Statistical Journal of the IAOS 37 (2021) 1239–1246
DOI 10.3233/SJI-200699
IOS Press

Food balance sheets provide information on food security, indicators of the prevalence of undernourishment and losses in the cases of Benin, Guinea and Mali

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Abstract. This paper was done within the framework of the Monitoring of the SDGs in Africa (SODDA) project which supported the analysis of the food balance sheets drawn up through the letter of agreement between FAO/GS[1] and AFRISTAT. Analysis of the self-sufficiency rate over the 2010–2015 period shows that Mali has higher food self-sufficiency than Benin and Guinea. In Guinea, overall, 43.2% of domestic product supplies are on average imports. Plant products are the most dependent on imports with an average annual IDR of 48.2% compared to 12.5% for animal products. In the three countries, plant products are the most dependent on imports. The use of FAO methodologies for calculating the prevalence of undernourishment under SDG 2 and the food loss index under SDG 12 made it possible to estimate these two indicators using BAs and other related indicators. The results in 2015 show that Benin and Guinea with respectively 14.2% and 15.6% of the population with a prevalence of undernourishment are ahead of Mali with 5%. In terms of individuals, estimates give 1.5 million Beninese, 1.2 million Guineans and 0.9 million Malians who were undernourished in 2015.

Keywords: Food balance sheet, food security, SDGs, undernourished, export, import, self-sufficiency, food losses

1. Introduction

While agriculture is the most important sector, particularly in developing countries, agricultural and rural statistics remain the poor relatives of national statistical systems. The initiative to develop the Global Strategy to improve agricultural and rural statistics is a response to the lack of capacity of developing countries in collecting reliable statistical data on agriculture and food and in developing a framework benchmark for sustainable and long-term agricultural statistics systems (see reference [1] World Bank, FAO and United Nations, 2010). To be able to respond to these challenges in developing countries, a Global Strategy (FAO/Global Strategy) was initiated for the improvement of agricultural and rural statistics and adopted by the United Nations Statistical Commission in February 2010. The Global Strategy aims to strengthen the statistical capacities of developing countries to enable them to provide reliable statistics on agriculture, food and rural development, necessary for the formulation, monitoring and evaluation of development policies.

It is in this context, through an accelerated technical assistance plan, the Food and Agriculture Organization of the United Nations (FAO) and the Economic and Statistical Observatory of Sub-Saharan Africa (AFRISTAT) have signed in December 2016, a letter of Agreement with a view to contributing to the implementation of certain actions of the Global Strategy for the

[1]FAO/GS: Food and Agriculture Organization of the United Nations/Global Strategy.

Table 1
Self-Sufficiency Ratio (%) 2010–2015

	Benin		Guinea		Mali	
Year	Animal products	Vegetable products	Animal products	Vegetable products	Animal products	Vegetable products
2010	41.1	84.1	87.9	6.9	97.8	94.2
2011	44.2	76.2	86.9	33.4	98.1	93.5
2012	41.3	86.3	87.5	75.2	96.6	89.4
2013	40.6	80.6	86.7	92.7	98.3	92.8
2014	51.8	82.3	88.8	76.8	97.9	91.4
2015	*53.4*	*85.9*	*87.8*	*48.1*	*98.7*	*90.3*

Source: INSAE, INS, INSTAT and our calculations.

improvement of agricultural and rural statistics in terms of training and technical assistance. This protocol has two components:

(1) The creation and use of main sampling frames in agricultural surveys such as those provided for in the integrated agricultural survey (AGRIS).
(2) The process of compiling food balance sheets using the new methodology developed by the FAO.

More precisely, four countries (Benin, Guinea, Madagascar and Mali) benefited from support for the compilation of a food balance sheet for the reference year 2015. Following this exercise, the SODDA project (Support project Monitoring of Sustainable Development Goals in Africa)[2] in accordance with its objective has enabled in-depth analysis of food balance sheets (see reference [7]). Indeed, these assessments were used, among other things, to inform two indicators of the Sustainable Development Goals (SDGs): Indicator 2.1.1 on the prevalence of undernourishment (PoU) Target 1 of SDG 2 “From here by 2030, end hunger and ensure that everyone, especially the poor and vulnerable, including infants, has access to healthy, nutritious and sufficient food throughout the year “and the indicator 12.3.1: Global food loss index for target 3 of SDG 12 “By 2030, halve the volume of food waste per capita globally in terms of both distribution and consumption and reduce food losses along the production and supply chains, including post-harvest losses”.

2. Methodology and results

Four indicators, according to the methodology recommended by the FAO, were estimated for the three countries of Benin, Guinea and Mali: (i) the self-sufficiency ratio; (ii) the import dependency ratio; (iii) prevalence of undernourishment and (iv) food losses.

2.1. Self-Sufficiency Ratio (SSR)

The Self-Sufficiency Ratio expresses the importance of domestic production in relation to domestic consumption. It is given by the equation:

$$\mathrm{SSR} = \frac{\text{Production}}{\text{Production} + \text{Imports} - \text{Exports} + \Delta\text{Stocks}} \times 100$$

In the context of food security, the SSR is often used to show the extent to which a country is self-sufficient in its own productive resources: the higher the SSR, the closer the country becomes to self-sufficiency. It can often be very high when the country is highly dependent on imports to feed its population. This occurs when a significant amount of domestic production is exported.

It appears from the table above that, overall, Mali tends to achieve food self-sufficiency since the SSR for the two types of products (plants and animals) close to 100.

On the other hand, in the case of Guinea, 60% of the domestic availability[3] of products comes from national production. It should be noted that in 2015 self-sufficiency was higher with products of animal origin (87.8%) than those of plant origin (48.1%).

2.2. Import Dependency Ratio (IDR)

The Import Dependency Ratio expresses the share of available domestic supplies that come from imports. Its formula is:

$$\mathrm{IDR} = \frac{\text{Imports}}{\text{Production} + \text{Imports} - \text{Exports} + \Delta\text{Stocks}} \times 100$$

This rate only makes sense if the imports are used exclusively for domestic consumption and are not re-exported.

[2]Only few pilot countries were concerned and the objective was to support them for the monitoring of the SDGs.

[3]Domestic availability = Production + Import − Export − ΔStocks.

Table 2
Import Dependency Ratio (IDR) from 2010 to 2015

Year	Benin			Guinea			Mali		
	Animal products	Vegetable products	Overall ratio	Animal products	Vegetable products	Overall ratio	Animal products	Vegetable products	Overall ratio
2010	64	13	46	12	45	40	2	6	24
2011	56	19	43	13	53	48	2	6	22
2012	59	12	31	13	48	42	3	11	25
2013	59	15	30	13	46	41	2	7	27
2014	48	17	28	11	49	44	2	9	22
2015	47	15	29	12	48	43	1	10	27
Average	*56*	*15*	*35*	*12*	*48*	*43*	*2*	*9*	*24*

Sources: INSAE, INS, INSTAT and our calculations.

In Guinea, overall, 43% of domestic product supplies are on average imports. Plant products are the most dependent on imports with an average annual IDR of 48% compared to 13% for animal products.

Mali is more dependent on imports of plant products than products of animal origin. However, it should be noted that fishery products (fish and seafood) have not yet been integrated into the new approach to drawing up food balance sheets.

2.3. *Indicator of the prevalence of undernourishment (PoU)*

The prevalence of undernourishment is an indicator of access to food and an indicator of the Sustainable Development Goals (SDGs). It measures the achievement of target 1 of SDG 2 which states: "*By 2030, eliminate hunger and ensure that everyone, especially the poor and people in vulnerable situations, including infants, have access throughout the year to a healthy, nutritious and sufficient diet*".

FAO defines undernourishment as "*a situation in which an individual's usual food consumption is insufficient to provide the dietary energy consumption (Dietary Energy Consumption, DEC) necessary for a normal, healthy and active life*". The corresponding indicator is the prevalence of undernourishment (PoU), which is an estimate of the percentage of people in the total population who are undernourished.

The methodology is exposed in Appendix. For Benin and Guinea, which have household consumption surveys, the coefficients of variation have been estimated.

In the case of Mali, there is no data on household food consumption that can be used to estimate the calculation parameters for the period 2010–2015. Coefficients of variation are provided by FAO and a normal logarithmic probability density function has been assumed to characterize the distribution of DEC. The minimum food energy requirements (MDER) are determined using the

Table 3a
Food loss percentages and food loss index for Benin

Products	% of loss 2010	% of loss 2015	Loss index 2015/2010
Maize	25.83%	15.03%	58.19
Rice (Blanched Equivalent)	8.01%	6.95%	86.81
Wheat	1.52%	6.19%	408.25
Sorghum	11.42%	8.93%	78.18
Dry beans	31.38%	0.10%	0.32
Pineapple	9.99%	3.11%	31.13
Coconut	10.05%	10.05%	100.00
Tomato	4.54%	4.54%	100.00
Yams	10.00%	8.75%	87.45
Cassava	13.00%	14.63%	112.53
Soybean	4.00%	32.17%	804.15
Other Legumes	10.05%	3.55%	35.35
Groundnut	17.01%	17.01%	100.00

Sources: National Institute of Statistics and Economic Analysis (INSAE) and our calculations.

standards established by the FAO/WHO[4] expert group on energy needs. The distribution of the population by age group and sex is given by the United Nations population outlook (2017 estimates). Data on the size of individuals are obtained from WHO and birth rates are those of the National Statistical Offices (INSAE[5] for Benin, INS[6] for Guinea and INSTAT[7] for Mali). The MDER has been estimated by combining all of this information using the EXCEL model put online by the FAO for this purpose the food energy availability per person per day of the FBS serves as a proxy for the average food energy intake (DEC).

According to this methodology, the results in 2015 show that Benin and Guinea with respectively 14.23%

[4]WHO: World Health Organization.
[5]INSAE: National Institute of Statistics and Economic Analysis (Benin).
[6]INS: National Statistics Office (Guinea).
[7]INSTAT: National Statistics Office (Mali).

Table 3b1
Evolution of food losses in MT by type of product from 2010 to 2015 in Guinea

Products	2010	2011	2012	2013	2014	2015
Animal products	10.7	11.2	11.8	12.4	12.2	12.9
Vegetable products	994	1027.3	1097.7	1217.5	1152.6	1297.7
Total of losses (MT)	*1004.7*	*1038.5*	*1109.5*	*1229.9*	*1164.8*	*1310.6*

Sources: National Institute of Guinea (INS) and our Calculations.

Table 3b2
Evolution of food losses in MT by product group from 2010 to 2015 in Guinea

Products	2010	2011	2012	2013	2014	2015	Weight (%)
	Volume of food losses (in MT)						
Cereals and products	573.7	602.2	653.1	692.1	626.4	663.8	55.57
Starchy roots and products	163.9	167	182.9	191.6	240.6	281	17.89
Fruits and products (Wine Excluded.)	179.4	181.3	185.2	257.4	211.1	211.3	17.87
Vegetables and products	41.3	40	39.3	38.7	40.3	33.7	3.40
Oilseeds (excl. Prod.)	17.2	18.3	17.9	18.2	13.7	87.2	2.52
Sugar crops (Excl. Prod.)	14	14	14.7	15	15.7	15.4	1.29
Milk and products (Butter excluded)	7.1	7.5	7.9	8.3	7	7.8	0.66
Legumes and products	4.5	4.5	4.6	4.5	4.7	4.1	0.39
Eggs and products	3.6	3.7	3.9	4.1	0	0	0.22
Meats (slaughter) and products	0	0	0	0	4.7	4.6	0.14
Stimulants	0	0	0	0	0	1.1	0.02
Edible offal	0	0	0	0	0.3	0.3	0.01
Animal fats and products	0	0	0	0	0.2	0.2	0.01
Sweeteners	0	0	0	0	0.1	0.1	0.00
Alcohol (Beer and Wine included)	0	0	0	0	0	0	0.00
Spices	0	0	0	0	0	0	0.00

Sources: National Institute of Guinea (INS) and our Calculations.

and 15.6% of the population with a prevalence of undernourishment are ahead of Mali with 5%. In terms of individuals. estimates give 1.5 million Beninese. 1.91 million Guineans. and 0.9 million Malians who were undernourished in 2015.

2.4. *World food loss index (WFLI)*

SDG 12 which aims to "guarantee sustainable consumption and production methods" with in particular its Target 3 which stipulates that "By 2030, halve the volume of food waste per capita globally to the level distribution as well as consumption and reduce food losses along the production and supply chains, including post-harvest losses." To achieve this objective, it is necessary to be able to assess food losses before any intervention aimed at reducing them. The United Nations agencies responsible for the evaluation of food losses (reference [6] Global Strategy Research Program, 2018) have proposed to split them into two parts: a part concerning food losses measured by the Global Food Loss Index and another part relating to food waste, the indicator of which is the Food Waste Index.

The selection of products is done taking into account national objectives. Indeed, it is difficult to find loss estimates for all products consumed in all countries to estimate the overall index and facilitate international comparisons. Given that dietary diversity and the achievement of food security are the main priorities targeted through the calculation of the WFLI.

For the three countries, the selection of the basket of goods was made according to the caloric intake of the products. The two products with the highest caloric intake by section in the base year (2010 as part of this exercise) are selected. Given the importance of certain products in the diet of each country, certain adjustments were made to the basket of products.

The results below were obtained for the three countries.

In the case of Benin, for the year 2010, the percentage of food loss is 12.45%, meaning that 12.45% of the food produced is lost during production, storage and processing. In 2015, this percentage rose to 10.58% equivalent to an index of loss this year compared to 2010 of 85.03%. The percentages of losses thus decreased by 14.97% on average over the period 2010–2015.[8] Corn and beans were the most contributing to this decrease

[8]Note: This variation may be due to the fact that the years 2010 to 2014 have more estimates than 2015.

Table 3c
Distribution of food losses by product for Mali (%)

Products	2010	2011	2012	2013	2014	2015	Weights
Wheat	5.2	5.4	5.4	5.6	5.8	5.6	*0.3*
Maize	15.0	15.0	15.0	15.0	15.0	15.0	*20.7*
Rice (Blanched Equivalent)	11.0	10.6	9.7	10.3	10.6	10.6	*29.4*
Millet	16.4	16.4	16.3	16.6	16.4	16.4	*19.0*
Sorghum	16.4	16.4	16.6	16.4	16.5	16.5	*17.1*
Cassava	15.0	15.0	15.0	15.0	15.0	8.8	*0.2*
Potatoes	32.9	34.7	34.8	35.0	34.8	34.6	*0.1*
Sweet potatoes	15.0	15.0	15.0	15.0	15.0	15.0	*1.0*
Yam	5.0	5.0	5.0	5.0	5.0	5.0	*0.4*
Peanuts	16.3	16.1	15.7	16.1	15.9	16.6	*6.6*
Tomatoes	14.3	14.4	12.9	14.1	13.0	13.6	*0.2*
Onions	10.0	10.0	10.0	10.0	10.0	10.0	*0.1*
Oranges and Mandarins	9.9	9.9	9.9	9.7	8.0	8.1	*0.6*
Bananas	20.0	20.0	20.0	20.0	20.0	20.0	*0.5*
Milk (excl. Butter)	4.5	4.2	4.4	3.8	3.8	3.7	*3.8*
Eggs	25.0	25.0	24.9	25.0	24.9	24.9	*0.1*
Total percentage of food losses	*14.0*	*13.8*	*13.6*	*13.8*	*13.8*	*13.9*	

Sources: National Institute of Mali (INSTAT) and our Calculations.

Table 4
Evolution and loss index

	Benin		Guinea		Mali	
	Percentage	Index	Percentage	Index	Percentage	Index
2010	12.45	100	12.5	100	14	*100*
2015	*10.58*	*85.0*	*11.3*	*90.4*	*13.9*	*99.1*

Sources: INSAE.INS.INSTAT and our calculations

in the loss rate with food loss indices of 58.19% and 0.32% respectively, while cassava contributed in the opposite direction with an index food loss of around 112.53%.

For Guinea, cereal products are the most exposed to food loss since this group of products alone represents half (55.6%) of the average volumes of losses over the six years. Then come the starchy roots and the fruits which each represent 17.9% in the average of the losses expressed in in metric tons (MT).

More specifically for Guinea, food losses particularly concern rice and its derivatives. Indeed, the average lost volume of this product alone represents more than a third (35.7%) of food losses over 6 years. Cassava is the second product affected by losses (12%), then corn (11%). Bananas and plantains recorded 10.3 losses on average over the period considered.

In Mali, the percentages of food losses have evolved around 13.8% over the period 2010–2015. The highest percentage of food loss was observed in 2010 with 14%. In addition, a fall was observed between 2011 and 2012 when the index fell from 13.8% to 13.6% before rising to 13.8% in 2013 and 2014, this fall is mainly explained by the fall in the percentage loss of rice which fell from 10.6% to 9.7% between 2011 and 2012, a decrease of 8.7 percentage points.

The Tables 3a, 3b1 3b2 and 3c below summarize some results obtained for the three countries.

The Table 4 presents the estimates obtained for the percentages of losses in 2010 and 2015 as well as the loss index for 2015 compared to 2010.

3. Caveat

The use of the food balance sheet to estimate undernourishment is an interesting remedy for consumption surveys which measure this estimate more precisely. Indeed. consumer surveys in southern countries are not too frequent because they are too expensive. The advantage of food balance sheets lies in the fact that they must be periodic. which allows for an evolving vision of undernourishment and post-harvest losses. As the compilation of food balance sheets requires the mobilization of a lot of data and therefore of many actors of the statistical system. depending on the country this can prove to be difficult. And one of the main limitations lies in the fact that for many products we have recourse to estimates or expert opinions.

4. Conclusion and recommendations

Analysis of the self-sufficiency ratio over the 2010–2015 period shows that Mali has higher food self-sufficiency than Benin and Guinea.

In Guinea. overall. 43.2% of domestic product supplies are on average imports. Plant products are the most dependent on imports with an average annual IDR of 48.2% compared to 12.5% for animal products.

In the three countries. plant products are the most dependent on imports less more for Benin.

The use of FAO methodologies for calculating the prevalence of undernourishment under SDG 2 and the food loss index under SDG 12 made it possible to estimate these two indicators using FBS and other related indicators.

Also. most of the information relating to industrial uses is not available at the national level. However. to have a complete FBS. it is recommended that the Technical Working Group (TWG) in Benin continue for seeking information on the uses of broken rice. in particular the quantity allocated to food. The Benin TWG started the FBS development activity for 2016. 2017 and 2018 which will allow monitoring of the SDG indicators.

In general. a certain number of aspects must be considered for monitoring these indicators:

- Improve the production of statistics for the sectors concerned by the preparation of the food balance sheet to obtain quality data;
- Continue the training and assistance of technical working groups in order to perpetuate the monitoring of aggregates useful for formulating policies in the context of the fight against food insecurity and undernourishment;
- Put in place food preservation systems to reduce losses of products in general. rice and cassava in particular;
- Support the agriculture sector at the national level by investing in research and development. manpower training and equipment in order to increase the productivity of the sector;
- Support policies to eradicate the undernourishment by promoting a resilient socio-political. economic and health environment.

Acknowledgments

I thank Paul-Henri NGUEMA MEYE, Pieter Everaers, James Whitworth and two anonymous referees for helpful comments. I was working at AFRISTAT when this research was initiated. Usual disclaimers apply.

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Appendix

A. Food balance sheet (see reference [2])

A food balance sheet (FBS) can be defined as an aggregated and analytical dataset that "presents a comprehensive picture of the pattern of a country's food supply during a specified reference period."[9] This is achieved in an accounting framework. wherein all potential sources of both supply and utilization of a given food product are specified. The quantities allocated to all the sources of total supply – amount of the food item produced. the amount of the food item that is imported. and the amount of the item that is either added to or taken from stocks – must be equal to the quantities allocated to all the sources of utilization. which can include exports. losses along the supply chain. livestock feed. seed use. tourist food. industrial uses. other uses. and food available for consumption by a country's residents. This balance is compiled for every food item (estimated on a primary commodity equivalent basis) consumed within a country. and then all of the primary commodity equivalent balances are combined into one overall food balance sheet.

This definition can be formalized by the following equation: **SUPPLY = UTILIZATION**

[9] For this definition and a more extended description of the motivation behind the development of food balance sheets, see the 2001 FAO food balance sheets handbook: "Food Balance Sheets: A Handbook," http://www.fao.org/docrep/003/X9892E/X9892E00.HTM.

$$\mathrm{P} + \mathrm{I} - \mathrm{dSt} = \mathrm{X} + \mathrm{Fo} + \mathrm{Fe} + \mathrm{Se} + \mathrm{T} + \mathrm{IU} + \mathrm{Lo} + \mathrm{ROU} + \text{food processing}$$

where P = production; I = imports; dSt = Δstocks; Fo = food; Fe = feed; Se = seed; T = tourist food; IU = industrial Use; Lo = Loss: Rou = Residual or other uses.

B. Methodology for calculating the Prevalence of undernourishment (PoU) (see reference [4] and [5] Wanner and al. (2014). Naiken. L. (2003))

The PoU indicator is defined as the probability that an individual's daily dietary energy intake (x). taken randomly from the reference population. will be less than the minimum dietary energy requirement (MDER) to lead a normal. healthy and active life (Wanner and al. 2014). Hence the formula:

$$PoU = \int_{x<MDER} f(x|\theta)\mathrm{d}x;$$

where $f(x)$ is the probability density function of daily calorie consumption per individual (Dietary Energy Consumption. DEC) and θ a vector of parameters of this function. The number of parameters depends on the law followed by the function f. In most cases. the distribution is considered to follow a log-normal distribution. in which case it is determined by two parameters. namely the mean DEC and the coefficient of variation (CV). In other cases. an asymmetric normal or asymmetric log-normal distribution is considered. so in addition to the two previous parameters. the asymmetry coefficient (Skewness. SK) is required (FAO and al.. 2018).

So to calculate the PoU. you must first choose a functional form of the distribution of food consumption $f(x)$ and have the following parameters: the daily food energy intake (DEC); the threshold for minimum food energy requirements (MDER); the coefficient of variation which accounts for the inequality in the consumption of food products between the different layers of the reference population and the coefficient of asymmetry (in the case where the distribution of daily consumption is not symmetrical to a transformation-close).

B.1. Determination of the functional form of f

Until 2012. the probability distribution $f(x)$ was modeled as a Log-normal probability density function (pdf). informed by only two parameters: mean and coefficient of variation. In its most recent formulation. it is modeled as a three-parameter pdf. capable of representing different degrees of asymmetry. ranging from that of a symmetric normal distribution to an asymmetric log-normal distribution.

The flexibility to capture different degrees of asymmetry is necessary to take into account for the fact that the levels of food energy consumption are naturally limited by the physiological state of individuals. It is therefore conceivable that. when average consumption increases. the asymmetry of distribution decreases. It gradually changes from log-normal (positively asymmetric) distributions. typical of populations where average food consumption is relatively low. towards normal (symmetrical) distributions. The families of asymmetric-normal distribution and asymmetric log-normal make it possible to characterize all the possible intermediate degrees of positive asymmetry. (See http://www.fao.org/3/ai4046e.pdf for a detailed description).

B.2. Estimated average Dietary Energy Consumption (DEC)

i. There are three main sources of information for estimating Dietary Energy Consumption which are: surveys on individual food consumption which make it possible to capture. for each individual. the daily consumption of food products.
ii. Household expenditure and consumption surveys which provide information on the quantities of products consumed and the expenditure borne by households. Using such data. the average food consumption per individual can be used by dividing the total food consumption of households by their size.
iii. Food balance sheets which use the food energy availability per capita which serves as a proxy for the DEC.

B.3. Estimated minimum dietary Energy requirements (MDER)

The dietary energy requirements of a person according to their sex and age are determined by multiplying the standardized needs associated with the basic metabolic rate (expressed per kilogram of body weight) by the ideal weight of a healthy person (considering her size). The values obtained are then multiplied by a coefficient corresponding to the level of physical activity (NAP) in order to take this latter into account. Since body mass index (BMI) and NAP vary within active and healthy groups of the same sex and age. only one range of energy requirements can be calculated for each age group. and gender of the population. The MDERs of the total population correspond to the weighted average of the MDERs for each age and sex group. the share of the population represented by each group taking the place of weighting coefficient (reference [6] FAO. 2008). The quantity obtained following this calculation is increased by a surplus of consumption for pregnant women by using the birth rate in the population considered.

B.4. Estimation of the coefficients of variation (CV) and of asymmetry (SK)

The CV and SK coefficients are derived from nationally representative household surveys. When these data are available. they should be processed to eliminate any observations that could cause great variability in the consumption of food products.

It therefore appears that for the SK CV estimate. food balance sheets cannot be used because they do not provide information on the distribution of food consumption within a population (FAO. 2018).

It should be noted that the CV is broken down into two orthogonal components. namely the variations in food energy consumption which are attributable to income ($CV|y$ and the variations which are attributable to any other factor orthogonal to income ($CV|r$) including weight. physical activity etc.:

$$CV = \sqrt{(CV|y)^2 + (CV|r)^2}$$

The $(CV|y)$ is directly calculated using household survey data by adjusting the distribution of household food consumption by the variability due to the number of people consuming the meal (which is often different from the size Household); household composition; and the sampling plan. The CV of this corrected distribution can be used as a proxy for the $(CV|y)$.

In the past. a comparison of $(CV|r)$ over time and between countries made it possible to set its value at 0.2 (see reference [5] Wanner and al. (2014)). To account for the change in the structure of the population by age and sex. we use the dietary energy requirements of each group and the corresponding population ratios (share of each group in the total population) as weights to estimate the $(CV|r)$.

The asymmetry coefficient is estimated from data from household food consumption surveys (if these data are available and reliable). When there is no data available on household consumption or when the data available cannot calculate household food consumption in terms of food energy (the quantities consumed are not available or cannot be estimated). the log-normal distribution can be assumed. in this case the asymmetry coefficient is not used.