WHAT IS FOOD AND NUTRITION SECURITY AND HOW CAN IT BE MEASURED?

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Contents

A. Introduction[1]

The increased prices of foods, fertilizers and energy in 2021, exacerbated in 2022 by war in Ukraine, have renewed concerns about food and nutrition security (FNS), as was the case in the period 2008-2011, and previously during the price shocks of the 1970s (Díaz-Bonilla 2015a). FNS is also part of Sustainable Development Goal (SDG) 2: "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture." Consequently, various international organizations and countries have called for different joint actions against global food insecurity. In particular, the Inter-American Institute for Cooperation on Agriculture (IICA) at the Summit of the Americas in Los Angeles in June 2022 proposed a Continental Alliance for Food Security and Sustainable Development, to be implemented through specific national programs in the region.

This document seeks to support the work of the countries of Latin America and the Caribbean (LAC) in preparing and executing their FNS programs, as part of wider efforts to strengthen and improve agrifood systems.[2] For the design and implementation of these programs, one initial question is: What is the problem that we wish to resolve? That is, how do we define and measure food and nutrition insecurity? How important is this problem quantitatively in LAC countries? And what is the metric for claiming that the problem "has been solved"? This is the basis for designing comprehensive programs that include goals, instruments, technology, costs, funding, institutionality and an implementation schedule. In other studies prepared for IICA it is expected to analyze the methodologies and approaches to prepare and implement these comprehensive national programs, as a way of helping LAC countries to

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[1] The author thanks Manuel Otero, Máximo Torero, Eduardo Trigo, and Federico Villareal, who are not responsible for any errors or omissions by the author.

[2] The proper functioning of agrifood systems is crucial for meeting virtually all the SDGs and targets of the 2015 Paris Agreement on climate change. Therefore, FNS programs must be part of the more general work of strengthening, improving and modernizing agrifood systems (analyzed at the United Nations Food Systems Summit (UNFSS) in September 2021) and climate change negotiations (within the United Nations Framework Convention on Climate Change, UNFCCC).

implement the Alliance and strengthen and improve agrifood systems in the region.

The first section presents a brief history of concepts related to FNS. It shows the different levels of analysis, from the production to the consumption of foods, and from global perspectives to a focus on individual human beings. A second section analyzes different FNS indicators for individuals and presents data for LAC.

Annex C discusses more global indicators, especially related to food trade. For those who wish to explore these issues further, there are other annexes with additional information about the methodologies to calculate those indicators and with more disaggregated data by LAC countries. The document concludes with some considerations to support the preparation of comprehensive FNS programs in LAC.

B. Brief historical overview of the notion of FNS[3]

The notion of FNS and its causes[4] were clearly conceptualized in the closing declaration of the United Nations[5] Conference on Food and Agriculture in 1943, in Hot Springs, Virginia. This event led in 1945 to the creation of the Food and Agriculture Organization of the United Nations (FAO).

The conference stated the "belief that the goal of freedom from want of food, suitable and adequate for the health and strength of all peoples can be achieved" and defined as its objective that of ensuring "an abundant supply of suitable foods for all humanity." The closing declaration further argued that:

"The first cause of malnutrition and hunger is poverty […] There must be an expansion of the whole world economy to provide the purchasing power sufficient to maintain an adequate diet for all. With full employment in all countries, enlarged industrial production, the absence of exploitation, an

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[3] Based on Díaz-Bonilla 2015a and 2015b.

[4] Undoubtedly, the issue of food has been a central concern for human beings since the dawn of time. This brief history focuses on the more recent period since the Second World War.

[5] "United Nations" refers here to the USA, UK and other allied countries during the Second World War. The United Nations Organization was created later, in October 1945.

increasing flow of trade within and between countries, an orderly management of domestic and international investment and currencies, and sustained internal and international economic equilibrium, the food which is produced can be made available to all people" (Shaw 2007: 3-4).

This broad concept tied FNS not only to the direct supply of food, but also to a development plan with equity and employment, as well as being macroeconomically sustainable at the global level and in every country. In that way it anticipated by several decades later debates on food security and its causes.

Shortly after, the Universal Declaration of Human Rights proclaimed by the United Nations in December 1948 stated, in article 25 paragraph 1, that "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family," and mentioned food explicitly.

The broad vision of FNS issues and policies was gradually circumscribed in the 1950s and 60s to fears about food shortages resulting from the reconstruction of Europe and Japan and the possible advance of communism if hunger was not eliminated. Major price increases in the 1970s, as a result of a convergence of climate and geopolitical shocks and macroeconomic factors, reinforced fears about production shortages (Díaz-Bonilla 2010 and 2015b). At the World Food Conference in Rome in 1974, held to address the global food crisis of 1973-1974, talks focused on decreased food production in developing countries and problems of international trade of basic food products. The Conference defined food security, from the global supply perspective, as the availability at all times of sufficient global supplies of basic products to sustain the constant expansion of food consumption and compensate for the fluctuations in local production and prices.

The emphasis was on <u>food</u> production and trade, despite the fact that price increases observed during the 1970s affected all raw materials and, therefore, they clearly had a major macroeconomic component (Díaz-Bonilla 2010), as the 1943 Conference noted. However, this broader vision disappeared to a great extent in the 1970s. Likewise, issues of poverty and nutrition were not central,

despite the fact that in 1966 the UN had adopted the International Covenant on Economic, Social and Cultural Rights, which made more explicit the right to adequate food (including nutrition aspects) and to be free from hunger.[6]

In the second half of the 1980s, global food markets moved to a situation of excess supply as a result of various factors that increased production, on the one hand, and reduced demand, on the other (the latter due especially to the double global recession at the start of the decade and the debt crisis of many developing countries that followed such recessions).[7] The subsequent "export subsidies war" between the European Union and the USA aggravated the fall in agricultural prices and led to a variety of trade conflicts and multiple negotiations in the General Agreement on Tariffs and Trade (GATT) to try to resolve the imbalances in global agricultural markets. These efforts eventually led to the Uruguay Round Agreement and the creation of the World Trade Organization (WTO) in 1995. Throughout all these negotiations, attention was focused on production and trade measures.

The general collapse of prices in the 1980s showed that the level of agricultural production was not at that time the main constraint on food security. Therefore, the focus shifted from the global and national food supply or availability, to the access to and use of foods by families and individuals. It became evident once again that the main obstacles to food access were poverty and lack of income opportunities and not the scarcity of food supply; this reiterated the point made by the 1943 UN Conference and which Amartya Sen (1981) re-discovered and emphasized in the 1980s. Another basic point was that the consumption of foods should be more than just eating what is needed for simple survival and should also sustain an active and healthy life. Although this aspect was already clear in 1943, it was presented in the 1980s as a new refinement of the definition of food security.

Development strategies in the 1980s also began to emphasize a vision of "basic human needs," which led to the UN's human development approach, and

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[6] The 1966 decision further underlined the right to food that had already been recognized in the Universal Declaration of Human Rights of 1948.

[7] Reduced demand affected other raw materials as well, and not only food (for a more general discussion, see Díaz-Bonilla 2010 and 2015a).

eventually to the Millennium Development Goals (MDGs) for 2015 and SDGs for 2030. The issue of food was reflected in Goal 1 of the MDGs ("Eradicate extreme poverty and hunger") and, as mentioned above, in SDG 2 (sometimes summarized as "Zero Hunger," but which includes other aspects).

Thus, the analytical focus shifted from global production in the 1970s to the consumption of families and individuals in the 1980s, which is where food problems are manifested concretely in whether or not people can attain an active and healthy life.

Combining these ideas, the FAO World Food Summit in 1996 produced the well-known definition that states that food security exists "when 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" (Rome Declaration on World Food Security, FAO 1996, paragraph 1).

In the course of subsequent debates the notion of food security continued to evolve. It was noted that physical availability and economic access are only prior conditions for the adequate use of foods and it is possible that they do not unequivocally determine the more important issue of individual malnutrition when this is measured with anthropometric indicators (Smith 1998; Smith and Haddad 2000).[8]

In this regard, some definitions started to differentiate between food security and nutrition security. For example, a report by FAO et al. (2013) uses the following definitions:

"Food security: A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Based on this definition, four food security dimensions can be identified: food availability, economic and physical access to food, food utilization and stability over time…"

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[8] For example, Smith and Haddad (2000) analyzed nutritional insecurity at individual level (using anthropometric measurements of child malnutrition as indicator). They found that although the national availability of foods plays an important role, there are also other major determining factors, such as the health environment, women's education level, and the relative status of women in society.

"Nutrition security. A situation that exists when secure access to an appropriately nutritious diet is coupled with a sanitary environment, adequate health services and care, in order to ensure a healthy and active life for all household members. Nutrition security differs from food security in that it also considers the aspects of adequate caring practices, health and hygiene in addition to dietary adequacy" (FAO, IFAD, WFP, 2013; p. 50).

These definitions recognize the fact that the world has been increasingly suffering from what has been called the "triple burden" of malnutrition affecting households and individuals (Pinstrup-Andersen 2007): undernutrition (calorie deficiency or hunger); deficiency of other macro- and micronutrients (sometimes called "hidden hunger"); and overnutrition, which leads to obesity problems and a variety of non-communicable diseases (such as diabetes, cardiovascular problems, and certain types of cancer).

Although malnutrition and deficiency of micronutrients fit into the notion of "nutrition insecurity," which is conceived as a rather linear problem from insecure to secure, overnutrition problems require a more precise characterization of what a "healthy and active" life means. This suggests a non-linear relationship between consumption and nutritional state, where the excessive consumption of food is also part of "bad nutrition."

As a result, the emphasis has recently shifted to dietary diversity, in addition to the simple availability of calories per capita, as a crucial element to reduce the three malnutrition problems that affect individual countries in different ways. Each of the components of this triple burden of malnutrition has specific effects on people's health and wellbeing and can be influenced in different ways by individual public policies.

It is generally considered that the definition of FNS involves four main components: availability (which depends on domestic supply and international trade of food); access (which is influenced by patterns of income, employment and poverty related to the nature of a country's process of growth and economic development); use (which depends on the safety, nutritional qualities and diversity of foods, but also other factors such as health services, water,

sanitation, education, women's roles, and good governance); and stability (i.e., physical and economic access to foods has to be possible all the time, which can be affected by economic crises, climate events, pandemics, and other shocks).

Recently there have been discussions as to whether two further aspects should be added (FAO et al., 2022): agency, in that individuals can make their own decisions about food; and sustainability, referring to the capacity of food systems to ensure FNS now and in the future, which connects FNS to climate change and the sustainable management of natural resources.

Because FNS has so many dimensions and levels, a central question is: what do we want to measure exactly and at what level, e.g., global, national, regional, families or individuals? (Figure 1). The answers to these questions are fundamental for defining the public policies to be applied.

Figure 1. FNS dimensions and levels.
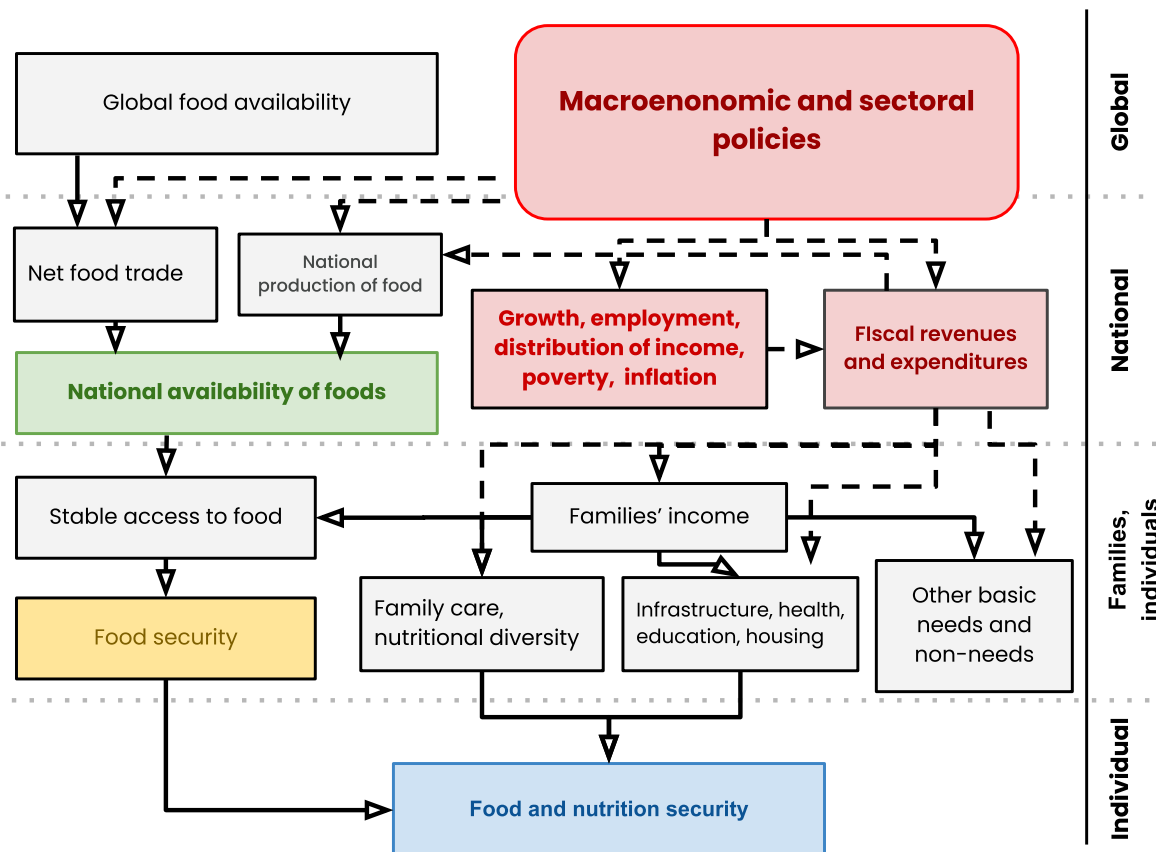
Source: Díaz-Bonilla 2015, adapted from Smith 2000.

Figure 1 also shows that what ultimately matters is the impact of policies on individuals. The following section seeks to give greater operational and quantitative precision to the notion of FNS, analyzing in more detail different indicators and how they are measured.

C. Which ones are indicators for FNS and how are they measured?

Since the concept of FNS is multidimensional, some basic questions for the design and implementation of public policies are: a) what is the problem that needs to be solved? and b) how is it measured? The indicator used should be directly related to that problem and measure it correctly to determine its

quantitate importance. It should also track the advances and setbacks in its resolution and, eventually, show whether the problem has been "solved": in this case, that individuals have achieved FNS.[9]

The construction of indicators must generally be part of the stages of a logical framework of public policies which, in simplified form, includes:

Inputs: human, financial and other resources allocated to the programs that could solve the problem identified.

Products: activities, services, events and products to solve the problem, resulting from the use of inputs and other causes.

Results: modifications to changes in the dimension of the problem, resulting from the products and other causes.

These stages are framed by certain structural conditions or basic drivers. There should be a "theory of change" that connects these stages, that is, what are the causal mechanisms that link the inputs with the products and the products with the results, given certain assumptions about the context.

Figure 2 shows the different dimensions of food systems: structural aspects and drivers as well as the components of food systems that include food supply chains, food environments, and factors at the level of individuals that lead to consumption decisions and diets. The figure also shows the policies and the general economic, legal and institutional framework, and, finally, the results (nutritional and health, economic, equity and social inclusion, and environmental).

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[9] There is a variety of analyses of the desirable characteristics of indicators and their construction, such as the aspects highlighted by the acronym SMART, which stands for: specific (the indicator must describe accurately what is to be measured and must not include multiple measurements in a single indicator; measurable (it is something measurable that different people can verify independently, obtaining consistent results under the same conditions); attainable (data gathering must be simple, direct, and cost-effective); relevant (the indicator must be directly related to what is being measured); and time-bound (the indicator must refer to a specific time frame).

Figure 2. Dimensions of food systems
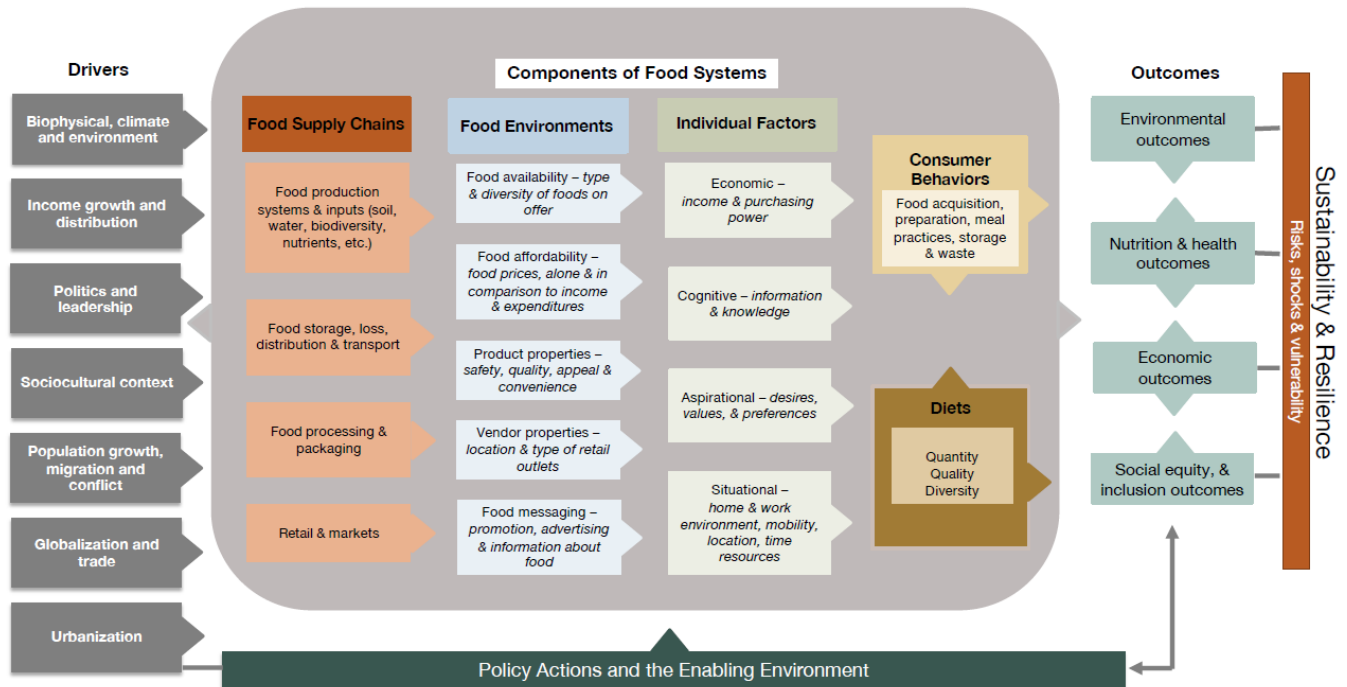
Source: From Herforth, Bellows et al. 2022.

In addition to the fact that the problem (the lack of FNS) is multidimensional, indicators can be used at different levels. For example, indicators can be considered on: a) drivers and structural factors; b) policies and economic and institutional frameworks; c) the productive and operational conditions of food systems themselves; and d) indicators that measure the results of FNS and other goals. Indicators have also been differentiated considering temporal dimensions: whether they refer to circumstantial/transitory aspects or long term/persistent aspects. Also, they may be applied at different levels, from the macro (global, regional, national) to the micro (household, individual) (Pangaribowo et al. 2013).[10]

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[10] It has also been argued that food security at individual level is a theoretical construction of a "latent variable" that can only be measured indirectly. In some cases, statistical methods have been applied, such as factor analysis, to identify dimensions or components of the phenomenon that are not considered to be directly observable (see Vaitla et al., 2017). This document discusses different specific indicators of observable aspects that can be addressed with FNS programs.

Given these considerations (that is, the multidimensionality of FNS that can lead to different ways of defining the "problem" along with different levels of structural conditions, inputs, processes and results), it is not surprising that there is a large variety of indicators. Table 1 shows three types of databases, with FNS-related indicators.

Table 1. Different databases.

FAO food security databases	Classifies FNS variables according to the four dimensions of availability, access, stability and use (annex A).
Data4Diets Platform	Focuses more on indicators of diets and nutrition (annex B)
The Food Systems Dashboard	At present there are 259 indicators that cover more than only FNS, including also different dimensions of Figure 2.[11]

Source: Created by the author.

The emphasis in the next subsections is on indicators of results that refer to the FNS situation of human beings (families and individuals), that is, aspects related to consumers, diets and their impact on nutrition and health (Figure 2), but not other results. The more global indicators, such as whether countries are net importers of food and other related aspects, are analyzed in Annex C.

Figure 3 shows the cycle of food security problems along with the discontinuity presented by the issue of diet quality which, depending on the composition and amount, can lead to undernutrition and hunger, or to problems of overweight, obesity and non-communicable diseases. In both cases there can be a lack of essential macro and micronutrients, albeit of various types and for different reasons.

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[11] The groups are drivers (24 indicators), food supply chains (54 indicators), food environments (73 indicators), individual factors (23 indicators) and results (85 indicators). It is part of a study by the FAO, the Global Alliance for Improved Nutrition (GAIN) and Johns Hopkins University to develop indicators for the transformation of food systems (a goal that includes FNS, but also other dimensions) (Fanzo et al., 2021).

Figure 3. General framework for situating food security indicators.
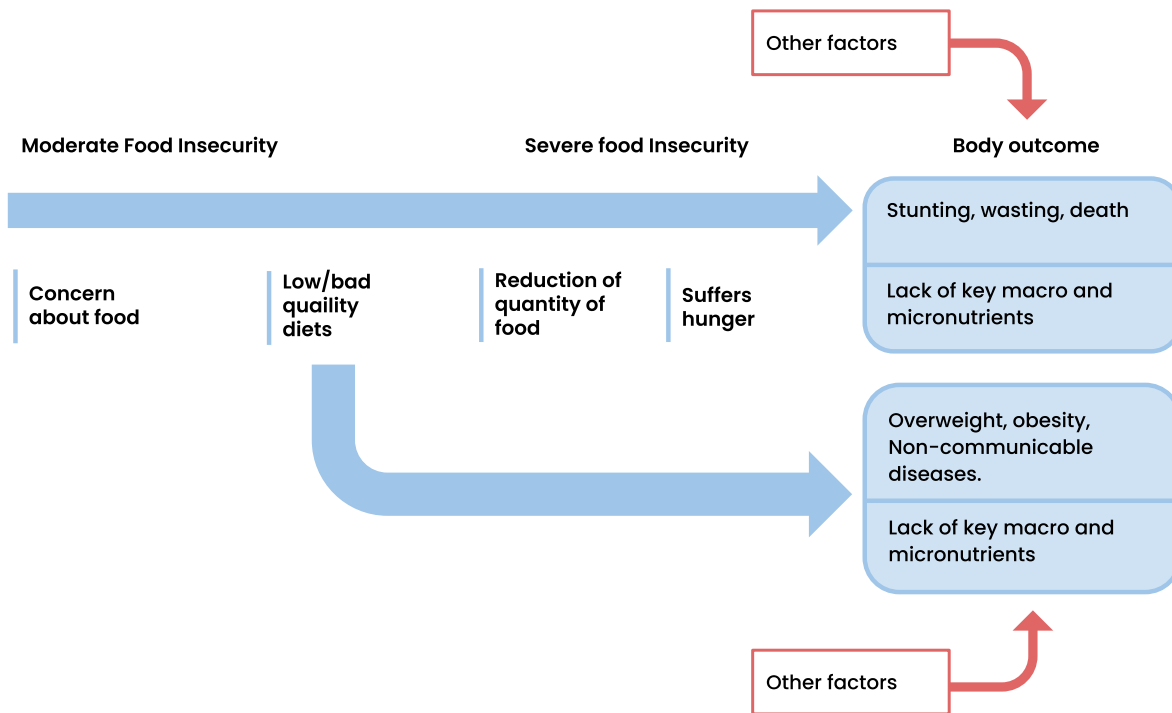
Source: Created by the author, adapted and expanded from Broussard and Tandon 2016.

In Figure 3, from the left hand side, we can see that a first level of food insecurity occurs when people are afraid that they cannot feed themselves adequately. Moving to the right, a more concerning second level is when people are forced to reduce the quality of their diet. Here there is a bifurcation, with two arrows. The upper one shows the start of a growing deterioration that then leads to decreasing the amount of food consumed (the following stage of severity in figure 3) and which, in cases of more serious food insecurity, leads people to suffer hunger (the last point of the arrow, before the anthropometric impacts). Eventually, along with other factors (such as a lack of drinking water and sanitation, poor health services, etc.) this can lead to undernutrition (hunger), low body weight and even death.

The lower arrow shows that the deterioration of the diet quality can generate problems different from hunger, including the lack of certain basic nutrients, or

lead to overweight and obesity with the related non-communicable diseases (diabetes, cardiovascular problems and certain types of cancer).

Figure 3 also helps to place the different food problems and their indicators in the sequence of FNS conditions. These indicators can be divided into five categories[12] measuring different aspects: a) calorie deficiency, which is presented as the estimated percentage and the number of people who suffer hunger; b) experiential indicators, which show the estimated number and the percentage of people classified at three levels: with food security, with moderate insecurity and with severe insecurity; c) monetary indicators, presented as the number and the percentage of people who are under the poverty threshold or who do not have income to pay for the estimated cost of desirable diets; d) dietary diversity measurements, which show the percentage and number of people with different levels of diet variety; and e) anthropometric measurements, such as wasting and stunting in infants or overweight and obesity.[13]

Table 2 shows the position of these different indicators in the sequence of food insecurity problems depicted in Figure 3 and which of the five categories they belong to. It also mentions whether they are part of the official indicators of the SDGs.

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[12] For example, Headey and Ecker (2013) analyze the four first types of indicators discussed in the text.

[13] The indicators of wasting and stunting are usually applied in the case of children under five. Indicators for low weight, on the one hand, or overweight or obesity, on the other, are estimated for different ages.

Table 2. Summary of Indicators.

Indicator position on the chart	1. Calories	2. Experiential	3. Monetary	4. Diversity	5. Anthropo metric
	SDG Indicator 2.1.1. "Undernutrition" or "hunger"				
		SDG Indicator 2.1.2. "Food insecurity (moderate or severe)			
			Cost of healthy diet	Diversity of diet that is effectively consumed.	

Moderate Food Insecurity — Severe food Insecurity — Body outcome; Concern about food; Low/bad quality diets — Reduction of quantity of food — Suffers hunger; Stunting, wasting, death; Lack of key macro and micronutrients; Overweight, obesity, Non-communicable diseases; Lack of key macro and micronutrients; Other factors				Poverty threshold (extreme and non-extreme), which defines income for food and other basic needs.		
Moderate Food Insecurity — Severe food Insecurity — Body outcome; Concern about food; Low/bad quality diets — Reduction of quantity of food — Suffers hunger; Stunting, wasting, death; Lack of key macro and micronutrients; Overweight, obesity, Non-communicable diseases; Lack of key macro and micronutrients; Other factors						Indicators for under-5s for stunting (2.2.1. of SDGs), wasting (2.2.2a), and obesity (2.2.2b). Indicators for other ages.

Source: Author

As can be seen, each of these indicators measures different aspects on the continuum of situations presented in Figure 3. Therefore, it is crucial to understand which aspect of FNS is being measured with each indicator.

In what follows there is a brief analysis of the indicators from Table 2. More detailed references to the way they are constructed appear in different annexes, which also include additional quantitative data about LAC and the global context of the problems involved. Other annexes present information more disaggregated by countries in LAC.

1) Calorie deficiency

The best-known indicator in this category is calculated by the FAO and is titled "prevalence of undernourishment." It is the estimate of the percentage and the

number of people who consume less than the minimum dietary energy requirement (MDER); that is, they suffer hunger (annex D has more methodological details).[14] It is used as official indicator 2.1.1. of SDG2: "Zero Hunger."[15] It is widely used to give an overview of the situation and trends of access to food at global and national levels. It is also the most used indicator in simulations with global and national models to analyze the impact of different policies and investments on hunger. In the sequence of Figure 3, the indicator is located in the point related to this condition (marked with the oval figure with a dotted line in Figure 4)

Figure 4. Indicator of calorie deficiency or hunger.
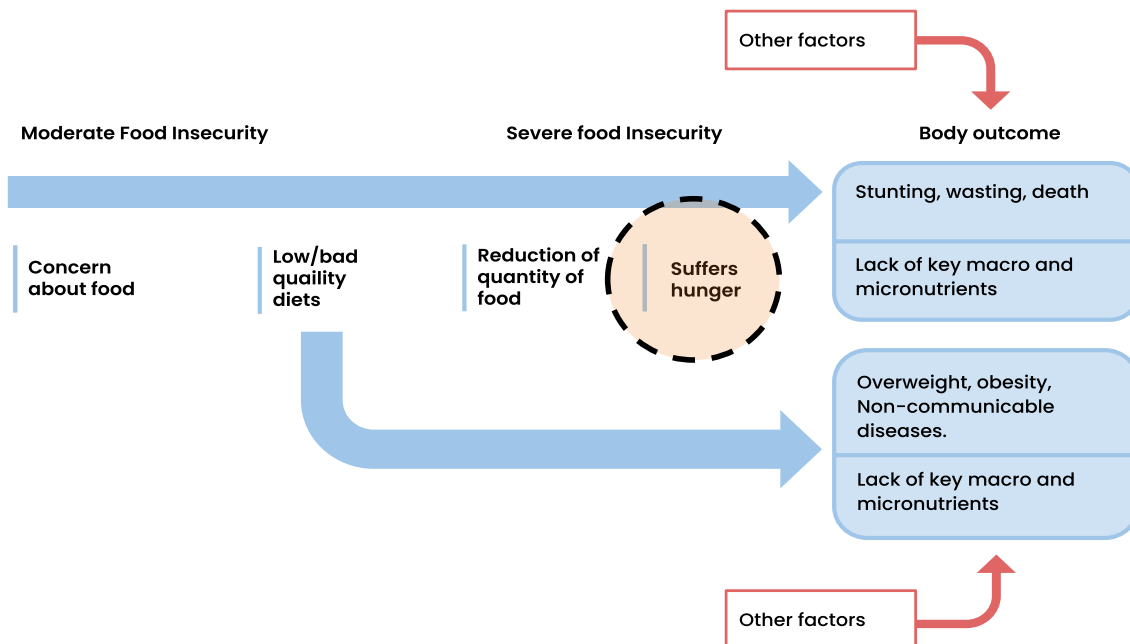
Source: Created by the author

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[14] A more detailed analysis of the calculation can be found in FAO et al. (2022) in annex 1B: Methodological Notes for the Food Security and Nutrition Indicators.

[15] Hunger (calorie deficiency) and undernutrition (which includes calorie deficiency but could also refer to other nutritional problems) are not necessarily the same. However, the indicator calculated by the FAO, based on estimates of calorie consumption (hunger), has received the official title of "prevalence of undernourishment." In the following I will try to use the word "hunger," although there will sometimes be references to the official indicator name.

As there are no surveys available for all the countries that are representative of individual diet intake, the indicator is constructed using a series of calculations (based on the availability of food in a country and its calorie content) to estimate what percentage of people may be consuming less than the required minimum (Annex D).

Figures 5 and 6 present comparisons of the indicator for LAC within the global context.

**Figure 5. Prevalence of undernutrition (hunger), in percentages (2019–2021).**
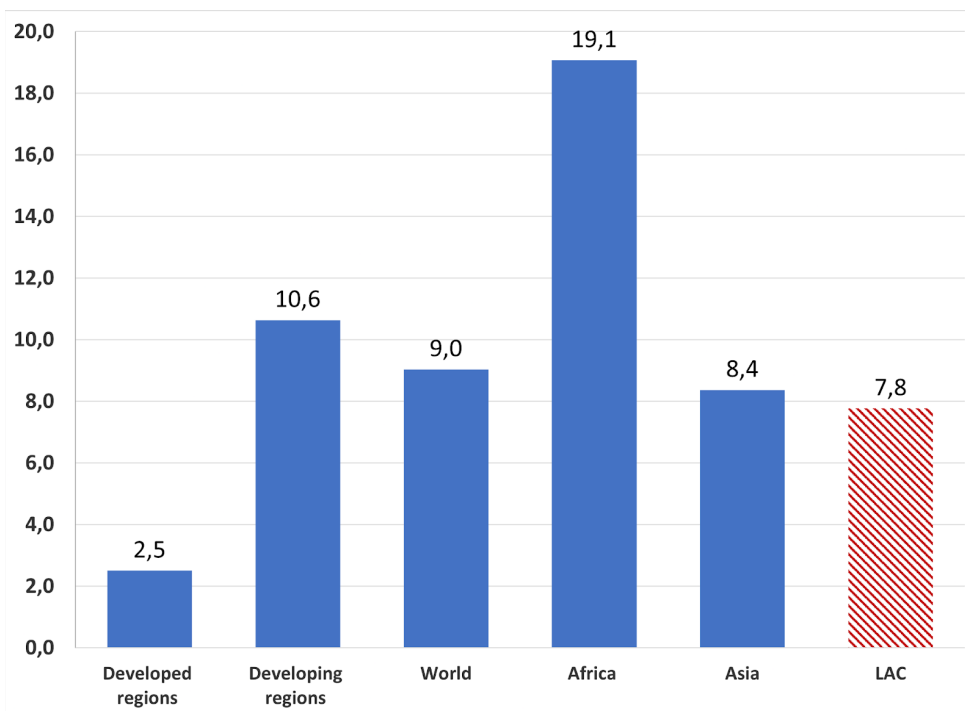
Source: Created with information from FAOSTAT database (2022).

In comparison with other developing regions and with the world in general, LAC shows a lower estimated percentage of people who suffer hunger: 7.8 percent in the region compared with 10.6 percent in developing countries and 9 percent in the world (average 2019-2021). The average number of people for this period was around 50 million in LAC, compared to a global total of a little over 700 million.

Figure 6 shows the evolution over time of the same indicator compared with developing countries and the world.

Figure 6. Prevalence of undernutrition (hunger) in percentages
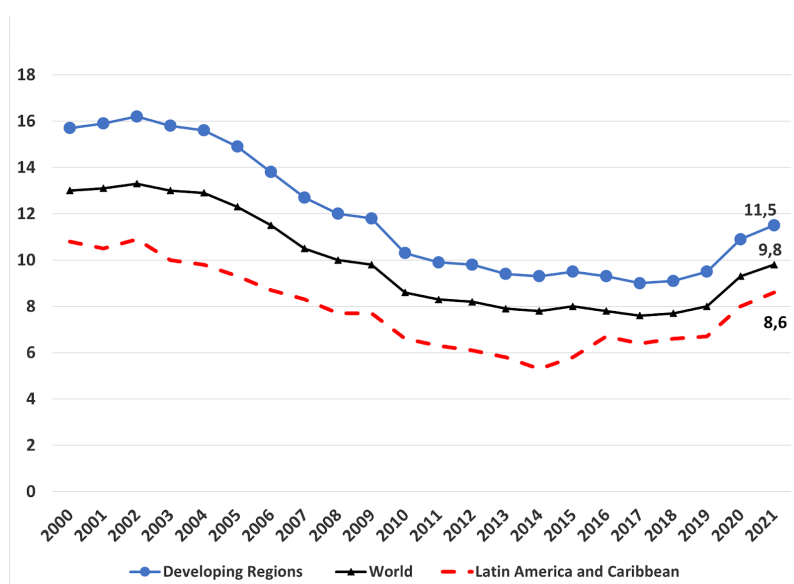
Source: Created with information from FAOSTAT database (2022).

Since the beginning of the 2000s, LAC has shown less incidence of hunger than the average of developing countries and the world as a whole. All the groups of countries considered in Figure 6 show, since approximately 2002, an initial downward trend in the percentage of people with hunger. This trend was interrupted by the pandemic in 2020 in developing countries and in the world. However, in LAC while the cycle of rising commodity prices sustained economic growth and helped reduce hunger from early 2000 to about 2013-2014, since then the downward trend stopped and the region began to show an increase in

hunger, as a result of the global and regional economic slowdown and the decline in commodity prices (Díaz-Bonilla et al. 2021). In the rest of the world,[16] the indicator continued to fall until 2020 and 2021, when the pandemic led to an increase in hunger in a number of countries globally.

Annex E shows more information disaggregated by LAC countries.

2) Experiential indicators

This indicator is used to quantify food insecurity (as something different from hunger). It is also mentioned in SDG2, which establishes the indicator 2.1.2 defined as the "prevalence of moderate or severe food insecurity in the population, according to the food insecurity experience scale (FIES)." This seeks to measure limited access to food by individuals or households, due to a lack of money or other causes (see some methodological aspects in Annex F; a more detailed treatment is in FAO et al. 2022).

Figure 7 shows that this indicator covers the whole spectrum of food insecurity from moderate to severe (marked with the oval figure with dotted lines).

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[16] The raw material producing areas in Africa and the Middle East also moved with the price cycle of these products.

Figure 7. Experience indicators.

Other factors

Body outcome

Moderate Food Insecurity   Severe food Insecurity

Concern about food | Low/bad quaility diets | Reduction of quantity of food | Suffers hunger

Stunting, wasting, death

Lack of key macro and micronutrients

Overweight, obesity, Non-communicable diseases.

Lack of key macro and micronutrients

Other factors
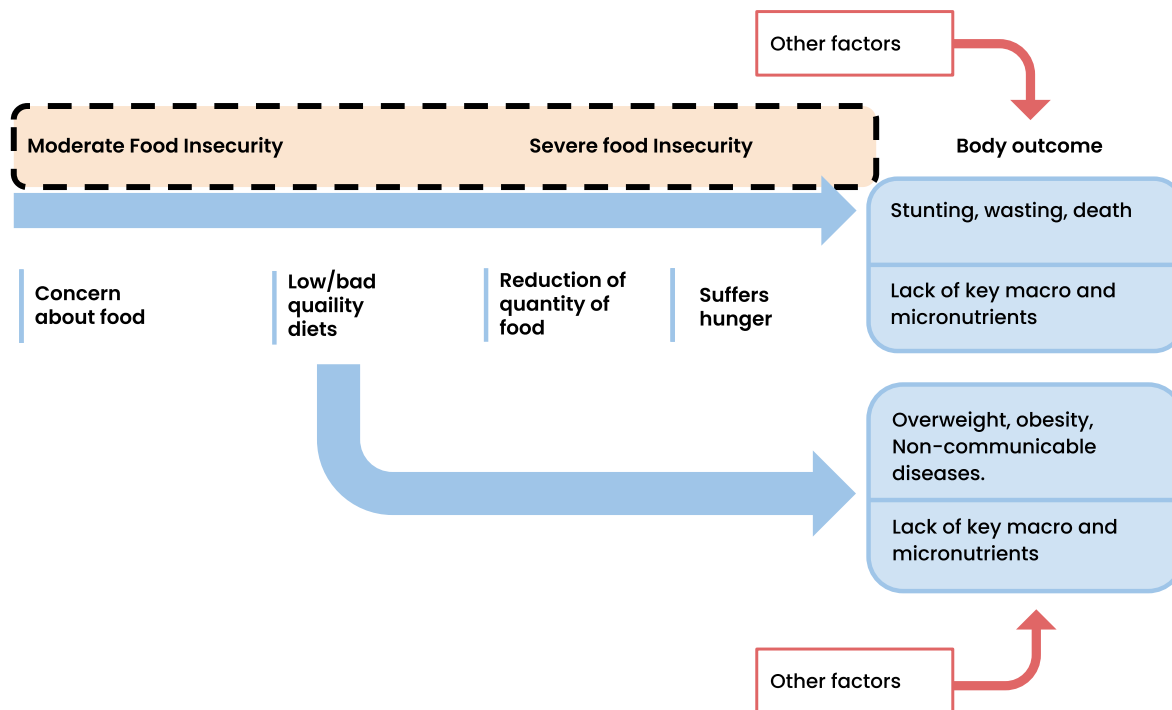
Source: Created by the author

Figure 8 compares LAC with the world and other regions. For this indicator, there is no disaggregation between developed countries and developing countries as in indicator 2.1.1 shown in Figure 5. In the case of Africa, the data is also shown separately for the Sub-Saharan Africa subgroup.

Figure 8. Prevalence of food insecurity (in percentages) (2019-2021).
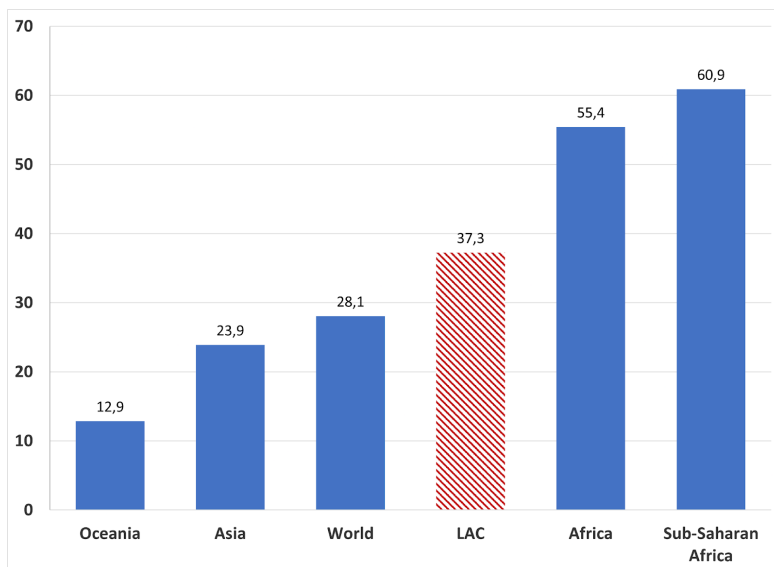
Source: Created with information from the FAOSTAT database (2022).

While with the hunger indicator (2.1.1.) LAC appeared in a better situation than the developing regions and even than the global average, its food insecurity indicator is worse than in all the regions except Africa. This raises the question of whether a region with less incidence of hunger than other parts of the developing world can at the same time suffer more food insecurity than the same comparators.

As this indicator also includes separately the estimate of severe food insecurity, this question can be analyzed by comparing this indicator with that of hunger (2.1.1), considering that both should be related (FAO et al., 2022). The argument is that if someone experiences severe food insecurity, this also means they will have difficulties in acquiring the necessary foods to cover their energy needs; that is, they would suffer from undernutrition or hunger. Figure 9 presents the case of LAC, the world and other regions for the severe food insecurity indicator.

Figure 9. Prevalence of severe food insecurity in percentages (2019–2021).

Region	Value
Oceania	3,6
Asia	9,5
World	10,6
LAC	12,3
Africa	22,0
Sub-Saharan Africa	24,8
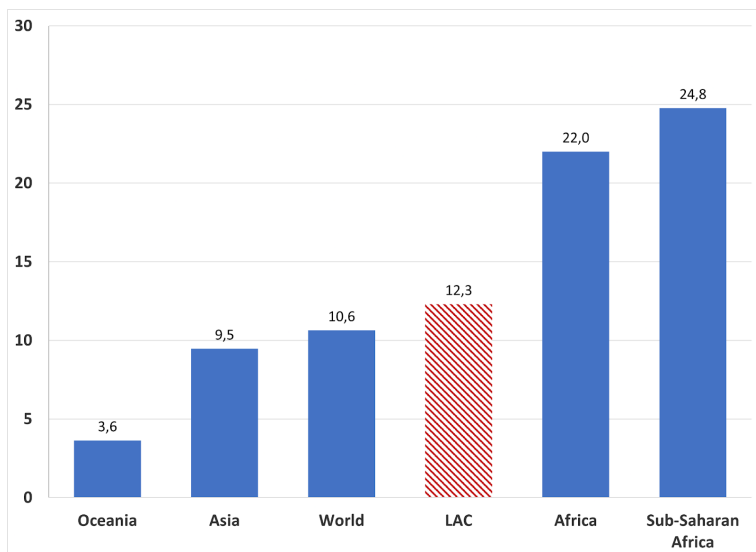
Source: Created with information from the FAOSTAT database (2022).

Once again LAC is more severely food insecure than the world and other continents, except Africa. So while with the hunger indicator (2.1.1) LAC appears to be in a better situation than the global average and other developing regions, with the severe food insecurity indicator (a component of 2.1.2 that should be aligned with 2.1.1) it appears in a worse situation. Disaggregating the data, indicator 2.1.1 places above the global hunger average only 26 percent of the countries in the region with estimates,[17] while the severe food insecurity indicator classifies 40 percent of the countries of LAC as being above the global average. One of the possible reasons for this discrepancy is the weight of China in the

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[17] It should be noted that the number of countries in LAC with data published in FAOSTAT differs by indicator: 27 countries for indicator 2.1.1 (hunger) and 20 countries in the case of severe food insecurity. The Bahamas and Grenada have data on severe insecurity, but not hunger, and Bolivia, Colombia, Dominica, Guyana, Nicaragua, Panama, the Dominican Republic, Saint Vincent and the Grenadines and Venezuela have data on hunger but not food insecurity. It appears that not all countries agree to have their hunger and food insecurity data published. Therefore, the comments in the text are based on published data and will have to be adjusted when all existing information can be accessed. Annex G presents information more disaggregated by countries.

totals: because the country has very low levels of severe food insecurity, the average values for Asia and the world are reduced.[18]

Furthermore, the percentages of people affected by severe food insecurity in LAC tend to be higher than those shown by the hunger indicator. Although this also occurs in Africa and Asia since 2018 (Figure 10 with the quotient between both indicators), the difference between the percentage of undernutrition and hunger estimated with indicator 2.1.1 and that calculated with the experience indicator (the severe food insecurity component of 2.1.2) is higher in LAC than in other developing regions.

Figure 10. Percentage of severe food insecurity divided by hunger percentage.
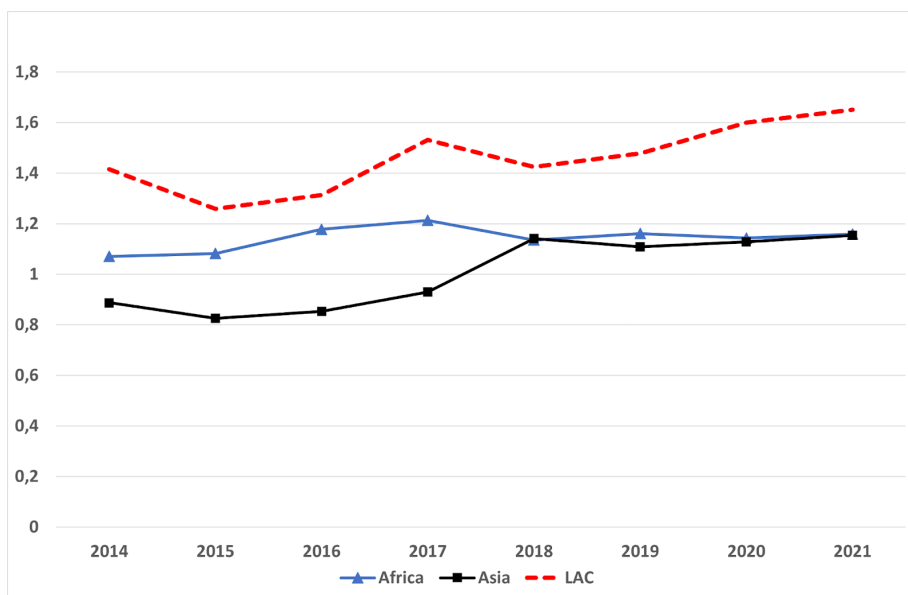
Source: Created with information from the FAOSTAT database (2022).

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[18] The author wants to thank Máximo Torero's comments and data, which indicates that using the years prior to the pandemic (2017-2019) and excluding China, LAC shows 9.7 percent severe food insecurity, while the values for Asia and the world without China are 10.3 and 10.5 percent respectively. That is, excluding China and considering the period before the pandemic, LAC again had less food insecurity than the average of other developing regions and the world.

This difference remains using data for individual countries[19] instead of aggregate numbers: taking the average of both indicators for the period 2014-2020, the severe food insecurity indicator suggests an incidence of hunger in the average of LAC countries (18 countries with public data for this period), 48 percent greater than that calculated by indicator 2.1.1., compared with a difference of 21 percent in the case of the rest of the developing countries (a total of 74 countries with data). The correlation between both indicators is also different: 0.856 in the case of the rest of the developing countries, but only 0.427 for LAC (excluding Haiti).[20]

As can be seen in Figure 10, the gap between both indicators appears to widen during the period 2019-2021 compared to other regions: in LAC the difference in the countries with data for both indicators suggests that approximately 58 percent more of the population suffered severe food insecurity than those that suffered hunger (indicator 2.1.1.) This increase may be due to the impact of the COVID-19 pandemic, which was more negative in LAC (in terms of health and the economy) than in the rest of the developing regions (Díaz-Bonilla et al. 2021) and the experiential indicator may be capturing in "real" time problems that do not yet appear in other indicators.[21]

In any case, the differences in the case of LAC of both indicators require greater analysis. Additional considerations on this issue are discussed below and especially in Annex F.

3) Monetary indicators

This group briefly considers two indicators: one that uses the cost of a healthy diet and one that uses poverty thresholds. Both apply a similar idea: a certain amount of money is needed to buy the necessary foods. Household surveys

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[19] These are based on FAOSTAT public data, which may be a subgroup of the existing data of the countries. The comments in the text may change with the complete data.

[20] Both indicators also have a different classification of individual countries in LAC regarding the severity of the problem reflected (hunger or severe food insecurity).

[21] Thanks once again to Máximo Torero for this observation.

allow us to determine the percentage of the population that does not have that minimum income and, therefore, may suffer in some way from food insecurity. One difference between both indicators is the definition of the food consumption basket used as reference (see Annex H with some additional comments on methodologies).

3.1 Healthy diet[22]

A healthy diet is one that ensures the adequate consumption of calories and, additionally, it provides the necessary levels of essential nutrients for a healthy life. Figure 11 shows that this indicator is in the area of "low/poor diet quality" (circle with dotted line).

Figure 11. Healthy diet indicator.
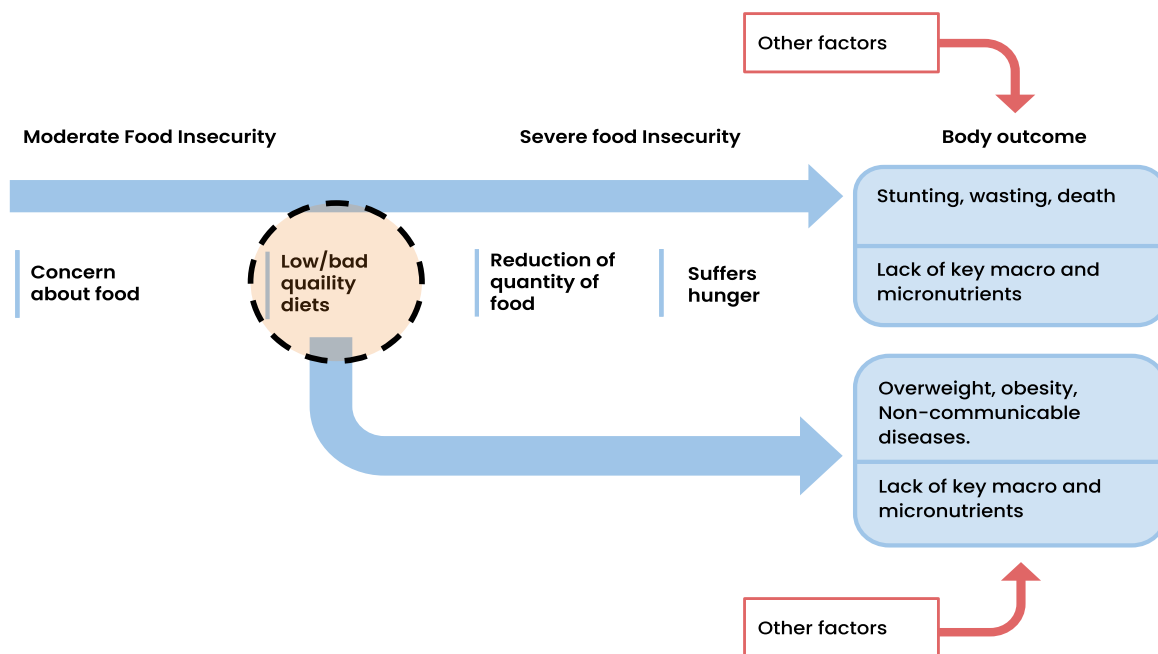
Source: Created by the author.

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[22] The detailed methodology is in Herforth, Venkat, et al. (2022). See also the "Annex 3 Updated Data Series of The Cost and Affordability of a Healthy Diet, 2017–2020" (FAO et al. 2022).

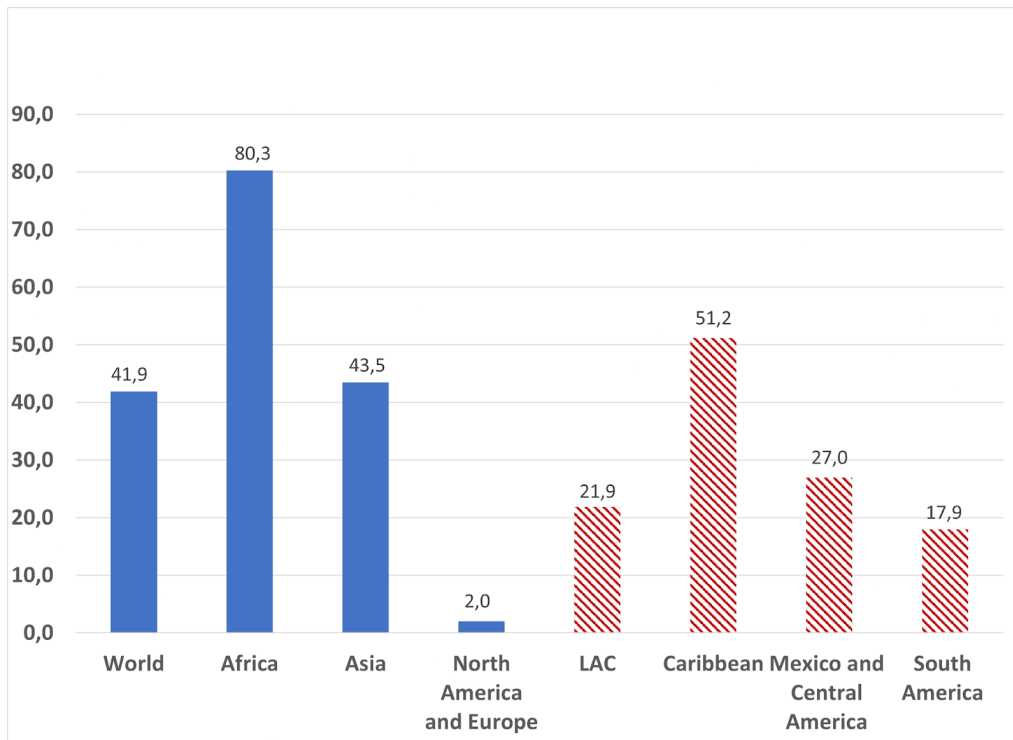Figure 12 shows the data estimated in FAO et al. (2022) (Annex 3, table A3.1 of that publication), as an average for the period 2017-2020. The information divides LAC into three regions: Mexico and Central America, the Caribbean and South America.

Figure 12. Population that cannot access a healthy diet, in percentages (2017-2020).

Source: Created by author with data from FAO et al. 2022.

In LAC, almost 22 percent of the population is estimated to lack sufficient income to access a healthy diet. As in the case of the undernutrition or hunger indicator (2.1.1.), but unlike the food security indicator (2.1.2), the region is better off than the world and other developing regions. Nonetheless, important differences can be seen within LAC: in the Caribbean, influenced especially by Haiti, over half the population cannot access a healthy diet, an alarming percentage that is even higher than the global average and Asia. The other two subregions of LAC are in better conditions than the rest of developing groups and continents (although they show worse indicators than the developed

countries of North America and Europe). But it is also worrying that between a fifth and a quarter of the population cannot access a healthy diet.

Annex I shows data more disaggregated by countries.

3.2. Poverty threshold

It is accepted that poverty is a leading cause of hunger and food insecurity. Therefore, another indicator may be the percentage and number of poor. For this it is necessary to define in each country: a) a minimum consumption basket of basic goods to avoid being poor; b) calculate its cost; and c) compare with the income distribution to see what percentage of the population does not have the money necessary to buy this consumption basket (see annex H with some additional methodological considerations).

In many cases, the calculations begin with the food basket that provides the minimum energy to live and then a further cost margin is added for the consumption of basic non-food items that are considered necessary to avoid being poor. This leads to two poverty thresholds: extreme poverty or indigence (which only considers the food basket for a minimum calorie consumption) and total poverty (which includes food and non-food consumption items that are considered necessary to avoid poverty).

Thus, the threshold of indigence or extreme poverty can be another way to calculate the incidence of hunger, as well as indicator 2.1.1 discussed above. However, those indicators do not always have similar levels and trends because there are methodological and data collection differences between them (Annex H).

As suggested above, the poverty thresholds (extreme or total) are also differentiated from the indicator of the cost of healthy diets discussed above, because the consumption basket for the former is defined based on what is effectively being consumed in each country, while the food basket for a healthy diet is a normative definition of what should be consumed.

Another issue to highlight is that the national poverty thresholds, being a sovereign political-ethical definition by each country, can differ from each other

considerably; therefore, the percentage of poor in different countries cannot be compared based on the national thresholds. The World Bank seeks to homogenize the poverty lines so that they can be comparable between countries, using Purchasing Power Parity (PPP) (which equates in a common monetary measure prices of similar goods and services). The values of the three poverty lines that the World Bank calculates were recently updated to reflect 2017 prices (the previous ones used 2011 data). The new global poverty lines are 2.15[23] dollars PPP/person/day, 3.65 dollars PPP/person/day and 6.85 dollars PPP/person/day. It is considered that each of those thresholds reflects, respectively, the national poverty lines of countries with low, medium-low and medium-high incomes. These are total poverty lines for each group of countries, without any of them being characterized as a threshold of extreme poverty or indigence. However, in the case of LAC countries, which generally are in the medium-income category, it could be argued that the international threshold of 2.15 is an approximation to the extreme poverty line and, consequently, the percentage and number of people with hunger.

The position of this indicator in Figure 3 depends on whether it is the total poverty line (which would be positioned close to the conditions marked as "low/poor quality diet") or the indigence or extreme poverty line (which would be marked as "reduced quantity" or directly hunger). This is shown with the oval figure in dotted lines in Figure 13.

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[23] This threshold is the update adjusted for inflation of the well-known threshold of the 1990s of one dollar/person/day.

Figure 13. Indicators with poverty threshold.
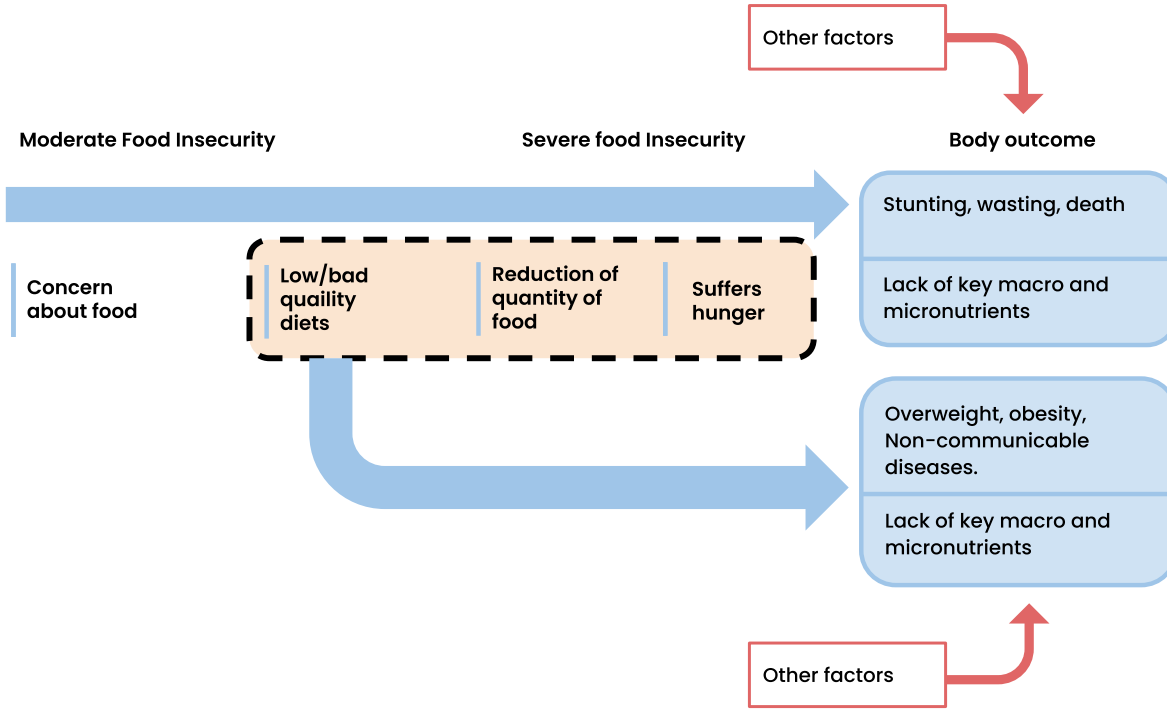
Source: Created by the author.

Figure 14 compares LAC with other regions[24] using the thresholds of 2.15 and 6.85 dollars PPP/person/day. The lowest, as mentioned above, can be used as an approximation of the percentage of people who suffer hunger and the highest can give an idea of the people who cannot afford a healthy diet (comparing the average cost of healthy diets[25] with the percentage of the income of 6.85 dollars PPP/person/day that would apply to buy foods; see more details in Annex H.)

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[24] Note that the classification of the regions and the availability of information in the World Bank database is different from the data that FAO et al. (2022) shows.

[25] The data can be seen in Annex 3, table A3.1 of FAO et al. (2022).

Figure 14. Poverty at 2.15 PPP and 6.85 dollars/person/day, in percentages, (2018 and 2019).
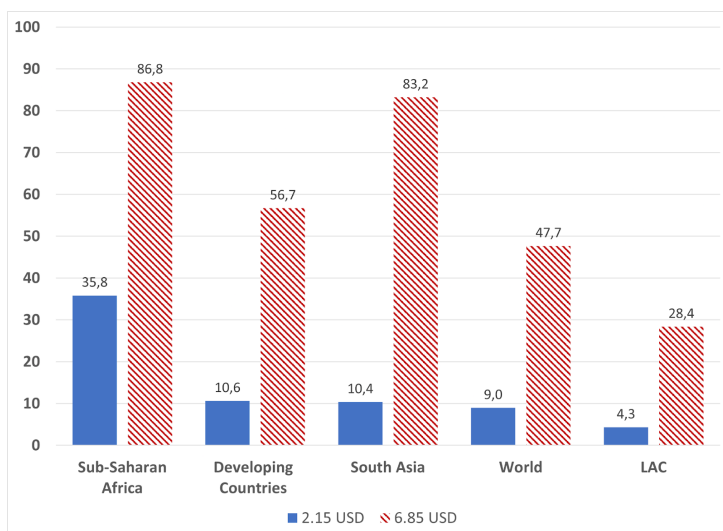
Source: Created by the author with World Bank (2022) data.

Two observations can be made here:

- The percentage of poor with the threshold of 2.15 (4.3 percent) is three percentage points <u>below</u> the hunger indicator 2.1.1 (7.8 percent) and the poverty indicator at 6.85 (28.4 percent) is six percentage points <u>above</u> the percentage of people who it is estimated could not afford a healthy diet (21.9 percent); that is, the lowest and highest poverty thresholds calculated by the World Bank appear to bracket from below the percentage of people with hunger in LAC and from above the percentage of people who cannot afford a healthy diet.
- In line with the indicators of hunger (2.1.1) and cost of healthy diets, LAC appears with better indicators in relation to poverty than the global average and developing regions for which there is information, unlike the food insecurity indicator (2.1.2).

Annex I includes information more disaggregated by countries.

3.3. Comparison between healthy diets and total food insecurity

The incidence of <u>severe</u> food insecurity was compared above with the estimated percentage of the population with hunger and it was shown that, in general, the former is above the latter and that this discrepancy is especially marked for LAC. Here the analysis is expanded to the indicator for <u>total</u> food insecurity (2.1.2). Figure 15 shows the coefficient of the division between the percentage of the population that cannot afford a healthy diet and the percentage that suffers total food insecurity. The expectation is that this coefficient should be greater than 1, as the percentage of people who do not have sufficient income to afford a healthy diet should be <u>greater</u> than that of the population that suffers food insecurity. In other words, if a person suffers food insecurity, they cannot afford a healthy diet, but if someone has the resources to buy a healthy diet, it seems less likely that they will suffer food insecurity.

Figure 15. Relation between the percentage that cannot afford a healthy diet and the percentage considered as food insecure (average 2017-2020).
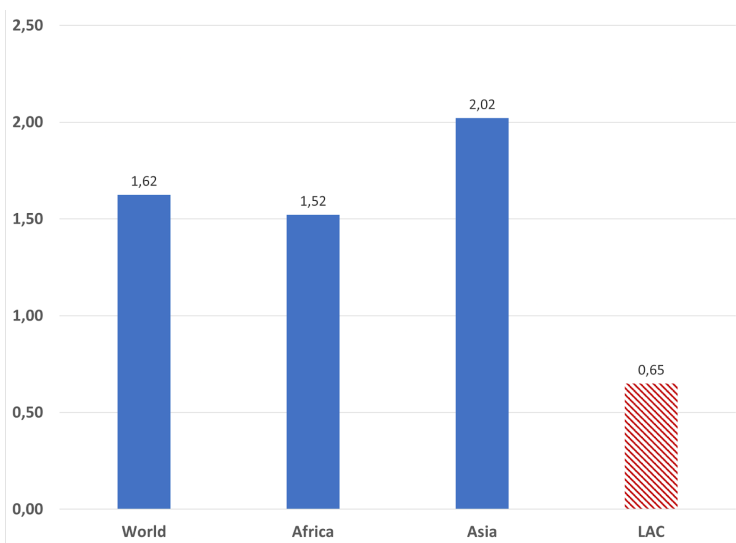
Source: Created based on data from FAO *et. al* (2022).

It is clear that the relationship between both indicators is very different in LAC from the other regions and the world. In the latter, the coefficient is greater than

1 (as expected), with a percentage of people who cannot afford a healthy diet between 50 percent and 100 percent above the percentage with food insecurity. But LAC shows the opposite of what happens at the global average and the two continents shown: the coefficient is 0.65, which suggests that in LAC people who may have sufficient income to afford a healthy diet are nonetheless suffering from food insecurity. This needs to be analyzed more closely (some further considerations are in Annex F).

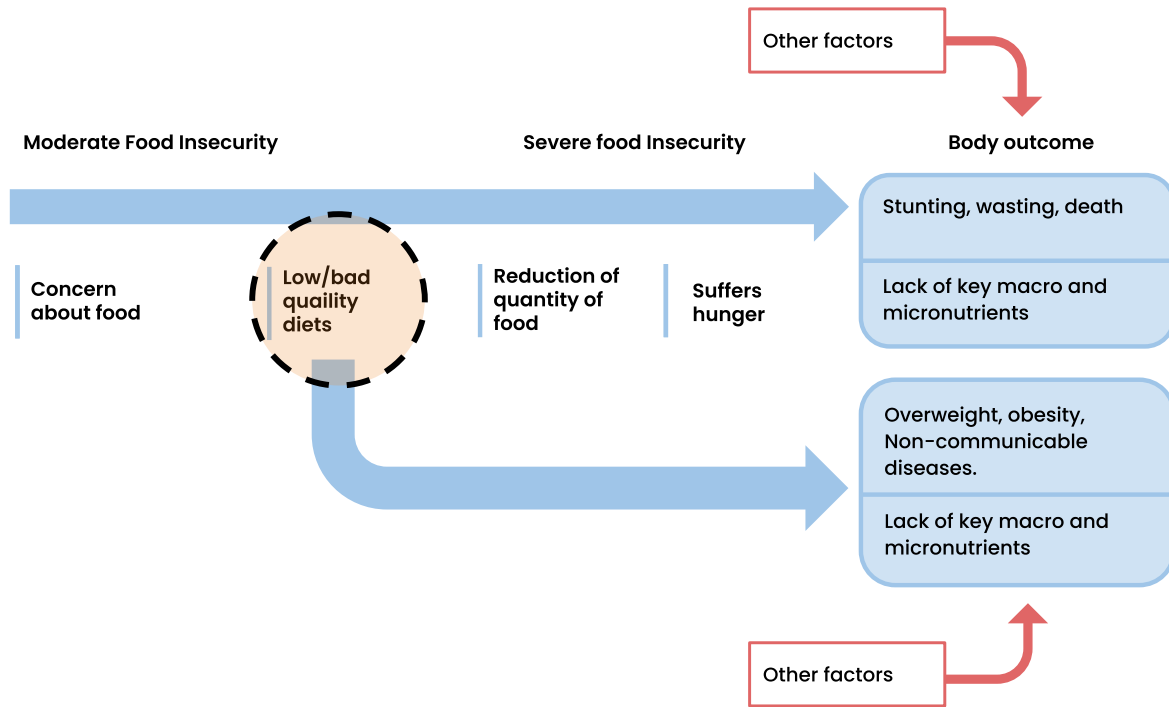### 4) Indicators of dietary diversity

The indicators of dietary diversity can be considered at different levels. One level to consider production of regions or countries (Remans et al. 2014). Another level of analysis is the specific diet in the case of families or individuals. This section focuses on this second type of indicator.

Dietary diversity has been associated with better nutrition results when these are evaluated with anthropometric measurements, such as indicators of stunting, wasting and similar problems (Arimond and Ruel 2006). This is because dietary diversity appears to capture not only the adequate consumption of calories, but also a better intake of macro- and micronutrients. Also, the theory of demand suggests that people diversify their consumption of foods toward products of greater value and richer in nutrients (such as meat, fish, eggs, dairy products, fruits and vegetables) once they have met their basic calorie needs (Headey and Ecker 2013).

Therefore, a FNS approach that emphasizes only a small number of basic food products that are considered important because of their calorie content may be too limited. This is so not only because nutritional improvements in the population come from diversity in food (with a broad variety of sources for the requirements of calories, proteins, minerals and vitamins), but also considering that in terms of generation of income and rural jobs, it is preferable to have more diversified production and employment opportunities and not limit policies or programs to promoting only a few basic food products.

Considering Figure 3, this indicator would be located in the area marked by the oval figure with dotted lines in Figure 16

Figure 16. Indicators of dietary diversity.

Source: Created by the author.

There are no indicators of dietary diversity for all the population comparable with the indicators discussed in the previous sections. The database with the most coverage is for infants (between 6 and 23 months old). Figure 17 shows the indicator of Minimum Dietary Diversity (MDD) for this population group. As explained in more detail in Annex J, these indicators consider the number of food groups consumed by those surveyed. In this case, Figure 17 shows the percentage of children from 6 to 23 months of age who, in the day prior to the survey, consumed food and drinks from at least five of the eight defined food groups.[26] Figure 17 includes two additional indicators: the percentage of infants who consumed eggs and meat and the percentage of infants who did not consume fruits and vegetables (F&V). Obviously, for the first two indicators, a

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[26] The eight food groups are: a) breast milk; b) grains, roots, tubers and plantains; c) pulses (beans, peas, lentils), nuts and seeds; d) dairy products (infant formula, milk, yogurt, cheese); flesh foods (meat, fish, poultry, organ meats); f) eggs; g) vitamin A-rich fruits and vegetables; h) other fruits and vegetables.

greater percentage is better, while for zero consumption of F&V a lower percentage is better.[27]

Figure 17. Diets of infants from 6 to 23 months (in percentages).
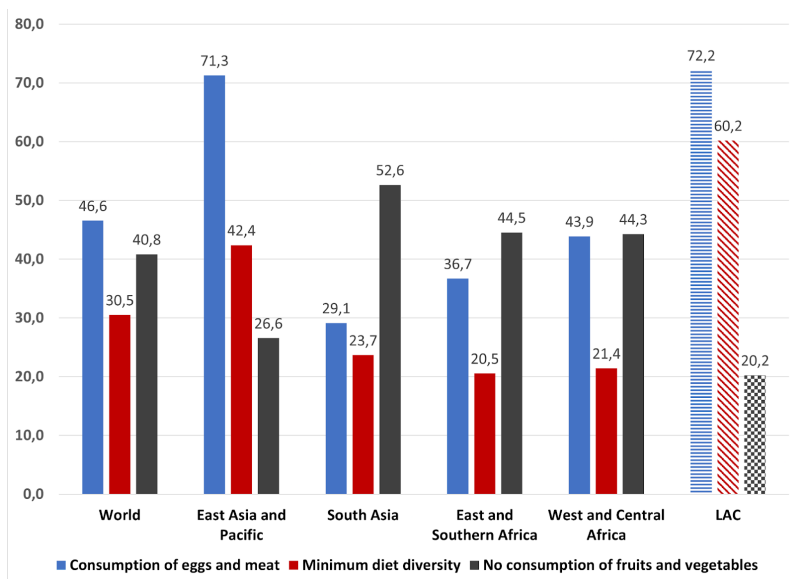
Source: Created by the author with information from UNICEF databases (2022)

As in other indicators, but not in 2.1.2 for food insecurity, LAC appears better positioned than other developing regions and the global average. However, it is extremely worrying that 20 percent of infants do not consume any F&V, almost 28 percent do not consume eggs and meat, and 40 percent do not have the minimum dietary diversity.

5) Anthropometric indicators

Anthropometric measures are the result of a variety of factors that usually go beyond the notion of "food security." Therefore, some believe that they should not be part of food insecurity analyses. However, the health and nutrition

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[27] Annex K analyzes other indicators that can be considered as approximations of dietary diversity, such as the percentage of calories that come from cereals and tubers. It is assumed that the higher this percentage, the less diversified and therefore worse the diet is. The percentage of proteins of animal origin consumed is also analyzed. In general, a greater percentage should imply a better diet.

situation of the country's inhabitants (reflected in biological and anthropometric data) is a principal concern of public policies and has an important component related to the foods consumed. Therefore, anthropometric indicators are also considered here.

These are based on weight and height measurements or the presence of certain minerals in the body (such as iron, zinc and others) or certain vitamins (such as A, B, D, and others). Much of this data is gathered at health centers and schools, but is also the result of estimates based on a certain number of those effective observations that are then extrapolated with econometric techniques (FAO et al. 2022). The FAOSTAT database is the most complete, but it does not cover all the years. Consequently, in the graphs presented below, averages from several years are used. More continuous and standardized work is required to gather this type of information, especially in relation to simple variables such as weight, height, and age.

These variables make it possible to construct the indicators for SDG 2.2 which seeks to "end all forms of malnutrition, including by no later than 2025 achieving targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons." The indicators mentioned in SDG 2 are:

*2.2.1 "Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age;" and

*2.2.2 "Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)."

So there are three indicators related to children under 5 years of age: 2.2.1 (stunting); 2.2.2a (wasting); and 2.2.2b (overweight). It is considered that stunting is associated with chronic or recurring undernutrition while wasting is the result of acute undernutrition.

Of the indicators mentioned officially in the SDG document, there is not one for overweight or obesity in adults, although SDG 2.2 mentions the need to "end all forms of malnutrition…" Here indicators for overweight and obesity are also presented, considering the increasing presence of those problems in the world and in LAC.[28]

In relation to Figure 3, these indicators are located in the area marked by the oval with dotted lines (Figure 18).

Figure 18. Anthropometric indicators.
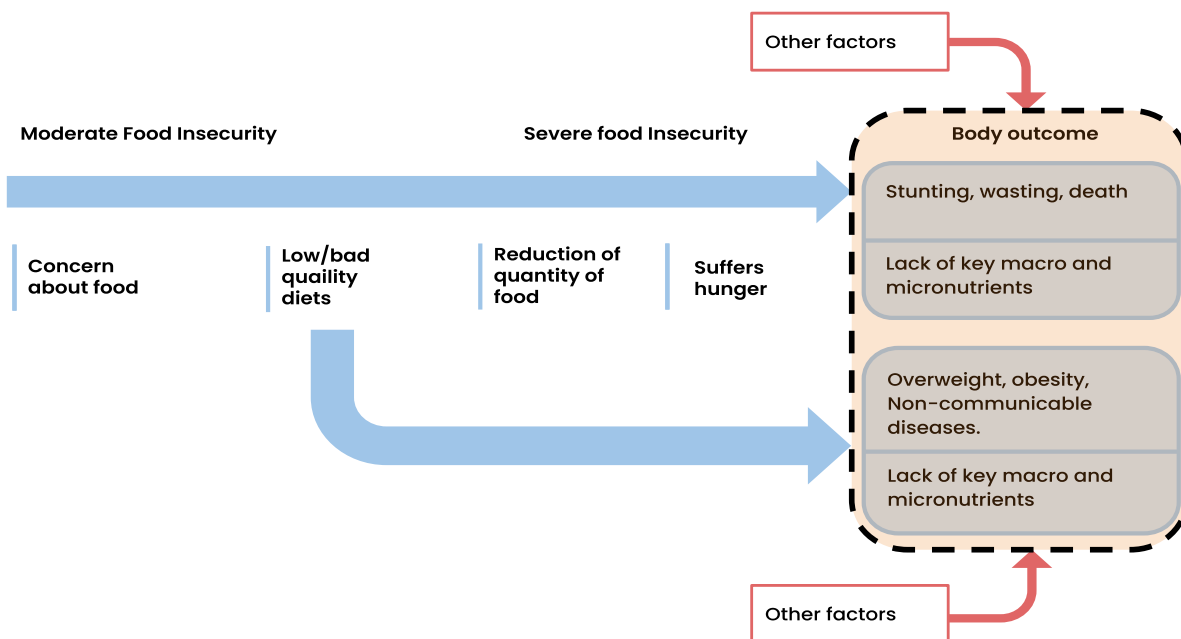
Source: Created by the author.

Figure 19 shows the situation of LAC (and the three subregions that FAOSTAT uses) regarding stunting in children under 5 years of age, compared with other regions and income groups in the world.

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[28] There are two additional anthropometric indicators that are part of the goals defined in the Comprehensive Implementation Plan on Maternal, Infant and Young Child Nutrition during the 65th World Health Assembly (WHA) in May 2012: reduce anemia among women of reproductive age (for which data is presented in Annex L) and reduce low birth weight (which is not discussed in this document).

Figure 19. Stunting, in percentages (2015–2020).
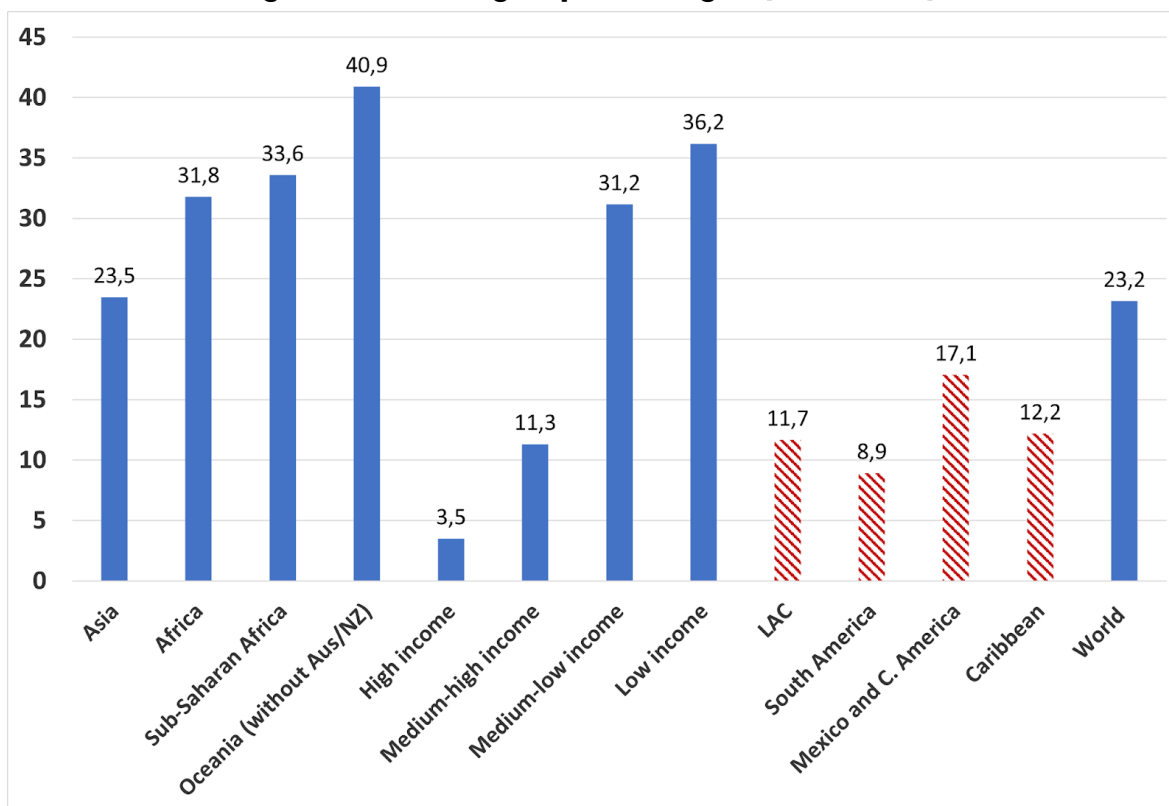
Source: Created with FAOSTAT database (2022).

The percentage of children with stunted growth in LAC (11.7 percent) is lower than the global average (23.2 percent) and is generally below other regions and groups of developing countries. The most affected subregion is Mexico and Central America.

Figure 20 shows the percentage of children under 5 years of age suffering from wasting (which, as mentioned above, reflects acute hunger) in LAC in comparison with other groups of countries.

Figure 20. Wasting, in percentages (2015–2020).
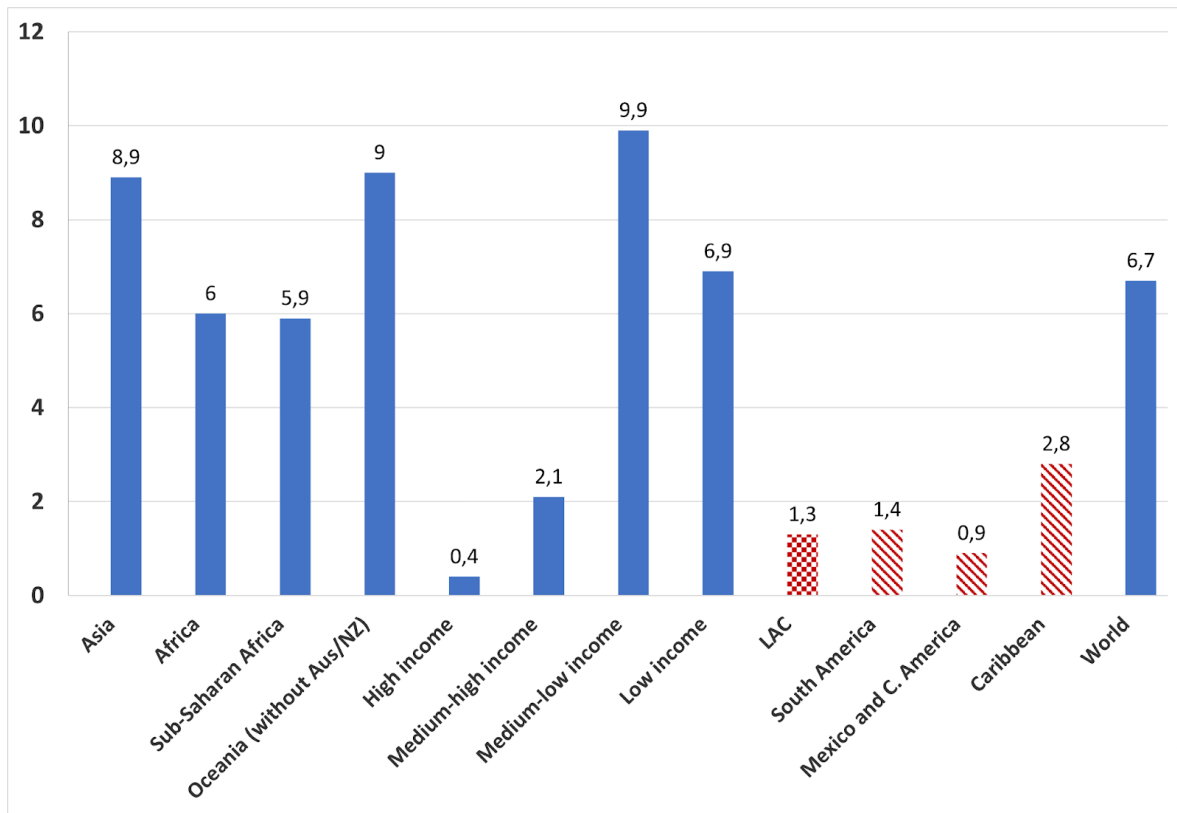
Source: Created with FAOSTAT database (2022).

LAC is clearly below the global average and the conditions of other developing areas. The Caribbean is the subregion within LAC with the worst indicators, although the incidence of wasting is about 60 percent below the global average.

On the whole, a more frequent and consistent collection of anthropometric data is needed for deeper analysis.

While the above problems of malnutrition are related to undernourishment, Figure 21 shows problems of overnutrition, using indicators of overweight of children under 5 years of age.[29]

Figure 21. Overweight, in percentages (2015-2020).
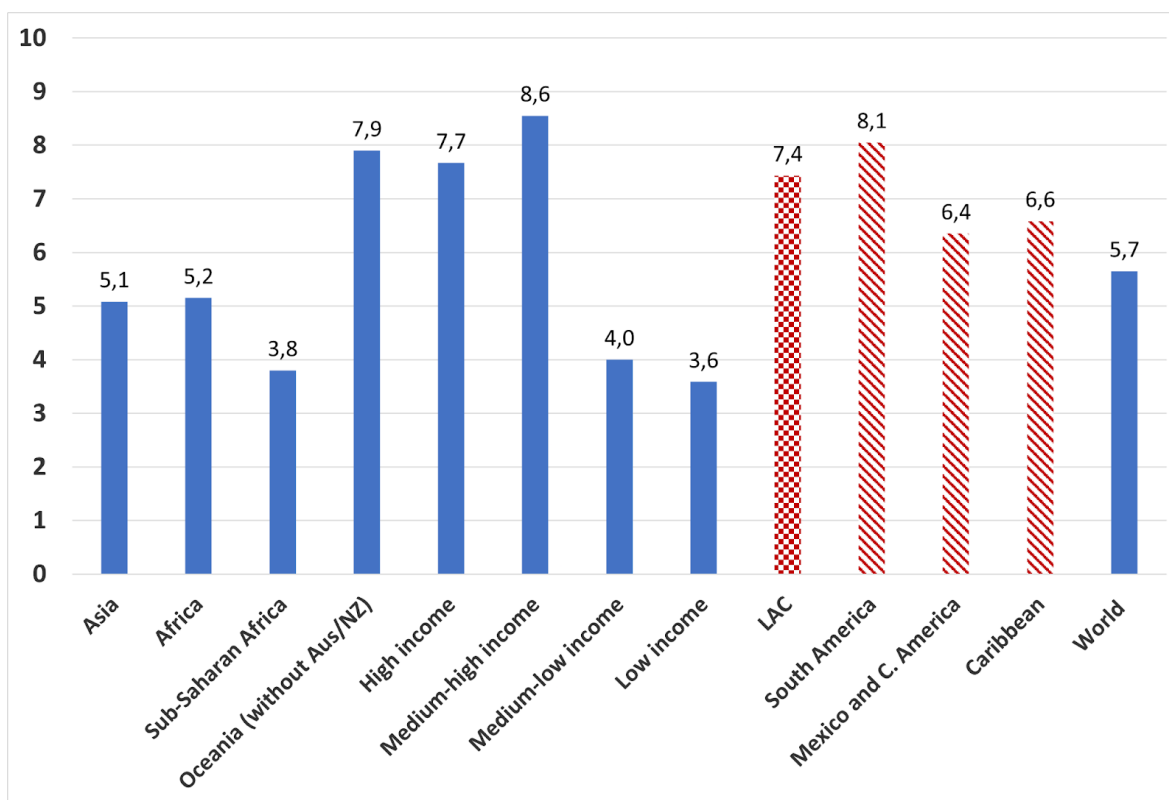
Source: Created with FAOSTAT database (2022).

LAC has greater child overweight problems than the global average and many regions of developing countries, especially in the case of South America. Overweight in children means that major health problems will appear in the future for the affected population.

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[29] In the case of children under 5, overweight refers to weight-for-height greater than 2 standard deviations above WHO Child Growth Standards median; and obesity is weight-for-height greater than 3 standard deviations above the WHO Child Growth Standards median.

The issue of adult obesity, as mentioned above, does not appear with quantitative goals in the SDGs, but the problem is explicitly mentioned among the goals approved for the Assembly of the World Health Organization as part of its "Global Action Plan for the Prevention and Control of Noncommunicable Diseases" (NCD) in 2013 (WHO 2013) and other conferences on nutrition. The seventh goal is that there should be no more growth in the percentage of obese people. However, this malnutrition problem continues to grow and this trend must be reversed. The FAOSTAT database includes the percentage and number of adults (over 18) who are obese.[30] As mentioned above, many of these anthropometric indicators are based on some observations and physical measurements that are then extrapolated with econometric methodologies (in Díaz-Bonilla and Paz (2019) there is more information about sources of obesity data.)

Figure 22 shows the percentages of obesity for LAC, divided again into the three regions used by the FAO, compared with the world and different groups of developed and undeveloped countries.

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[30] Obesity is defined using the Body Mass Index (BMI) which is calculated as a person's weight in kilograms divided by the square of their height in meters (kg/m^2). Overweight applies to the case of persons who have a BMI greater than or equal to 25 kg/m^2, but less than 30 kg/m^2. Obesity applies to a person who has a BMI equal to or greater than 30 kg/m^2.

Figure 22. Percentage of obesity in adults aged 18 or over (2015-2016)
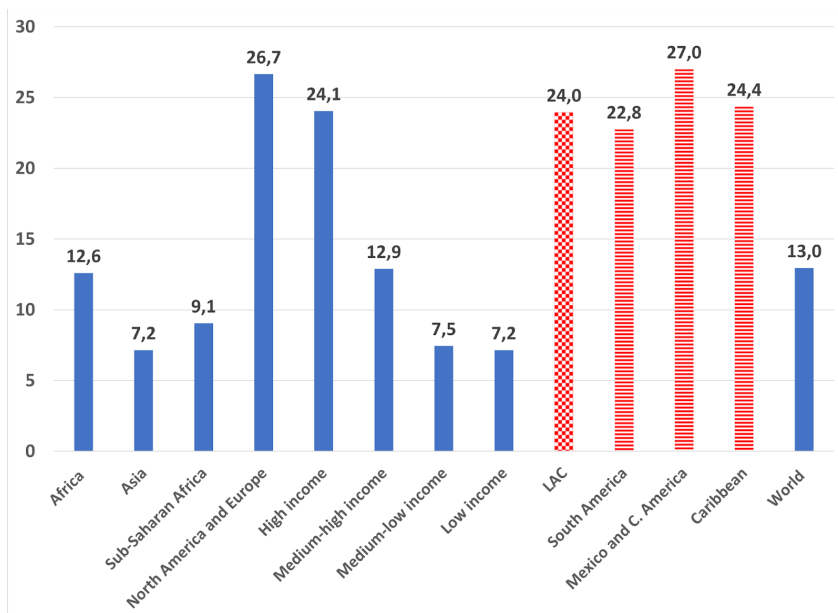
Source: Created with FAOSTAT database (2022).

LAC shows worse indicators than the global average and the areas and groups of developing countries. Only the developed countries of North America and Europe have worse obesity indicators than LAC as a whole. In particular, the area of Mexico and Central America (influenced by Mexico) is almost twice the global average and is slightly higher than the region of North America and Europe.

The issue of obesity has become the main malnutrition problem in LAC, with an obesity average (24 percent of the population) that clearly exceeds the percentage suffering from undernutrition (hunger): 7.8 percent on average in recent years, although lately this has risen to around 9 percent. Malnutrition and health problems associated with obesity, as well as the negative impact on productivity at work and psychological well being, are particularly urgent in the 12 countries of LAC (of the 32 with data) that have between a quarter and a third of their population affected by this problem (see Annex L for more data disaggregated by country).

D. Some final reflections

This document has analyzed the recent history of the evolution of the FNS concept and its measurement in the previous sections and there are a number of annexes with further details for those who wish to explore these topics in greater depth. The document is part of IICA's work in support of the countries of the Americas for the design and implementation of national programs to address hunger and malnutrition in their population, and to attain food and nutrition security. In turn, these programs are a central component of more general public plans and policies to strengthen and improve food systems, all of which is necessary to achieve the SDGs and Paris Agreement targets.

The document first analyzed the history of the FNS concept and showed that it covers numerous dimensions. Consequently, there are many potential indicators for measuring it. Those indicators may focus on inputs, political processes, drivers, structural conditioners, food value chains, consumer environments, and results of different types. It was also mentioned that the indicators can operate at different levels, from global to individual.

This document has focused on results, with the main text dedicated basically to indicators of this type that are applied to individuals, while Annex C analyzes other more global indicators, which usually regain notoriety in times of global crises affecting production and prices.

In particular, this document has sought to clarify how to measure the public policy target of "eradicating food and nutrition security" at the level of individuals. As this document argues, to define plans, policies, programs and strategies it is necessary to have a clear idea of what is the problem that must be addressed. This leads to questions about the most suitable indicators to measure the extent of the problem and monitor progress, until it can be said that the problem has been "solved." With this in mind, five types of indicators at individual level were analyzed (calories, experiential, income and costs, dietary diversity, and anthropometric indicators).

The following conclusions and considerations may help countries in preparing national programs to attain FNS. These considerations are mainly focused on the design of programs that address more permanent conditions of food and nutrition insecurity, as different from the attention of humanitarian emergencies.[31]

1) What is the problem to be resolved?

The first point is to define the problems to be solved in LAC countries. Indicators show at least four issues to consider: hunger, healthy diets/dietary diversity, obesity and food insecurity.

One basic problem that has always concerned humanity is <u>hunger</u> (or calorie deficiency). The text analyzed the indicator of malnutrition due to calorie deficiency (SDG 2.1.1), but also others related to hunger, such as extreme poverty (monetary indicator), wasting and stunting in children up to 5 years of age (anthropometric indicators) and the incidence of severe food insecurity (experiential indicator). Ideally, the countries should use indicator 2.1.1 to measure the problem and its trends and complete the analysis with other indicators. For example, the poverty indicator of 2.15 dollars PPP could be the lower limit of incidence of hunger, and the indicator of severe food insecurity, which tends to suggest a greater incidence of hunger than other indicators, could function as an upper limit.

Another public policy concern is the consumption of <u>healthy diets</u>, considering the multiple positive effects they have on human health and bodily and intellectual development. The text analyzed two monetary indicators that define potential economic access to such diets: the cost of the healthy diet and the poverty threshold of 6.85 PPP dollars/capita/day (the latter because there is an

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[31] Ideally, permanent programs must consider components that can be expanded in the event of emergencies, instead of having separate systems, as occurs in many cases in LAC. Both for the execution of permanent national programs and to operate in the event of emergencies, the dietary diversity and experiential indicators discussed in the text are very useful due to the greater ease and flexibility of application of the corresponding surveys. These indicators can be combined in more complex statistical analyses to design interventions according to a typology of problems and/or families (see, for example, Vaitla et al., 2017).

alignment between the average cost of healthy diets and the estimated percentage of the value of that poverty threshold that is allocated to food).

However, having the economic resources to afford a healthy diet does not necessarily imply that such a diet is bought and consumed. Therefore, the text also discussed indicators of diversity of the diets effectively consumed. It was argued that such diversity is associated with better nutritional results, as this appears to capture not only the consumption of calories, but also a better consumption of macro- and micronutrients associated with a healthy diet. Unfortunately, there are no databases on the diversity of diets consumed with a broad coverage of countries (as is the case with other indicators). The greatest coverage of data on the diversity of diets consumed is for infants (6-23 months), an indicator that is analyzed in the respective section.

There is more data on the average consumption of certain products and of other average indicators of dietary diversity, such as the percentage of calories from cereals and tubers or the percentage of consumption of proteins of animal origin (see these indicators in Annex K). However, this is data aggregated by country on the production side, which allows comparisons at this level, but does not offer information on the specific distribution of consumption across families or individuals.

Countries could use the monetary indicators to measure the problem, but more direct information would be needed on dietary diversity to better design and focalize the interventions. Nonetheless, the indicators related to the production or availability of specific food products are useful to define programs to increase and diversify supply. These indicators are not analyzed in the main text, but there are examples in Annex K (with fruits, pulses and vegetables). Other anthropometric indicators (such as anemia, deficiency of certain vitamins and minerals) can be used to guide both productive programs and interventions for the fortification of foods, and consumer information and education. For example, Annex L provides data on anemia in women of reproductive age.

Another nutritional problem is related to <u>overweight and obesity</u>, which is increasing in LAC and the world. The text analyzed two anthropometric

indicators related to these problems: overweight in children up to 5 years of age (which is part of SDG 2.2.2) and obesity in adults. The indicators for both age groups show that in various countries of LAC the problems of overweight and obesity affect a greater percentage of people than hunger.

In general, countries need information on the incidence of obesity and the different nutritional needs of special groups, such as women of reproductive age and pregnant women, children under 5 years of age, children of school age and adolescents, adult population and indigenous groups and other ethnic groups. A deeper analysis should consider whether the diet-nutrition-health relationship differs by socioeconomic level (SEL) (measured from income, wealth or assets, education and other indicators), gender, race/ethnic origin and rural-urban characteristics. In general, the available data suggest that the problem of obesity in LAC appears to be more typical of urban areas than rural ones, and affects women more than men. In turn, the relationship with SEL indicators (such as income) is not linear: the existing information indicates that, in general, the lowest levels have a lower incidence of obesity, which then increases in the middle-income groups, and decreases again with high-income groups (the latter may be due, among other factors, to more information about, and better economic access, to healthier diets) (Díaz-Bonilla et al., 2018)

Lastly, the problem of food insecurity in the SDGs is addressed by using experiential surveys (SDG 2.1.2). As mentioned, this indicator is specifically mentioned by the SDGs and is also one of those more cited in the press (along with 2.1.1). The text analyzed the differences in the case of LAC between this indicator and the others revised here, which may reflect underlying characteristics that differ from other regions.[32] Consequently, it is important to

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[32] As well as the general impact of the COVID-19 pandemic and the weight of China in other aggregates (as mentioned above), there may be other reasons for the differences between the experiential indicator and the other indicators. Annex F discusses other possible explanations, related to such things as differentiated macroeconomic problems, variations in democratic governance, different ideas about what "hunger" and "dietary diversity" mean, and other aspects. In any case, these differences between indicators and regions need to be analyzed in greater detail.

understand these differences better when using indicator 2.1.2 for comparisons between regions.

Another point that must be considered from a public policy perspective is that, given the spectrum of situations that this indicator covers, the problem identified is very broad: it includes everyone from people who are worried about their food situation and who may have made some minor adjustments to the quantity and quality of foods consumed, to people who report that they are suffering hunger. Therefore, the indicator of total food insecurity (2.1.2) does not appear to have a simple or direct correlation with possible interventions to resolve the underlying problem. So from the perspective of designing operational programs, it may be preferable to focus on the three prior problems: hunger, dietary diversity and obesity. On the other hand, the methodology of surveys and questions that lead to the construction of this indicator has proven relevant for focalizing interventions in the event of humanitarian crises or specific projects. Furthermore, as they are direct surveys of families or individuals, they can show the emergence of problems before the other indicators, which are more complex, costly to collect, and have greater delays in gathering and processing information.

While related, all these challenges of food and nutritional security are different, and so the political policies for addressing them should also be different. Furthermore, there is an obvious heterogeneity in the region regarding the extent of each of these problems and their combination. Some countries have better undernutrition indicators but worse obesity indicators. Others have bad undernutrition indicators but do not have many obesity problems. And in the middle, there are countries with different combinations of the two problems, including a small number of cases that combine bad aggregate indicators in both dimensions, although presumably these problems would affect different groups of people. Lastly, the problems of deficiency of essential minerals and vitamins, associated with a low level of dietary diversity, also vary by countries and are combined in different ways with problems of hunger and obesity.

In short, public policies have to consider the different combinations of FNS problems with a comprehensive vision: the triple burden of malnutrition

associated with deficient diets can appear in different combinations in the same country, in the same family, or even in the same individual. The starting point of a FNS program is to define the configuration of problems to be resolved, with an emphasis on hunger, obesity and dietary diversity, and identify which groups of people are affected.

2) Measuring the scope of the problem, defining the goal and its timeframe

After clearly identifying the problems and sectors that suffer them, the next step in designing a FNS program requires three considerations: 1) its quantitative scope (that is, determining the current number of people affected); 2) defining the goal (by what number do we wish to reduce the number); and 3) determining the time period to achieve 2).

Regarding the scope of the problem, the indicators suggest large variations in the number of people affected by each challenge. That is, the use of one indicator or another not only underlines a different problem (as analyzed in the previous subsection), but the scale of the effort needed to solve it is also different.

Table 3 shows the number of people affected (in millions) according to different problems and indicators. The last year with information in the different databases is also shown. The calculation of extreme poverty for LAC is the number of poor people, using the average of the World Bank thresholds of 2.15 and 3.65 PPP dollars/person/day.[33]

Table 3. Different FNS problems and people affected

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[33] In the case of extreme poverty, ECLAC (2021) calculates that in 2019 there were 70 million people in this condition (11.3 percent of the population). For the same year, the World Bank estimates that the percentage of total poverty at 3.65 dollars PPP/person/day was 10.6 percent, or around 4.5 million less people considered extremely poor. ECLAC generally has higher estimates of poverty than the World Bank. As this document also tries to compare LAC with other regions, World Bank data, that have global coverage, has been used.

	2.1.1 Undernutrition (million people)	"Extreme" poverty (million people)	Severe food insecurity (million people)	2.1.2 Total food insecurity (million people)	Diet cost (million people)	Obesity (million people)
Hunger	56.5	48.2	93.5			
Unhealthy diet					131	
Obesity						106
Total food insecurity				267.7		
Year of estimate	2021	2019	2021	2021	2020	2016

Source: Created by the author based on FAOSTAT (2022), World Bank (2022) and FAO et al., 2022.

The hunger indicator (2.1.1) and the extreme poverty indicator suggest a somewhat smaller scope of the problem (between 48 and 57 million people) than the severe food insecurity indicator based on FIES surveys (almost 94 million): that is, between 37 and 46 million more people who would have to be considered if the second indicator were used.[34] Obviously, the scale of the public programs for eradicating hunger will be very different depending on which indicator is used.

As mentioned above, the extreme food insecurity indicator and the undernutrition or hunger indicator (2.1.1) may tend to represent the same problem, although given the different methodologies there will always be some discrepancies in the scope of the challenge (that is, the percentage and number of people affected by hunger). Despite these differences, it is expected that the general trends and the classification of the countries should be

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[34] Even considering the highest ECLAC estimates for people in extreme poverty, the severe food insecurity indicator shows an additional of almost 24 million people.

relatively comparable using one indicator or the other. However, as analyzed previously, there is a visible difference in the case of LAC, which does not appear to occur in other regions. Also, the classification of countries in terms of the severity of the problem of malnutrition and hunger varies depending on the indicator used. The text showed that indicator 2.1.1 is more in line with the other indicators used for undernutrition or hunger, and therefore, as a first approximation, it may be better to use it to analyze this problem (obviously this indicator is also the official SDG metric).

Another issue to note is that the number of obese adults (which was already estimated at 106 million in 2016 and is considered to have continued to grow since then) exceeds that of people who suffer hunger (almost 57 million in 2021 according to the indicator 2.1.1). The indicator of wasting (related to acute hunger), on the one hand, and the one of overweight children under 5 years of age, on the other, also suggest that the latter problem appears to be numerically more important than the former in many countries of LAC. This means that FNS programs in LAC must be addressed with public policies that include not only overcoming the tragic problem of hunger, but also consider the challenge of overweight and obesity and, in relation to these problems, diet quality and diversity.

The other aspect mentioned above is the quantitative definition of goals. In designing FNS programs, it is necessary to specify numerically the number of people (or the percentage of incidence) it would take to decide that "the problem has been solved." SDG 2 refers to "zero hunger," "eradicating all forms of malnutrition" by 2030 and "international targets" for stunting and wasting in children under 5 years of age.[35] Countries may want to consider whether those are the only goals or whether there are others they want to achieve. Then they

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[35] Resolution 65.6 of the World Health Assembly in 2012 defined as goals for 2025 a 40 percent reduction in the number of children under 5 years of age with stunting and reducing and maintaining infant wasting at under 5 percent. Regarding this latter indicator, of the 23 countries with data in LAC, 19 appear to have reached the goal by 2020 and only 4 were above 5 percent in that year. Therefore, several countries in the region could set more demanding targets such as reaching less than 0.5 percent, or approximately the level of developed countries (only one country in LAC showed indicators below this limit in 2020).

must decide about the <u>quantitative</u> definition of these goals and the timeframe within which they intend to fulfill them. For example, does "zero hunger" mean exactly no people with hunger by 2030 (which is the ideal) or countries may accept a minimum that can be different from zero?[36]

Whatever the definition of the quantitative goal and the period in which to achieve it, in many countries there is a need to have a broader and more frequent database of basic information. In particular, given that anthropometric information is a combination of observations and statistical modeling, more direct and consistent measurements of anthropometric data and its systemic collection are required. In this regard, anthropometric information should be standardized and collected in a uniform manner in schools and health centers. The same can be said of information on dietary diversity. Expanding these databases is the best way to attain a clearer vision of the situation of food and nutritional (in)security in LAC.

3) Final comments

In conclusion, it is hoped that this document will help countries of LAC to clearly define the main FNS problems to be solved (considering their quantitative importance). This information is the basis for designing the necessary programs, which must include quantitative targets and timeframes; public policy instruments, laws and regulations; a strong institutional framework; technologies in the broad sense; the necessary resources; and the costs and financing.

In other documents, different methodologies and approaches will be discussed for preparing and implementing FNS programs, including the possibility of generating a typology of countries that better guide the design of such programs and thus help implement the Continental Alliance for Food Security and Sustainable Development. This in turn is part of the preparation and execution of broader programs to strengthen and improve agrifood systems in

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[36] Without suggesting that this should be the value taken as reference, it can be noted that the FAOSTAT database of indicator 2.1.1. has as a minimum 2.5 percent of the population, below which there is no further precision of the numbers involved.

LAC, given that, as was argued above, the adequate functioning of them is crucial for helping achieve practically all the SDGs and the targets of the 2015 Paris Agreement on climate change, not only at the level of countries in the region but also at global level (IICA, 2022).

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Annex A. FAO food security database.

Availability
Average sufficiency of food energy supply
Average value of food production
Proportion of food energy supply from cereals, roots and tubers
Average protein contribution
Average supply of protein of animal origin
Access
Railroad density
Gross domestic product per capita (in purchasing power parity)
Prevalence of undernourishment (annual and three-year average)
Prevalence of severe food insecurity in the total population (annual and three-year average)
Prevalence of moderate or severe food insecurity in total population (annual and three-year average)
Stability
Rate of dependence on cereal imports
Percentage of arable land equipped for irrigation
Value of food imports over total merchandise exports
Political stability and absence of violence/terrorism
Variability of food production per capita
Variability of food supply per capita
Use

People who use basic drinking water and safe drinking water services
People who use basic sanitation and safe sanitation services
Percentage of children under 5 affected by wasting
Percentage of children under 5 affected by stunting
Percentage of children under 5 overweight
Prevalence of obesity in adult population (18 and above)
Prevalence of anemia among women of reproductive age (15-49 years)
Prevalence of exclusive breast-feeding among nursing babies 0-5 months of age
Prevalence of low birth weight
Additional useful statistics
Total population
Number of malnourished people, three-year averages
Number of malnourished people, annual estimates
Number of people with severe food insecurity, three-year averages
Number of people with severe food insecurity, annual estimates
Number of people with moderate or severe food insecurity, three-year averages
Number of people with moderate or severe food insecurity, annual estimates
Minimum dietary energy requirement (MDER)
Average dietary energy requirement (ADER)
Coefficient of variation of habitual caloric consumption distribution
Incidence of caloric losses at retail distribution level
Dietary energy supply (DES)
Average fat supply
Number of children under 5 affected by wasting
Number of children under 5 affected by stunting

Number of children under 5 overweight
Number of obese adults (18 and older)
Number of women of reproductive age (15-49 years) affected by anemia
Number of infants exclusively breastfed (0-5 months)
Number of newborns with low birth weight

Source: FAOSTAT (2022)

Annex B. Indicators in Data4Diets

Depth of food deficit
Diet Quality Index - International (DQI-I)
Dietary energy supply
Dietary exposure assessment indicators
Domestic food price index
Food affordability index
Food Consumption Score (FCS)
Food Insecurity Experience Scale (FIES)
Fresh food retail volume
Household adequacy of fruit and vegetable consumption
Household average dietary energy acquisition or consumption
Household Dietary Diversity Score (HDDS)
Household food expenditure share

Household Food Insecurity Access Scale (HFIAS)
Household Hunger Scale (HHS)
Household share of animal protein in total protein consumption
Household share of dietary energy from macronutrients
Household share of energy consumed from non-staples
Household share of food from various sources
Inadequacy of specific micronutrient intake
Latin American and Caribbean Food Security Scale (ELCSA)
Market-level food diversity score
Mean Adequacy Ratio (MAR)
Meat consumption
Minimum Acceptable Diet (MAD)
Minimum Dietary Diversity (MDD)
Minimum Dietary Diversity for Women (MDD-W)
Modified Functional Attribute Diversity (MFAD)
National average supply of protein
National energy available from non-staples
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 |

Source: INDDEX Project 2018.

Annex C. Global and country indicators.

This Annex briefly analyzes some global indicators[37] and others that combined different primary indicators to construct aggregated indicators, such as the Global Hunger Index (GHI) and the Global Food Security Index (GFSI), published by The Economist Intelligence Unit.

Trade indicators by countries

As analyzed in the history of the concept of food security, the focus has been at different times on indicators of production and trade at the global or country levels. One indicator widely mentioned as determining the "food insecurity" of a country is that of being a "net importer of foods." For example, negotiations at the World Trade Organization (WTO) led to the creation of the category of "net food importing developing countries," which has some special treatment within the Agriculture Agreement approved by WTO members. However, it can occur that a country is a net importer of food but is not necessarily vulnerable internationally because it has large exports of other products (such as oil) or services (such as tourism).

As a region, LAC is the main net exporter of food and agricultural products in the world (table C.1.)

Table C.1. Net trade (billions of dollars, in the period 2015-2020)

	Food a/	Agriculture
Africa	-30.2	-29.0
Asia	-174.1	-210.5
Australia/New Zealand	35.0	38.4
European Union (27)	56.9	56.3

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[37] As mentioned above, FNS can be discussed at different levels: global, by regions, countries, subregions, families and individuals.

| USA and Canada	7.0	18.5
Mexico and Central America	36.5	10.7
Caribbean	-29.1	-6.0
South America	95.3	115.8
LAC total	102.8	120.5

Source: FAOSTAT (2022).

a/ Excluding fishing products.

However, there are differences between the net exporting regions within LAC, where the Caribbean is a net importer because of the combination of Haiti and of English-speaking countries that include exporters of oil and minerals along with providers of tourism services.

Figure C.1 shows the relationship of net food trade (without fish products) by country (Brazil with 59.1 billion dollars on average in 2015-2020 is outside the chart).

Figure C.1. Net food trade (in billions of dollars, in the period 2015-2020).
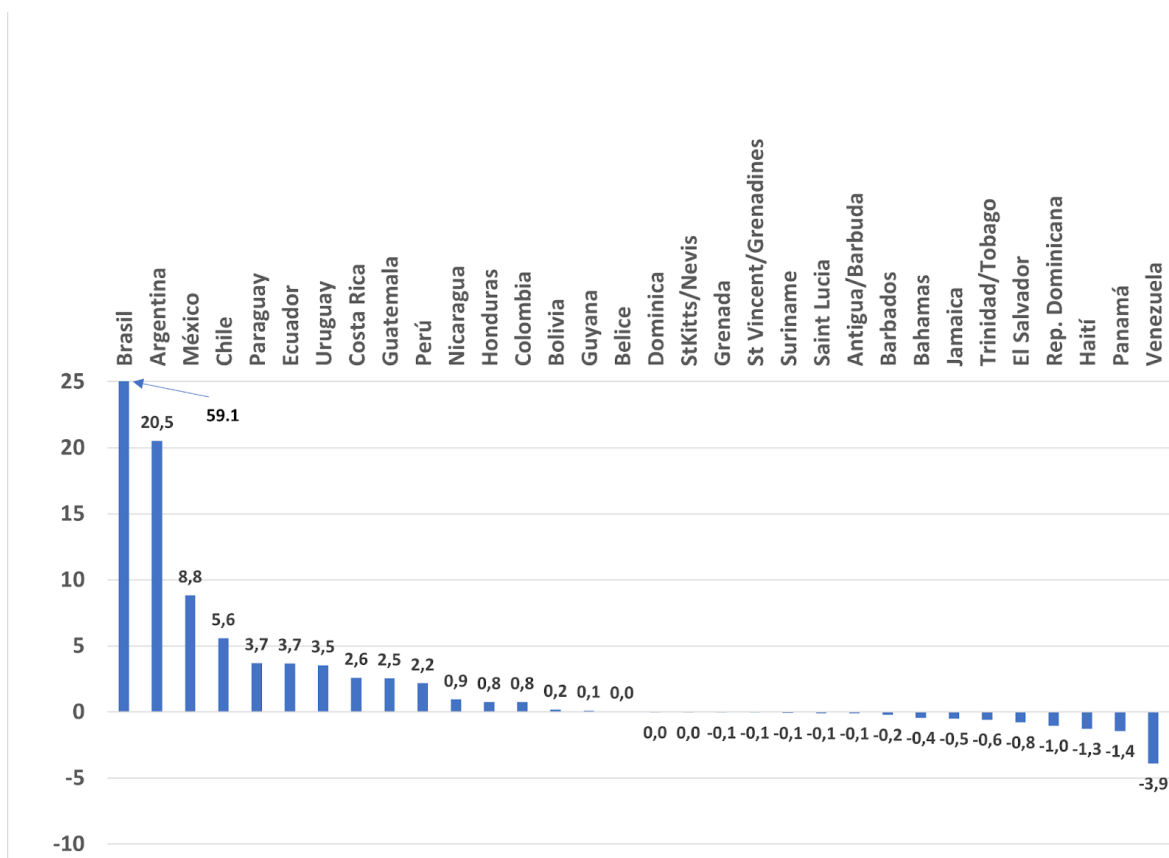
Source: FAOSTAT 2022.

There are 16 net exporters and 16 net importers. However, over 90 percent of the population of LAC live in the net exporting countries. Furthermore, there is no clear correlation between the indicators of food (in)security at individual level and a country being a net food importer. For example, several countries in Central America are net food exporters, while indicators at the individual level show food insecurity problems. At the same time there are net importers who do not appear to have severe food insecurity problems at individual level (such as some of the high-income English-speaking countries of the Caribbean).[38] In fact, various studies have shown that being a net food importer does not

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[38] In the case of Haiti, being a net importer it is also associated with food insecurity data at individual level.

necessarily show a correlation with other food insecurity indicators (Díaz-Bonilla et al., 2000; Díaz-Bonilla and Thomas, 2015).

Therefore, the FAO food (in)security indicators database (in Annex A) does not include the net food trade indicator, but instead shows another international trade indicator that is considered more relevant in determining countries' economic vulnerability: the value of food imports as percentage of total merchandise exports. It indicates what percentage of a country's external income related to exports has to be allocated to purchasing food in global markets. A higher percentage implies greater food vulnerability (or insecurity) in that country.

This indicator considers merchandise exports as an approach to the country's foreign revenue. However, this value is only one component of a broader category of foreign currency revenue on the balance of payments: exports of goods and services and primary income.[39]

Table C.2. shows the above indicator (using exports of merchandise as denominator) and another calculated with the same numerator (the value of food imports) but now the denominator is the broader concept of foreign currency income in the abovementioned balance of payments.

Table C.2. Two indicators of trade vulnerability.

	Indicator 1	Indicator 2		Indicator 1	Indicator 2		Indicator 1	Indicator 2
Brazil	4	3.2	Venezuela	12	na	Low income	38	Na
Mexico	5	4.6	Colombia	13	9.1	Jamaica	53	15.8

[39] Primary income is the net flow of profits, interest and dividends from investments in other countries and the net flows of remittances from migrant workers who still maintain residence in their country of origin. It is the income of a country's productive factors (basically capital and labor) when they are applied in another country, but there is a flow of payments from this other country to the owners of those factors that continue to live in the country of origin. This does not include the part of the remittances that corresponds to unrequited transfers.

Argentina	6	4.6	Guyana	13	11.3	St Kitts and Nevis	67	6.6
Ecuador	7	6.0	Uruguay	14	6.0	Bahamas	76	10.8
World	7	Na	Costa Rica	15	8.0	Barbados	77	Na
Bolivia	8	6.9	Nicaragua	16	14.6	Haiti	131	83.2
Chile	8	6.4	Honduras	18	21.4	Santa Lucia	158	10.8
Peru	8	6.9	Panama	19	7.4	St. Vincent and the Grenadines	173	27.4
Suriname	8	7.4	Dominican Republic	23	12.9	Dominica	210	17.7
Paraguay	9	5.8	Guatemala	23	18.1	Grenada	242	11.7
Trinidad/Tobago	10	8.0	Belize	34	14.0	Antigua Barbuda	244	7.2
Medium-low income	11	Na	El Salvador	34	25.4			

Source: Created with data from FAOSTAT (2022) and World Bank (2022). Indicator 1: Food imports as percentage of merchandise exports. Indicator 2: Food imports as percentage of export of goods, services and primary income.

Using the indicator for merchandise exports (Indicator 1), Haiti and some countries in the English-speaking Caribbean show values over 100 percent, that is, what they spend on food is more than what they receive in the form of merchandise exports. However, several of these indicators improve significantly when the broader concept of the balance of payments is used, which includes goods and merchandise as well as services (such as tourism) and income from the country's productive factors (Indicator 2). Nonetheless, Haiti continues to be the country with the most worrying indicator, with high values of over 80 percent. The resultant trade gap is funded with remittances and international aid funds (Díaz-Bonilla (2022) offers a detailed discussion on Haiti).

A further three countries show food purchase percentages over 20 percent of their international income. Again, the balance of payments indicator used does

not include remittances, which are unrequited transfers (donations) and which function as additional funding of imports of all types.
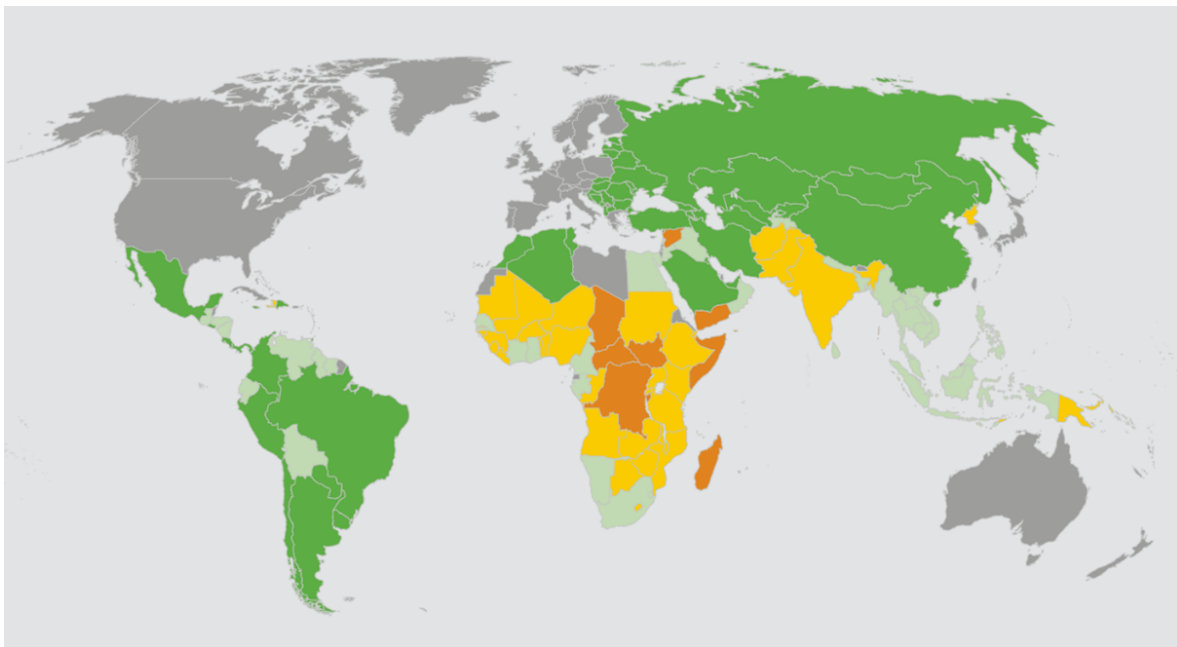
Aggregate indicators

In addition to the above indicators based on a single variable, other methodologies have been used to categorize conditions of food and nutrition (in)security at the country level, combining diverse variables. In some cases, those variables are combined in a single value index, such as the Global Food Security Index (GFSI), designed and constructed by the Economist Intelligence Unit and the Global Hunger Index (GHI), that was started by IFPRI with Concern Worldwide and Welthungerhilfe, but is now calculated only by the latter two institutions.[40]

The GFSI aggregates 28 variables in a single indicator. It also presents data on seven "structural variables" (Economist Impact, 2022). While the GFSI combines variables at country and individual level, the GHI uses only data on human beings and much of it is anthropometric (Global Hunger Index 2022). It combines three of the indicators for human individuals discussed in the main text: undernutrition or hunger (2.1.1 of the SDGs); stunting in infants under 5 (2.2.1); and wasting in infants under 5 (2.2.2a). And it adds a fourth indicator, the mortality rate of children under 5. Given that this tragedy is the result of many variables, not just food problems, in general it is not used in food security indicators (for example, it is not in any of the three databases mentioned in Table 1 of the main text). The GHI is calculated as the weighted average of the four indicators (wasting and stunting have 1/6 and the other two 1/3 each of weighting). The greater the value, the worse the conditions reflected in the indicator.

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[40] Another aggregate indicator, but at regional level, is the COVID-19 food vulnerability index constructed by IICA, using five variables that include some indicators of results and other contextual factors that represent possible channels of transmission of the pandemic to the agrifood sector in the countries of the Americas. These variables are: a) net per capita income; b) net food imports or exports per capita; c) the prevalence of undernutrition (the abovementioned indicator 2.1.1); d) governments' net fiscal stance; and e) the current account balance of payments (in percentage of the GDP).

Figure C.2 shows the classification of the countries considered in the last edition (2022): dark green are countries with "low" hunger problems (scores lower than 9.9); light green are considered "moderate" scores (10-19.9); the countries in yellow are considered as having "severe" hunger problems (20-34.9); the countries in orange are "alarming" (between 35 and 49.9) and lastly countries with "extremely alarming" conditions (the countries in gray do not have data or are not considered because they are developed countries).

Figure C.2 Countries classified by the Global Hunger Index.

Source: Global Hunger Index 2022.

In LAC, Haiti is the only country in the category of "severe" hunger problems. The rest are in the low or moderate categories.

This type of complex or aggregate indicator can be useful for gathering quantitative information from different sources and to allow some comparisons between countries. However, in designing specific national programs it is necessary to consider the types of individual indicators discussed in the main text. Furthermore, because they aggregate a number of variables into a single number, they do not capture the different underlying "geometries" of the indicators: the countries can have the same total value of the indicator due to a

completely different combination of variables that have averaged out in the aggregate, and therefore, the policies necessary to address the underlying problems may be very different (Díaz-Bonilla et al., 2014).

Other approaches for classifying countries are based on techniques that attempt to capture the multidimensional geometry of FNS and permit the differentiation of profiles by countries. Various attempts have been made to produce typologies of countries in relation to their FNS situation. These exercises differ in terms of the purposes of the typology, the number of variables considered, the methodology used, and the number of groups or types identified. To be useful, it is necessary for these classifications to generate a manageable number of categories, probably no more than 3-4 main groups of clearly differentiated countries and perhaps 10-12 subgroups (various country classification studies can be reviewed in Díaz-Bonilla and Thomas 2015).

Classifications or typologies can then be used to design differentiated policies by groups of countries.[41]

Final comments

As it was argued above, the fact that a country is a net exporter or importer does not appear to correlate with indicators of food (in)security at individual level. Another point to consider in these trade classifications is the tendency of using them to set self-sufficiency targets which, depending on the instruments used, may or may not improve general FNS. For example, using trade protection to achieve food self-sufficiency keeps internal food prices high which harms consumers, many of them poor, and even a high percentage of smallholder farmers who are net food buyers. The net effect of trade protection on poverty

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[41] For example, Díaz-Bonilla and Thomas (2015) use five variables and clusters to identify three main groups of countries (insecure, intermediate and secure) with a total of 10 subgroups: four in the category of countries with food insecurity, two in the intermediate category and four in the category of secure countries. The five variables are internal food production per capita (constant dollars per capita), a combination of the availability of calories and proteins per capita; the relationship between total food imports and exports; the importance of the rural population; and the mortality rate of children under 5. The study includes 155 developed and developing countries. Haiti was the only LAC country in the groups of "insecure" countries. There are a further 12 countries in LAC in the category of "intermediate" food security.

and food security, but also on the rest of the economy and the population's general wellbeing, will depend on the specific functioning of the markets for products and labor, with very diverse results (Díaz-Bonilla 2015a and 2015c).

In general, the evolution of the FNS concept suggests that although global or national trade indicators are relevant, the problems of food and nutrition insecurity are manifested specifically at the level of individual human beings, who must be the main focal point of public policies. Because of this the main text emphasizes indicators at individual level.

Annex D. Indicator of calorie deficiency (undernutrition or hunger)[42]

This indicator is calculated from food balance sheets that include the amount of food items produced in each country.[43] These values are adjusted for exports, imports, losses and other non-food uses, to reach a national average of calories available per person and per day. Using the structure of ages and genders and an approximation of the average level of physical activity, the minimum dietary energy requirement (MDER) is calculated for a hypothetical average individual with good health and a socially acceptable level of activity. Then income distribution information or the variability of consumption in a country, based on household surveys or similar measurements, are used to estimate, applying different statistical techniques, the percentage of the population whose consumption would be below the MDER (i.e. that suffers hunger).

As mentioned above, the official SDG indicator 2.1.1. is widely used to give an overview of the situation and trends for food access. It is also the indicator for simulations that use global or national models to analyze the impact on hunger of different policies and investments. It also has the advantage that it is calculated by the FAO with the same methodology for a high number of countries, and for a relatively long period.

The limitations of this indicator are that, as it is only based on calories, it does not consider the quality of the diet in other relevant dimensions. Furthermore, as it is calculated once a year, for the 12 months as a whole and at national level, it cannot be used for analyzing food problems with seasonal and regional variability or when there are specific shocks that require more timely and granular information (Headey and Ecker 2013; INDDEX Project 2018). Lastly, the

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[42] The complete methodological discussion is in FAO *et al*. 2022.

[43] To avoid double counting, processed food products are not included, whose components are already included in the balance sheets of foods that are raw materials.

estimates of food production and the derived calculation of the availability of calories have all the limitations of the underlying agricultural production statistics.

Annex E. Additional undernutrition or hunger data

Figure E.1 shows the incidence of hunger with more disaggregation for the countries of LAC with data (as average for the period 2019–2021), compared with the average for the region and all developing countries as a whole.

Figure E.1. Prevalence of undernutrition (hunger) in percentages (2019–2021).
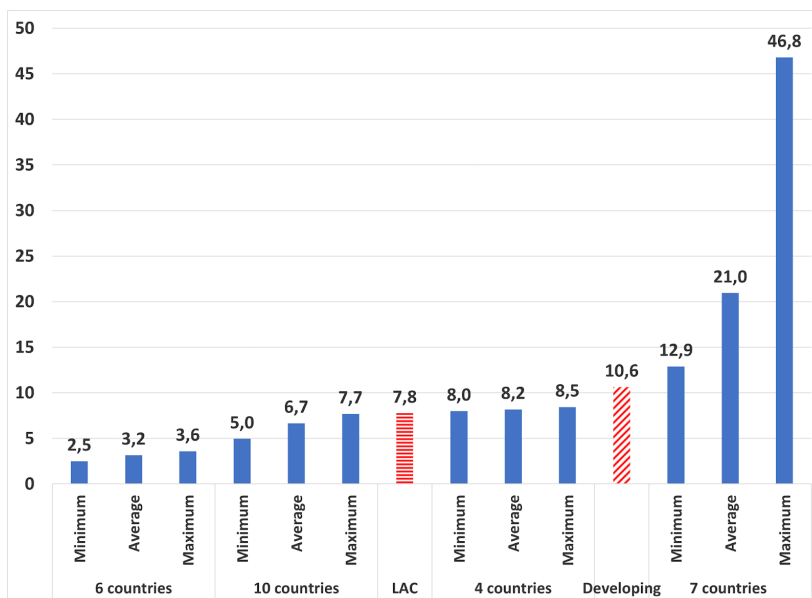
Source: Created with FAOSTAT data (2022).

Six countries have hunger percentages lower than 5 percent (the range is from 2.5 to 3.6 percent with an average of 3.2 percent). A further 10 countries are below the average of LAC (7.8 percent) as a whole, with an average of 6.7 percent. A further four countries are above the average for LAC, but below the developing countries, with an average of 8.2 percent. Lastly, seven countries have an incidence of hunger above the average of developing countries, with an average of 21 percent; however, this value is skewed by two countries with a high incidence of hunger. In fact, the other five countries show percentages below 20 percent of the population.[44]

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[44] Another indicator calculated by Food Security Information Network (FSIN), with the participation of the FAO, the World Food Programme (WFP), the International Food Policy Research Institute

(IFPRI) and others, is the Integrated Food Security Phase Classification (IPC). The data is presented in the Global Report on Food Crises. However, it only covers four countries in the region: Haiti, Honduras, Guatemala and El Salvador. It classifies the population based on different indicators in five phases: in phases 1 and 2, families have no problems in covering their needs or only minor problems. The next phases are the critical ones: 3 (crisis), 4 (emergency) and 5 (catastrophe/famine). Population percentages in phase 3 or worse for 2021 in the case of Haiti are in line with the values of indicator 2.1.1 discussed in the text; they are higher in the case of Guatemala and El Salvador; and they are considerably higher in the case of Honduras. As they do not cover all the countries of LAC, this indicator is not analyzed in the study.

Annex F. Experiential indicators

Unlike the hunger indicator that constitutes an indirect, national approximation of the problem, the food insecurity indicator is based on direct surveys of people, conducted by the Gallup company, national authorities or other sources. They are applied in over 140 countries with samples that are estimated to be representative at the national level (with the margins of uncertainty of any survey). The Food Insecurity Experience Scale (FIES) consists of eight questions about the experiences and behaviors of the people surveyed in relation to food and it is considered that they report growing difficulties in accessing food. The survey was developed by the FAO and is part of a group of surveys that focus on people's experiences.[45] The survey asks the following questions:

"During the last 12 months, was there a time when, because of lack of money or other resources:

1. You were worried you would not have enough food to eat?
2. You were unable to eat healthy and nutritious food?
3. You ate only a few kinds of foods?
4. You had to skip a meal?
5. You ate less than you thought you should?
6. Your household ran out of food?
7. You were hungry but did not eat?
8. You went without eating for a whole day?"

Using statistical techniques, the surveyed population is classified into three groups based on their answers: a) food security to mild food insecurity; b) moderate food insecurity; and c) severe food insecurity. Indicator 2.1.2 of the SDGs is the sum of b) and c). The FAO database also reports separately the data of people with severe food insecurity (group c), who should supposedly be related with indicator 2.1.1 (hunger). The FAO database includes information on i)

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[45] This type of survey started in LAC (as the Latin American and Caribbean Food Security Scale, ELCSA) and has then been tried out in other regions. Other examples of surveys and scales are: Household Food Insecurity Access Scale (HFIAS) and Household Hunger Scale (HHS) (INDDEX Project 2018).

the percentage (prevalence) of the population who live in households where it was identified that at least one adult suffered food insecurity and ii) the estimated number of individuals in that condition.

The advantages of this indicator are that the survey is easy to apply; it is based on direct answers of the people interviewed; it is related to similar methodologies used in other scales to measure features that cannot be observed. The FIES scale has also been validated for its applicability in different contexts and cultures. It can be used at national or regional levels and can include families (with a representative person responding) or individuals separately. In the FAO database there is data for the whole population and data separated between men and women. The FIES analysis methodology can be applied to data gathered using survey modules with similar questions implemented by national authorities and other international organizations (Headey and Ecker 2013; INDDEX Project 2018).

One limitation is that the FIES does not determine the amount of food consumption or analyze dietary quality. Another issue is that the samples (around 1000 people per country[46]) have relatively broad margins of accuracy (or confidence) around the central estimate.[47] There may also be year-on-year differences due to variations in the samples. To reduce variability, FAOSTAT also reports quarterly averages. All the problems of experiential or opinion surveys may also be present, including difficulties in remembering what happened in the last 12 months. Two different and opposing biases are the possibility that those who respond consider that their responses may help them access government social or food programs, so they exaggerate the negative aspects of their situation; or they may be embarrassed to admit that they have suffered food problems and do not report them.

The main text mentions the possible differences of this indicator in LAC compared to other developing regions: with the data published in FAOSTAT it

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[46] The samples are larger in countries with a greater population, such as India and China (FAO et al., 2022)

[47] FAO et al., (2022) mentions a 20 percent confidence interval gives the example that an estimate of 50 percent food insecurity can cover from 45 to 55 percent of the population.

appears that the region has a greater incidence of severe and total food insecurity than what the variety of other indicators analyzed in this document suggest (such as hunger, poverty, diet cost, stunting, wasting, dietary diversity in infants, consumption of meat and eggs in infants, consumption of fruits and vegetables in infants, anemia in women, etc.)

It is important to have a better understanding of these differences. The main text gives some explanations, such as the differential impact of COVID-19 in the region and China's weight in the aggregates. Another aspect is that because this indicator is based on simple, direct surveys, it can show the appearance of problems in real time, while the other indicators, more complex, costlier to collect, and with greater delays in gathering information, are not yet capturing them. However, taking averages from longer periods, and using the data published, the differences between LAC and other regions in relation to these indicators still persist, although they are somewhat attenuated.

So there may be other reasons for the differences between the experiential indicator and the other indicators as a group. One could be inflation: in the case of Argentina, the prevalence of the severe food insecurity indicator is 3.5 times higher than the hunger indicator, when they should be more aligned; in this sense the FIES survey may be capturing more general macroeconomic insecurity. Another differential aspect may be that in LAC, which has better democracy indicators than other developing regions (Economist Intelligence Unit 2022), the surveys reflect the possibilities of manifesting discontent with governments more openly. Additionally, the notion of "hunger" or of "variety of foods" in medium and medium-high income countries, as are those of LAC, can be different than in other poorer or more rural countries. Lastly, in a region that has pioneered income transfer programs, the surveys may have a bias toward emphasizing food problems if people expect that their responses will help them access government support programs. These differences need to be analyzed in greater detail.

In any case, given that the FAOSTAT database does not contain all existing data, as countries can refuse to allow it to be published, a more detailed study should be done to determine whether the differences remain the same with a larger coverage of countries with published data.
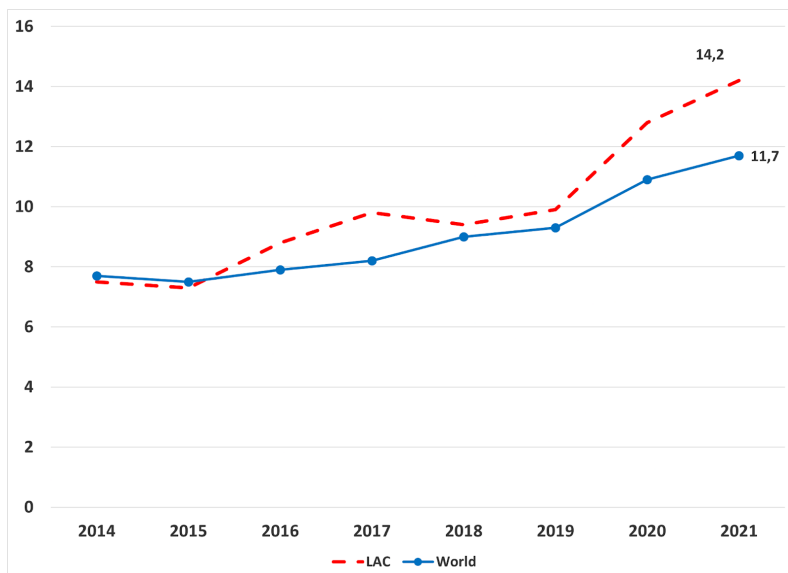
Annex G. Additional food insecurity data.

Figures G.1 and G.2 present the annual evolution of LAC compared with the world for the indicator 2.1.2, and for the severe food insecurity indicator only.

Figure G.1. Prevalence of food insecurity in percentages.
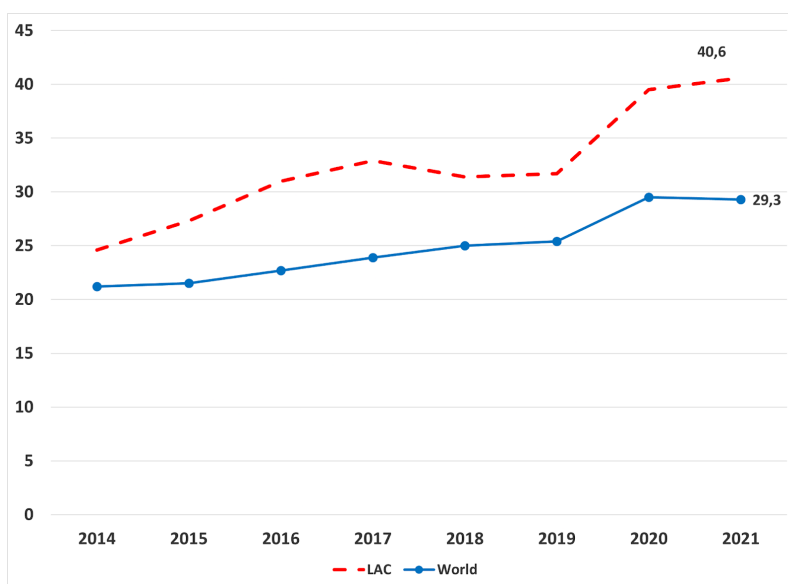
Source: Created with FAOSTAT data (2022).

**Figure G.2. Prevalence of severe food insecurity in percentages.**

Source: with FAOSTAT data (2022).

Unlike Figure 6 of the main text showing the evolution of indicator 2.1.1 (hunger), both food insecurity indicators suggest that LAC is worse than the global average. Another point is that the hunger indicator (2.1.1) at global level, from the middle of the 2010s to the pandemic, was stationary (or was still decreasing slightly in Figure 6 of the main text), while the severe food insecurity indicator was increasing before the pandemic (Figures G.1 and G.2).

Figures G.3 and G.4 show the total food insecurity indicator (2.1.2) and the subcomponent of severe food insecurity disaggregated by groups of countries in LAC (with average data from the period 2019-2021).

Figure G.3. Prevalence of food insecurity, in percentages (2019–2021).
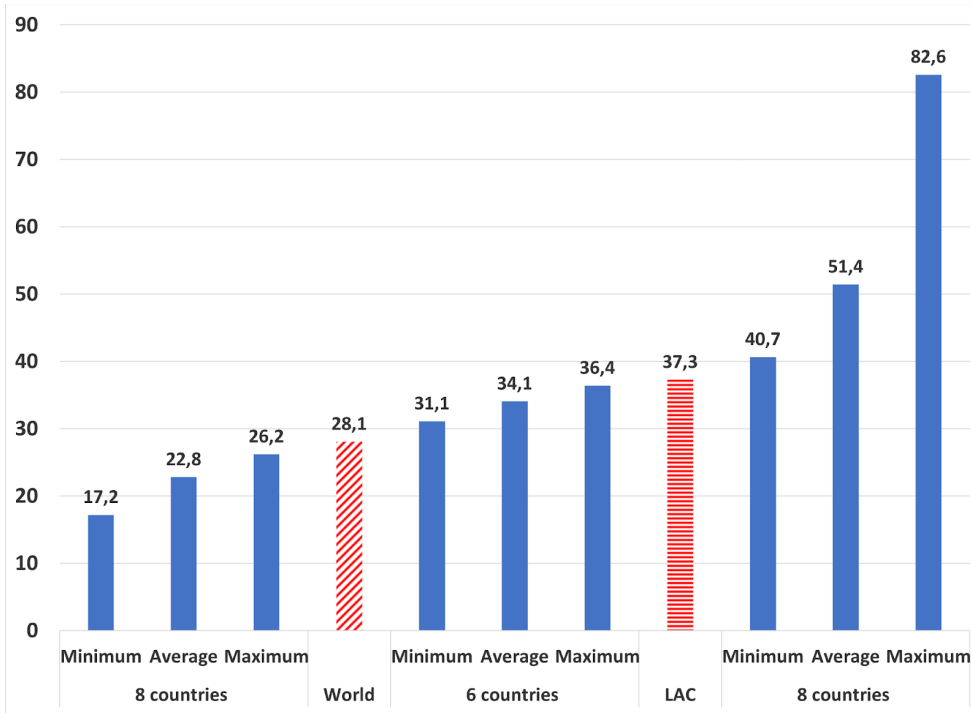
Source: Created based on FAOSTAT data (2022).

Eight of the countries with data show total food insecurity indicators lower than the global average, while fourteen countries are above it, of which eight clearly exceed the LAC average (51.4 percent compared with 37.3 percent, with a range from 40.7 percent to 82.6 percent of the population.

Figure G.4 Prevalence of severe food insecurity, in percentages (2019–2021).
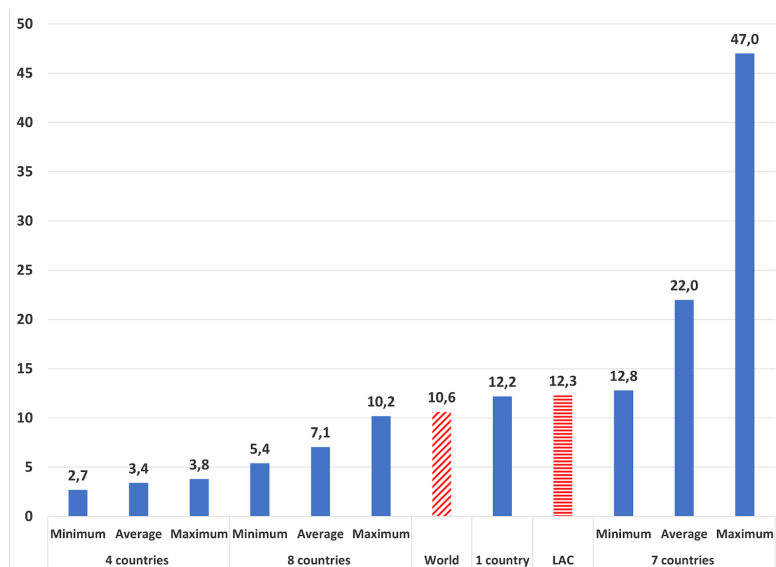
Source: Created based on FAOSTAT data (2022).

When comparing the severe food insecurity indicator with the hunger indicator, it should first be noted that the number of countries in LAC with data published in FAOSTAT is different: 27 countries for indicator 2.1.1 (hunger in Annex E) and 20 countries in the case of food insecurity.[48] With this in mind, indicator 2.1.1 places 26 percent of the LAC countries with data above the global hunger average, while the severe food insecurity indicator shows 40 percent of the LAC countries above the global average. In more general terms, the percentages of people affected by severe food insecurity tend to be higher than those indicated by the hunger indicator: the simple average of the countries with data in FAOSTAT during 2019–2021 of the difference for both indicators is almost 58 percent more population with severe food insecurity than population with hunger. These are some of the differences in LAC (but not in other regions) of the food insecurity indicator in relation to other indicators analyzed here.

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[48] The Bahamas and Grenada have data on severe food insecurity but not hunger, while Bolivia, Colombia, Dominica, Guyana, Nicaragua, Panama, Dominican Republic, Saint Vincent and the Grenadines and Venezuela have data published on hunger but not food insecurity.

Annex H. Monetary indicators

Healthy diet[49]

A healthy diet is one that ensures an adequate consumption of calories and the necessary levels of all essential nutrients, through the consumption of different groups of foods for a healthy life. This indicator is based on food dietary guides that are applied to a representative person of each country within a daily calorie consumption of 2330 kcal/day. It is estimated that the diet used in this indicator represents, on average, around 95 percent of the necessary nutrients, and is therefore considered a healthy diet. The cost calculation is based on the cheapest foods that can be bought in the respective country and which satisfy the composition of a diet deemed healthy.

The cost of a healthy diet is then compared with the income distribution in each country, using the World Bank Poverty and Inequality Platform (PIP) database. This information comes from national household surveys conducted in the different countries in a comparable manner, usually by the respective governments. The final result is the percentage of the population and the number of people for whom 52 percent of their income (considering the average assigned to foods of total income) is not enough to cover the cost of a healthy diet in their country. These are complex estimates, which relate products with diets and nutrients and which require detailed information on prices and income (Herforth, Venkat et al., 2022).

Obviously, a monetary approach only indicates whether the population has the income to afford the healthy diet, but it cannot determine whether people actually buy it: consumers can have sufficient income and nonetheless decide to buy a low-quality diet (which may be a combination of excess calories, salt and fats, with few of the necessary nutrients), simple because their preferences lead them to these decisions.

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[49] The detailed methodology is in Herforth, Venkat, *et al*. (2022). See also Annex 3 Updated data series of the cost and affordability of a healthy diet, 2017–2020 in FAO *et al*. (2022)

Alternatively, people for whom 52 percent of their income is not enough to afford the healthy diet could, in theory, assign more than that percentage to buy a healthy food (for example, because those people have information about the positive health benefits of a good diet, and are motivated to make the right decisions). To see whether people are indeed consuming healthy diets, consumption surveys and better anthropometric information would be needed, which is discussed in other sections and annexes.

Poverty

To calculate the percentage and number of poor people it is necessary to define in each country: a) the minimum basket of basic consumption so as not to be poor; b) its costs; and c) the income distribution to see what percentage of the population does not have enough money to buy such a basket.

It is a similar procedure to that of the cost of a healthy diet, with the difference that the minimum basket of goods and services so as not to be poor covers more than foods, and the foods considered are not necessarily those of a healthy diet, but rather those which are effectively consumed. As mentioned in the main text, in many cases the calculations start with the current basket of consumption of foods that provide the minimum energy to live and over that cost it is calculated an additional margin for the consumption of basic non-food items necessary to avoid being poor. This leads to two poverty lines: one for extreme poverty or indigence, which only considers the food basket to reach a minimum calorie consumption; and another for total poverty, which includes food and non-food consumption that people should be able to afford so as not to be poor.

Therefore, in addition to indicator 2.1.1, the income threshold of indigence or extreme poverty could be used to calculate the incidence of hunger. In principle, then, the percentage of people with hunger according to the line of extreme poverty and the estimated percentage with indicator 2.1.1 should have similar levels and trends. However, this does not necessarily happen in practice, because there are differences in the methodology for data collection between the two indicators. Some differences are that indicator 2.1.1 starts from an estimate of the calories available in the supply of food products of a country,

which are adjusted by age and gender to find the minimum necessary calories, while the minimum food consumption basket that defines extreme poverty comes from household surveys that determine the actual consumption and/or incomes of the families and individuals.

As mentioned above, the poverty lines (extreme or total) also differ from the indicator of the cost of healthy diets discussed above, as the consumption basket for the former is defined based on what is effectively being consumed in each country, while the latter is a normative definition of what should be consumed. This distinction has led to discussions about the construction of poverty lines based on the basket of food consumption that corresponds to healthy diets, to which are then added the other consumptions needed to not be poor. These methodological changes in the poverty lines are still incipient.

Annex I. Additional data for healthy diets and poverty.

Healthy diets

Figure 1.1 shows more disaggregated results for countries in the region, including the global average as comparison.

**Figure I.1. Percentage of the population that cannot afford a healthy diet (2017–2020).**
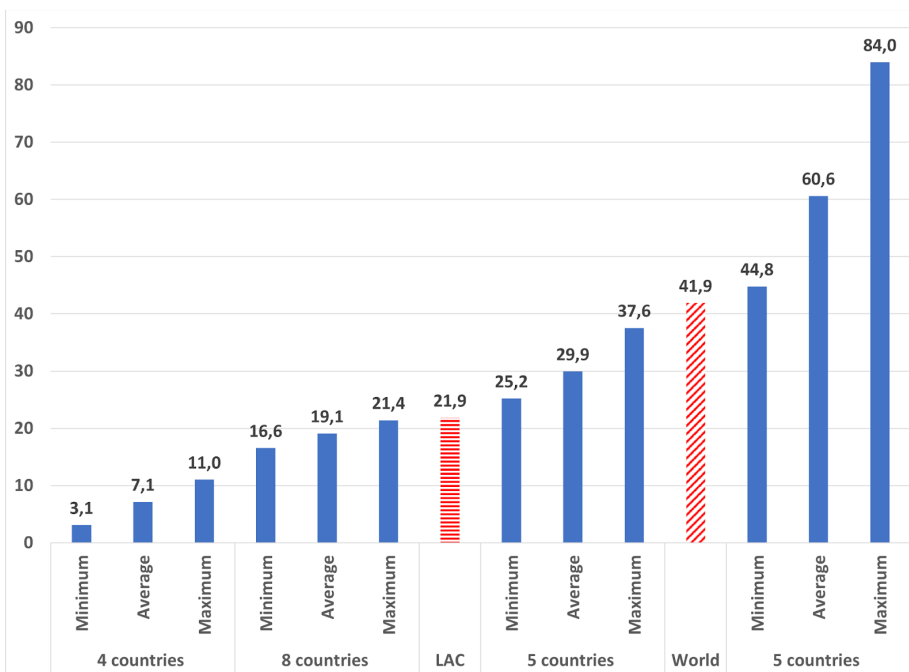
Source: Created with data from FAO et al. 2022.

In total, 17 of 22 countries show percentages of people who cannot afford healthy diets below the global average of 41.9 percent of the population. Of those countries, 12 have averages of people affected lower than the average for LAC of 21.9 percent. At the other extreme, there are five countries with high percentages of the population that could not afford healthy diets (with values of between 44.8 and 84 percent of the population, with an average for the five countries of nearly 61 percent).
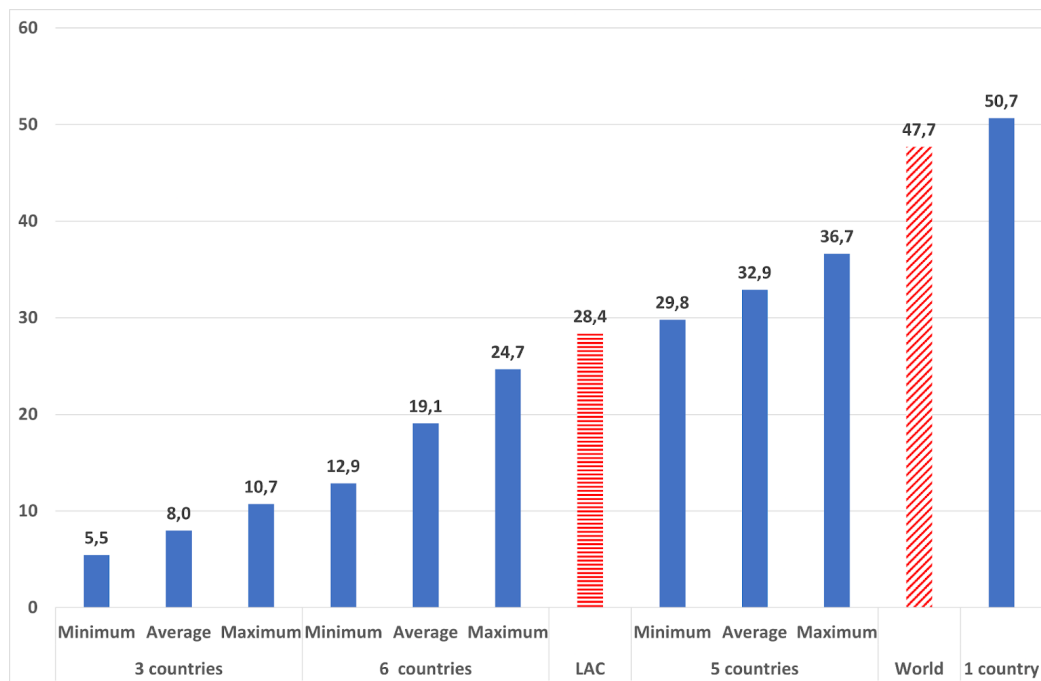
Poverty

The following figures show the percentages of people in poverty. The poverty threshold of 2.15 and 6.85 PPP dollars/capita/day are considered and the LAC countries are disaggregated (data from 2018-2020). The disaggregated results are compared with the average percentages for the world and LAC.

Figure I.2. Percentage of poverty at 2.15 dollars/person/day (2018-2020).
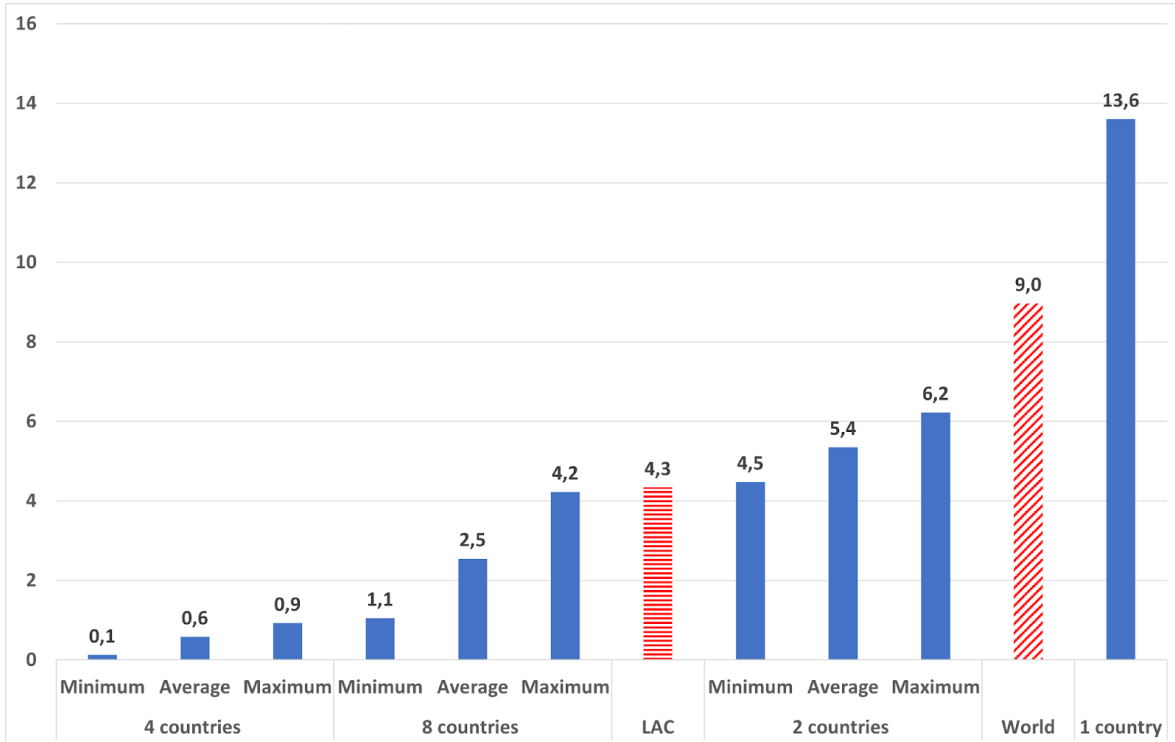
Source: Created based on World Bank data (2022).

Figure I.3. Percentage of poverty at 6.85 dollars/person/day (2018-2020).

Source: Created based on World Bank data (2022).

As suggested above, the percentages of poverty with the threshold of 2.15 PPP dollars/capita/day are relatively aligned with those suggested by indicator 2.1.1 on hunger, and the percentages of 6.85 PPP dollars/capita/day coincide generally with the percentages of people who could not afford a healthy diet. Therefore, they can be used as estimates when there are no calculations of the cost of the diets. There is some alignment and general agreement between the indicators of hunger (2.1.1), poverty and the cost of a healthy diet in terms of the levels of incidence and the country ranking. As mentioned in the main text, the total food insecurity indicator (2.1.2) and the subcomponent of severe food insecurity tend to show more differences with other indicators in terms of the incidence of the problems and the country ranking.

Annex J. Indicators of dietary diversity

This indicator is constructed based on surveys of households or individuals. Those surveyed are asked whether they remember having consumed foods in a predefined category, and within a specific period (which may be one day or the last week and which is usually no more than two weeks). The food groups that they are asked if they have consumed generally vary between 7 and 15.[50] In some cases they are asked about the amount consumed, but most commonly they are asked about the number of times (frequency) that foods from one group were consumed or even more simply whether they were consumed (without asking how many times). Then there are different methodologies for aggregating the scores, with the possibility of giving more weight to certain products considered healthier than others. Higher scores in the indicator show greater dietary diversity. As in other indicators, those that focus on the family do not necessarily reflect intrafamily dietary patterns (Headey and Ecker 2013; INDDEX Project 2018).

Another relevant issue is that the dietary diversity surveys are relatively cheaper and easier to administer than some of the methods discussed in other sections and annexes.

Table J.1 shows some of the dietary diversity indicators that are in the Tufts database (INDDEX Project 2018).

Table J.1 Examples of dietary diversity indicators.

Dietary Diversity Score Indicators	Data collection level	Number of food groups	Recall period
Household dietary diversity score, HDDS	Family	12	24 hours

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[50] One example of 12 groups is the Household Dietary Diversity Score (HDDS) (table J.1): a) cereals; b) roots and tubers; c) vegetables; d) fruits; e) meat, poultry, offal; f) eggs; g) fish and seafood; h) pulses, legumes and nuts; i) milk and milk products; j) oil/fats; k) sugar/honey; l) miscellaneous. In the case of the HDDS each food group is assigned a score of 1 (if it is consumed) or 0 (if it is not consumed). The household's score will vary from 0 to 12 and is equal to the total number of food groups consumed by the household (INDDEX Project 2018).

| Food consumption score, FCS	Family	8	7 days
Minimum Acceptable Diet, MAD	Infant/child (6-23 months)	8	24 hours
Minimum dietary diversity for women	Woman (15-49 years)	10	24 hours

Source: INDDEX Project 2018.

The indicator presented in the main text corresponds to the Minimum Acceptable Diet (MAD).

Annex K. Other indicators of dietary diversity.

There are other indicators that can be used as general approximations to dietary diversity and quality.

One case is the percentage of calories that come from cereals and tubers. It is supposed that the higher this percentage is, the less diversified and, therefore, worse the diet is.[51] Although it is a very simple indicator, Headey and Ecker (2013) show that it is more correlated with anthropometric nutrition indicators: a lower percentage of calories from cereals and tubers correlates with better (that is, healthier) indicators of wasting, stunting and BMI of pregnant women. The argument (mentioned in the main text) is that demand theory and empirical studies suggest that people diversify their diet toward other food products of better quality once they have the basic calorie needs covered.

Figure K.1. Percentage of calories from cereals and tubers (2017–2019).
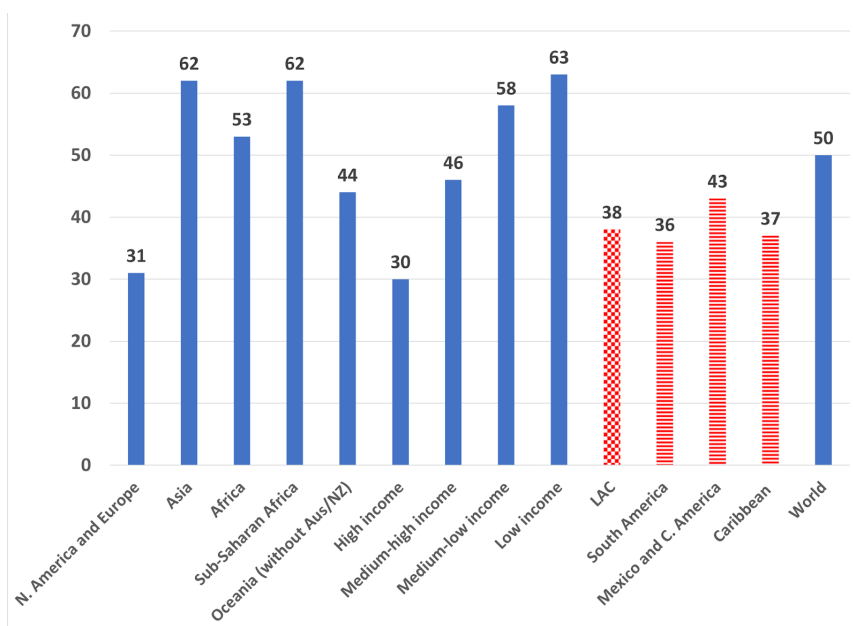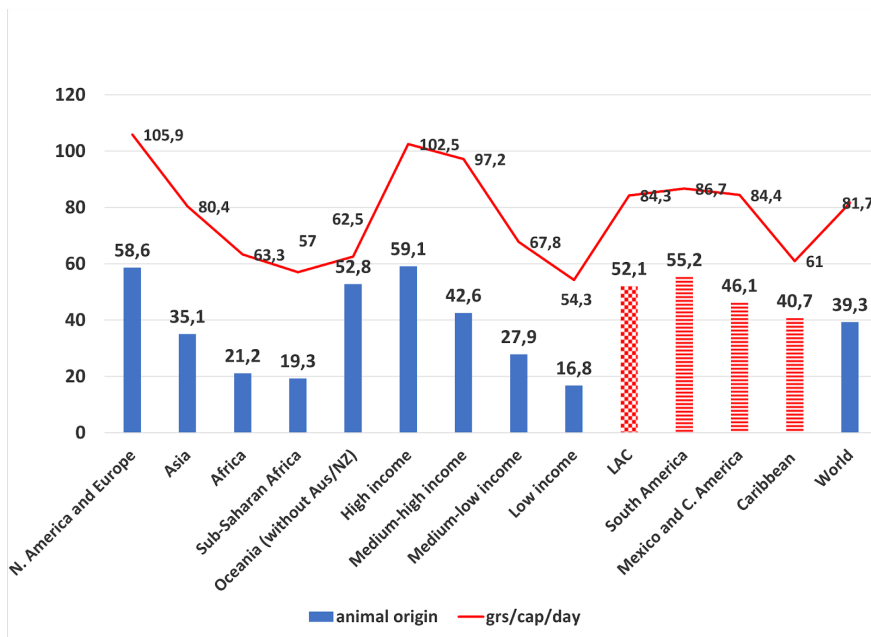

Source: Created with FAOSTAT data (2022).

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[51] For a more complete perspective it would be necessary to include the percentage that comes from sugar.

LAC shows a lower dependence on staples for calories (which suggests the consumption of a better diet) than the rest of the developing regions and the global average. Once again, this indicator places the region as a whole in a comparatively more favorable position (except in relation to high-income countries).

Another dietary quality indicator is the percentage of proteins consumed that are of animal origin: it is generally assumed that a greater percentage indicates a better diet (although this may perhaps be true up to a certain level in a non-linear relation). Data is presented below for both indicators, for which FAOSTAT geographic and economic categories were used.

Figure K.2 shows the level of protein (in grams per capita/day) by groups of countries (the line), and the percentage that comes from animal sources (columns).

Figure K.2. Total proteins and percentage of animal origin (2017-2019).

Source: Created with FAOSTAT data (2022).

Again on this indicator, LAC appears (on average) in better conditions than other developing regions and the world, although it is always worse than

developed areas. The only exception is the Caribbean, influenced mainly by Haiti.

Of the 28 countries with data on the percentage of calories from cereals and tubers, only three in LAC are above the global average and will then have a less diversified diet than the global average. Twenty-seven countries of LAC have data about the level of consumption of proteins and the percentage from animal sources. Of those, only six countries have a lower level of consumption of proteins per capita and a lower percentage of these proteins from animal sources than the global average.

Other examples may be simply the total consumption per capita/day of certain food products. Table K.1 shows the example of fruits, legumes and vegetables (in grams of availability of foods per capita/day), based on data from the Global Nutrition Report (2022).

Table K.1. Availability of fruits, legumes, vegetables and total (g/per capita/day).

	Fruits	Legumes	Vegetables	Total
Europe	129.3	167.0	13.8	310.1
Asia	69.7	208.0	25.6	303.3
Oceania	101.7	113.8	24.7	240.2
North America	91.7	128.9	19.4	240.0
Africa	67.7	138.7	25.0	231.4
Mexico and Central America	137.2	173.3	40.7	351.2
South America	110.7	120.3	47.6	278.6
Caribbean	115.6	103.2	31.0	249.8
World	79.9	180.8	25.9	286.6

**Source:** Created from data from the Global Nutrition Report (2022).

Central America appears with the greatest combined availability of the three products, while South America is somewhat below the global average and the Caribbean even more so. There is a notably low consumption in North America, especially compared to other developed regions such as Europe.

It is important to understand the methodology of these estimates, especially to define what is the variable being measured, such as availability, effective consumption, or another concept.

Annex L. Additional data on anthropometric indicators.

Figure L.1 presents a greater disaggregation of the indicator of stunting in LAC compared with the world.

**Figure L.1. Percentage of stunting (2015–2020).**
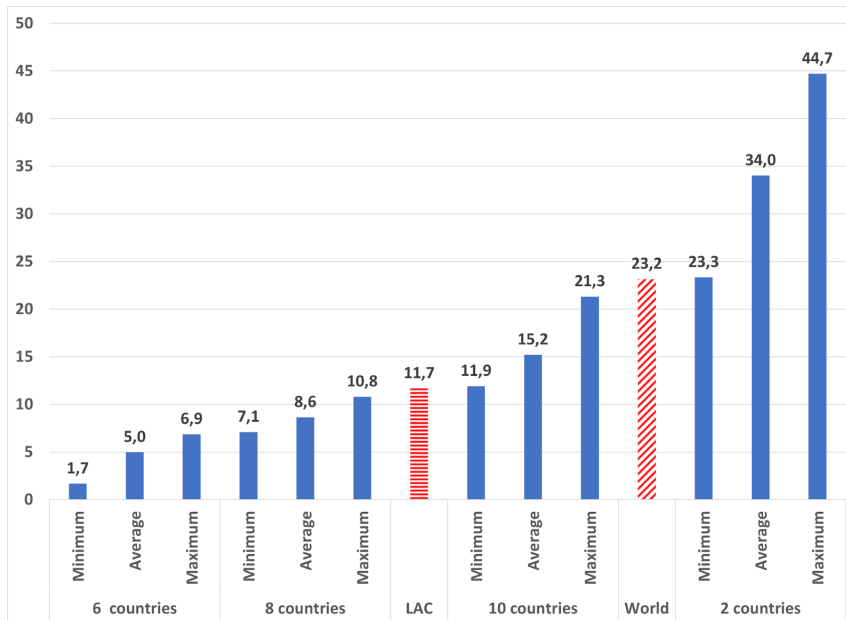
Source: Created based on FAOSTAT data (2022).

Only two countries in LAC have percentages of children with stunting higher (that is, worse) than the global average, while a further 24 countries have percentages lower than the global average. Of these, six have an average relatively close to that of high-income countries.

Figure L.2 presents a disaggregation of the wasting indicator in LAC compared with the world.

**Figure L.2. Percentage of wasting (2015–2020).**
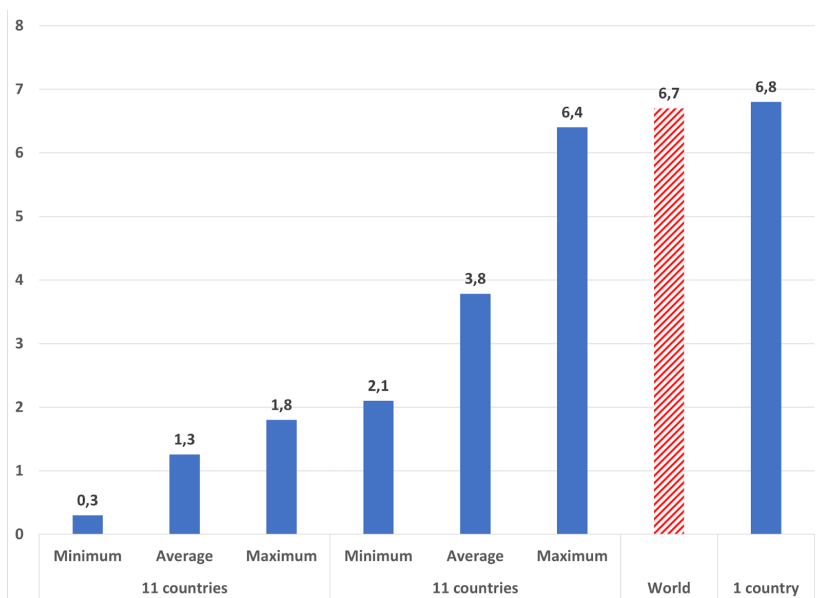
Source: Created based on FAOSTAT data (2022).

Of the 23 countries with data, only one is above the global average. Furthermore, there are 11 countries with an average of only 1.3 percent, or a fifth of the global average score.

In general, a more frequent and consistent collection of anthropometric data is necessary to go deeper into this analysis and resolve some paradoxes, such as a relatively higher incidence of problems of acute undernutrition in children in the English-speaking Caribbean that do not appear to correspond to other nutrition data from those countries.

Figure L. 3 presents a disaggregation of the indicator for overweight (for children up to 5 years of age) in LAC compared with the world.

**Figure L.3. Percentage of overweight (2015–2020).**
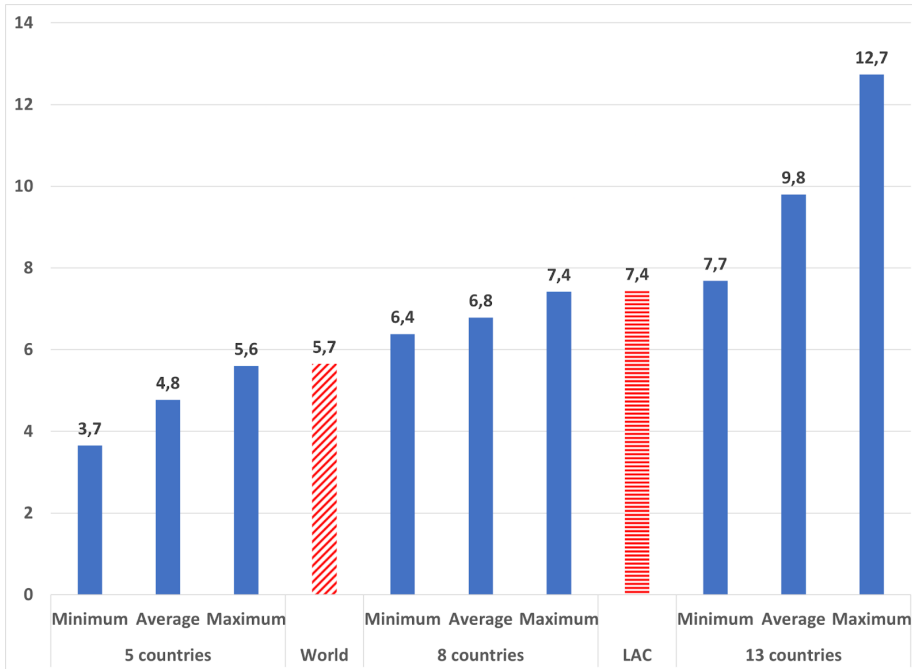
Source: Created based on FAOSTAT data (2022).

Of the 26 countries with data in LAC, 21 present worse child overweight indicators than the global average, especially the countries in South America and the English-speaking Caribbean.

Figure L.4 shows a more disaggregated view of the percentages of obesity in adults in LAC.

Figure L.4. Percentage of obesity in people 18 years and over (2015-2016).
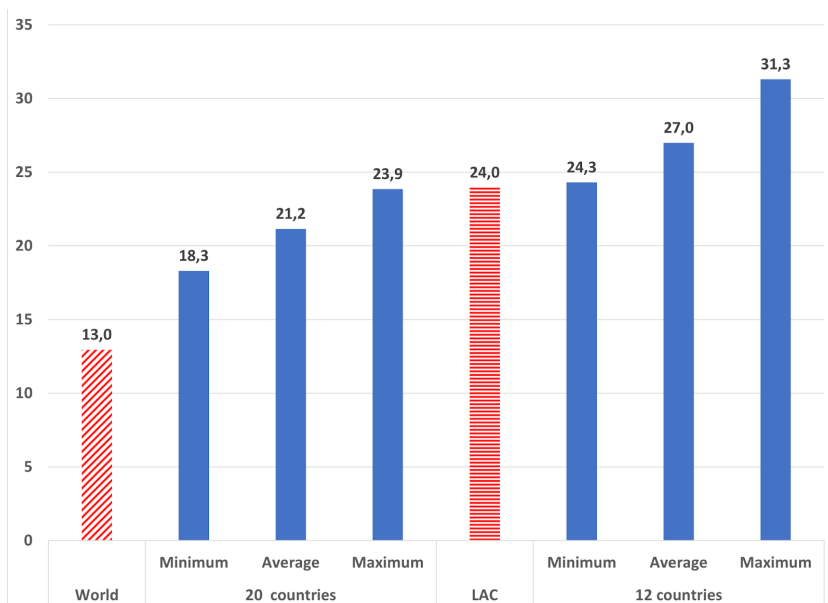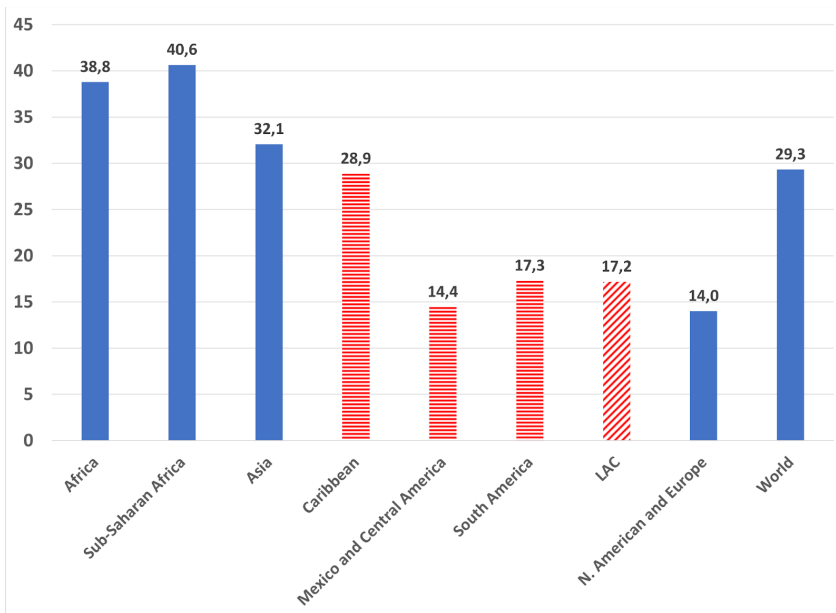

Source: Created based on FAOSTAT data (2022).

The 32 countries of LAC with data are clearly above the global average, including those that appeared with high indicators of undernutrition. This reflects the considerable inequalities that still affect the region, with people going hungry while others are overfed. This is also the result of low-quality diets among the poor, which is increasing the number of obese people even in low-income groups. As mentioned in the main text, the issue of obesity has become the main malnutrition problem in LAC, with an average obesity (24 percent of the population) that clearly exceeds the percentage suffering undernutrition or hunger (7.8 percent on average in the last years, although it has recently risen to around 9 percent).

There are other anthropometric indicators, such as anemia in women of reproductive age. Figure L.5 shows the data for different subregions of LAC, compared with the global average and other regions.

Figure L.5. Prevalence of anemia in women between 15 and 49 (2015–2019).

Source: Created based on FAOSTAT data (2022).

The Caribbean shows the highest levels of anemia, although these are slightly below the global average. Mexico and Central America have the lowest levels in LAC and are close to those of the developed countries.

As mentioned in different parts of this document, more consistent collection and statistical processing of anthropometric data is needed.