutrient Adequacy Ratio (NAR) and

Mean Adequacy Ratio (MAR), probability of inadequacy of specific micronutrient intake, Mean Probability of Adequacy (MPA) across several micronutrients, total individual macronutrient intake, and total individual energy intake. For more discussion on the comparative uses of these indicators, refer to the 'Uses' section below.

### Method of Construction

To estimate individual daily intake of micronutrients, data from a 24-hour Dietary Recall method, a Weighed Food Record, or a Food Frequency Questionnaire (FFQ) are required.

Population mean consumption can be estimated with a single survey but the survey must be repeated on at least a subsample of the survey population for two non-consecutive days of intake to estimate 'usual intake'. The number of days of intake per subject that must be collected depends on the micronutrient of interest ([Institute of Medicine \[IOM\], 2000](#)). The final sample should be representative of all days of the week. Enumerators must ensure individuals report not just food consumed, but also any supplements taken and if any of the foods were potentially fortified. Using the weight of foods consumed and a Food Composition Table (FCT), the amount of each micronutrient of interest contained in the reported foods is calculated. If information is available in the FCT, phytates and other factors that inhibit the absorption of key nutrients such as iron and zinc should be taken into consideration.

For more information on how this indicator is constructed, see Chapter 2 entitled 'Overview of the WHO Intake Monitoring, Assessment and Planning Program (IMAPP)' of the following World Health Organization (WHO) report ([WHO, 2009](#)). If this indicator will be used to calculate inadequacy or deficiencies, intake can then be compared to the distribution of Estimate Average Requirements (EARs) or Recommended Daily Allowances (RDAs) of specific micronutrients, which depend on the individual's age and sex (for more information, see [Murphy & Poos \[2002\]](#)).

## Uses

Individual micronutrient intake can be a useful indicator in assessing the need for, or impact of nutrient-specific interventions including fortification and supplementation, which may be desirable in given locations or with specific population subgroups, such as pregnant and lactating women. Additionally, if micronutrient intake data are available for all members of a household, this indicator could shed light on the dynamics of intra-household allocation of food. However, this indicator alone cannot be used to assess the adequacy of intake, and indicators that incorporate age and sex-specific nutrient requirements, such as [MAR](#) or probability of (in)adequate intake, may be more appropriate. Additionally, indicators such as [total intake of macronutrients](#) or [total individual energy intake](#) may need to be used in conjunction with this one to provide a fuller picture of the components of a healthy diet.

## Strengths and Weaknesses

One strength of this indicator is that it allows researchers to estimate an individual's intake of specific micronutrients and pair findings with individual demographic information, such as religion, age, sex, education, or any other characteristics of interest ([Cowan et al., 2019](#)). However, this indicator does not speak to the adequacy of the diet as a whole, to dietary patterns, or the ability of individuals to absorb and use the micronutrients.

## Data Source

Intake data can be obtained from individual [24-hour Dietary Recall surveys](#), [Weighed Food Records](#), or [FFQ](#). The Food and Agriculture Organization and WHO's Global Individual Food Consumption Data Tool ([FAO/WHO GIFT](#)) is a source for individual-level quantitative dietary data. The FAO/WHO GIFT aims to make publicly available existing quantitative individual food consumption data from countries all over the world. National or regional Food Composition Tables should be used to identify the nutrient contents of the foods and can be found at FAO's International Network of Food Data Systems ([INFOODS](#)) or the Agricultural and Food Systems Initiative World Nutrient Databases for Dietary Studies ([WNDDS](#)).

### Links to guidelines

- [WHO \(2010\). Estimating appropriate levels of vitamins and minerals for food fortification programmes: The WHO Intake Monitoring, Assessment and Planning Program \(IMAPP\): meeting report. Geneva.](#)

## Links to validation studies

- [Kennedy et al. \(2007\). Dietary diversity score is a useful indicator of micronutrient intake in non-breast-feeding Filipino children. The Journal of Nutrition.](#)

## Food Security Dimensions

- Quality

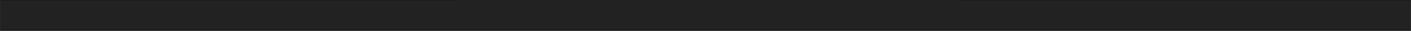
## Food Composition Database Required?

Yes

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End of Indicator: Total Individual Micronutrient Intake

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## Volatility of Food Prices

### Overview

Market-level analyses are an important method of measuring food security and can serve many purposes, including estimating domestic supply against population need, evaluating market response to changes in supply or demand, and providing insight into the consumer prices of food versus those of other goods ([World Food Programme, 2009](#)). The volatility of food prices is one of several market-level indices included in the Data4Diets platform, which also includes the [domestic food price index](#) and the [food affordability index](#). All three of these indicators use consumer-level data to measure food prices faced by consumers in markets. Unlike the other indices mentioned, however, the volatility of the food price indicator quantifies the intensity of fluctuations in food prices over time, rather than measuring the price level itself. It is commonly reported on a monthly or annual basis and uses a monthly consumer food price index and a rolling standard deviation of growth rates to compute volatility. High volatility can increase vulnerability to food insecurity by increasing uncertainty, contributing to asset draw-down during price peaks, and a consequent reduction in real incomes and calorie consumption by both urban and rural net consumers, as poor households are unable to substitute cheaper foods in the face of price increases ([von Braun & Tadesse, 2012](#)).

### Method of Construction

This indicator can be calculated on both an annual and monthly basis and is reported as the standard deviation around the mean of the price index over the reference period. It is based on a monthly domestic consumer food price index, such as the food price index calculated by the [Global Information Early Warning System \(GIEWS\)](#) at the Food and Agriculture Organization (FAO).

The GIEWS index takes the log of monthly price changes and calculates the monthly standard deviation over the previous 12 months. The length of the interval used influences how short-term and long-term fluctuations are reflected, as indicators that use longer intervals tend to obscure short-term volatility, while using shorter intervals may highlight fluctuations that more or less cancel each other out over time ([Diaz-Bonilla, 2016](#)). For information on how GIEWS calculates its price volatility index, see the [GIEWS](#) indicator description page.

### Uses

The GIEWS volatility of food prices index is used as one of three market-level indicators to track potentially detrimental increases in food prices and is reported monthly on the country level for several major commodities ([GIEWS Food Price Monitoring and Analysis Tool](#)). Although GIEWS provides indices based on major commodities, other indicators may be a superior choice depending on research or programmatic needs. For example, if more detailed information on food groups is required, the domestic food price indices are often available and disaggregated by major food groups.

## Strengths and Weaknesses

One strength of this indicator is that it is comparable within and across countries and over time. This allows for the identification of changes in food prices that are abnormal, and thus potentially indicate increased vulnerability to food insecurity, as it is used by GIEWS.

However, a weakness of this indicator is that it is only available at a national level, and therefore may not accurately reflect local price conditions faced by households and individuals in poorly integrated markets. Additionally, annual calculations may obscure seasonal price fluctuations and aggregate indices may obscure differing price fluctuations in nutritionally important foods ([Diaz-Bonilla, 2016](#)), particularly cheap staples that may be of importance for vulnerable households.

Some have questioned whether the use of a simple rolling average of unconditional standard deviations is an adequate measure of volatility since it does not incorporate the effect of past volatility on current volatility ([Food Security Portal, 2011](#)), while others have argued that high food prices, rather than high food price volatility, should be the priority concern of pro-poor government policy ([Barrett et al., 2011](#)), as high food prices have been shown to be more closely tied with political unrest ([Bellemare, 2011](#)).

## Data Source

Monthly country-level food price volatility data can be downloaded from the [GIEWS Food Price Monitoring and Analysis Tool](#) for specific commodities.

### Links to guidelines

- [Diaz-Bonilla \(2016\). Volatile volatility: Conceptual and measurement issues related to price trends and volatility.](#)

### Food Security Dimensions

- Stability

### Food Composition Database Required?

No

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End of Indicator: Volatility of Food Prices

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