



Review

Serving size and consumption frequencies in food-based dietary guidelines: A global scoping review

Beatrice Pellegrini^a, Federica Grant^{b,c,d}, Lara Chehade^a, Cristian Del Bo^a, Patrizia Riso^a, Daniela Martini^{a,*}, Laura Rossi^e

^a Division of Human Nutrition, Department of Food, Environmental and Nutritional Sciences (DeFENS), Università Degli Studi Di Milano, 20133 Milan, Italy

^b Department of Agricultural, Forestry and Food Sciences (DISAFA), University of Turin, Grugliasco, Italy

^c Department of Agricultural, Environmental and Food Sciences (DiAAA), University of Molise, Campobasso, Italy

^d CREA Council for Agricultural Research and Economics-Research Centre for Food and Nutrition, Rome, Italy

^e Department of Food Safety, Nutrition and Veterinary Public Health, National Institute of Health, Rome, Italy

ARTICLE INFO

Keywords:

Servings

Labelling

Food based dietary guidelines

Nutrition policy

ABSTRACT

Food-based dietary guidelines (FBDGs) shape health and nutrition policies, promoting balanced and sustainable diets. They recommend appropriate serving sizes and consumption frequencies across food groups. A clearer understanding of how serving sizes are defined globally is also essential for advancing harmonized food-labeling practices, an increasingly relevant objective for public health and industry. This study examines how these aspects are addressed globally, assessing the type and consistency of information provided. FBDGs were retrieved from the FAO database if available in English or Italian and published before March 2024. Of 100 documents, 60 were included in the final analysis. Quantitative data on serving sizes and consumption frequencies were found in 35 FBDGs, while 16 provided partial details, and 9 lacked quantitative advice. High variability emerged, particularly in serving sizes for dairy products and how consumption frequency is expressed (daily vs. weekly). While some countries provided detailed quantitative guidance, others relied on qualitative or partial recommendations. This inconsistency complicates policy development and public understanding. Standardizing serving size definitions can improve food labeling, dietary recommendations, and global health policies by enabling better comparisons of dietary data across populations. Greater harmonization at regional levels is crucial for strengthening food policy actions and promoting healthier diets.

1. Introduction

Malnutrition, which encompasses both undernutrition and overnutrition, is a global issue affecting every country (WHO, 2024). At least one form of malnutrition, such as starvation, stunting, wasting, micronutrient deficiencies, overweight, or diet-related non-communicable diseases, impacts a third of the world's population (FAO; IFAD; UNICEF; WFP; WHO, 2019; GBD collaborators 2017, 2019). The consequences include preventable health issues, premature mortality, and substantial economic burdens, with costs estimated at up to USD 3.5 trillion annually, of which obesity alone accounts for USD 500 billion (Global Panel Global Panel on Agriculture and Food Systems for Nutrition, 2016).

Unhealthy diets are the leading cause of malnutrition and the second

most significant risk factor for mortality and disability worldwide, highlighting the detrimental impact of poor dietary habits (Phelps et al., 2024). Addressing malnutrition in all its forms requires a strong focus on dietary choices and nutritional behaviours. However, individual food consumption decisions represent only one element of the broader food system landscape. The current food production system is both a major contributor to environmental degradation and a driver of natural resource depletion (Swinburn et al., 2019). For example, food systems account for a substantial share (20–35%) of global greenhouse gas (GHG) emissions and play a key role in land conversion, deforestation, and biodiversity loss (Crippa, Solazzo, & Guizzardi, 2021). Agriculture alone is responsible for approximately 70% of global freshwater withdrawals and significantly contributes to water pollution (Willett et al., 2019). With the global population projected to reach 9.7 billion by

* Corresponding author.

E-mail addresses: beatrice.pellegrini@unimi.it (B. Pellegrini), federica.grant@unito.it, federica.grant@crea.gov.it (F. Grant), lara.chehade@unimi.it (L. Chehade), cristian.delbo@unimi.it (C. Del Bo), patrizia.riso@unimi.it (P. Riso), daniela.martini@unimi.it (D. Martini), laura.rossi@iss.it (L. Rossi).

<https://doi.org/10.1016/j.foodres.2026.119225>

Received 9 August 2025; Received in revised form 25 March 2026; Accepted 14 April 2026

Available online 16 April 2026

0963-9969/© 2026 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

2050, these environmental pressures will only intensify, making the current food systems increasingly unsustainable (Crippa et al., 2021). The Intergovernmental Panel on Climate Change (IPCC), in its most recent report, recognized that “Consumption of healthy and sustainable diets presents major opportunities for reducing GHG emissions from food systems and improving health outcomes” (IPCC, 2019).

In 2019, the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) jointly published a document titled *Sustainable Healthy Diets: Guiding Principles* to favour, through 16 points, the sustainable transition of diets (FAO; WHO, 2019). In this document, paramount importance is given to the *Actions for The Implementation of Sustainable Healthy Diets*, specifically in reference to food policy documents and food based dietary guidelines. Actions n. 9 and n. 8 respectively suggest: “Promote capacity development strategies for behaviour change, including consumer empowerment, and effective food and nutrition education” and “Develop national food-based dietary guidelines that define context-specific Sustainable Healthy Diets by taking into account the social, cultural, economic, ecological and environmental circumstances.”

In the same year, the European Commission introduced the Green Deal, the most ambitious green renovation plan to date, aimed at achieving climate neutrality by 2050. As part of its efforts to promote more sustainable food consumption, the Green Deal developed the Farm-to-Fork Strategy. This operational framework identifies front-of-pack and informative food labelling, along with the implementation of key food policy documents such as Food-Based Dietary Guidelines (FBDGs), as essential tools to guide consumers toward healthier dietary choices and habits.

Given the increasing global burden of non-communicable diseases and obesity (NCD-RisC, 2024) there is an urgent need to support governments and, in turn, individuals in enhancing adherence to nutritional recommendations. Understanding serving sizes and consumption frequencies plays a crucial role in translating nutrition guidelines into practical and real-life applications that can influence consumer behaviour (Almiron-Roig, Navas-Carretero, Emery, & Martínez, 2018). However, consumers are often exposed to diverse and sometimes contradictory messages regarding appropriate food quantities, which can create confusion and hinder informed decision-making (Salesse, Eldridge, Mak, & Gibney, 2024). This highlights the importance of clear, consistent communication strategies to reinforce accurate perceptions of serving sizes and consumption patterns, empowering consumers to make informed choices that align with both health and sustainability goals (Livingstone & Pourshahidi, 2014).

Correct information on food servings, serving sizes, and appropriate consumption frequencies is essential for achieving a well-balanced diet, starting with their proper definition. According to the American food based dietary guidelines and the National Heart, Lung, and Blood Institute (NIH), *portion* refers to the amount of food an individual chooses to eat at any given time, which can vary widely based on personal preferences and context. In contrast, *serving* is a standardized unit of measurement used as a dietary guideline for maintaining a balanced diet. For instance, a *serving* might be defined as one slice of bread, or one cup (8 oz) of milk (National Heart, Lung, and Blood Institute (NHLBI), 2013; U.S. Department of Agriculture and U.S. Department of Health and Human Services, 2020). The Italian Dietary Reference Values for Nutrients and Energy (LARN) also adopted this distinction, reinforcing its relevance in dietary recommendations. According to LARN, a *portion* is described as the quantity of food that an individual consumes during a specific eating occasion, emphasizing its subjective and variable nature. Meanwhile, *servings* are standardized units, typically expressed in grams (g) or millilitres (mL), identified as a reference for a balanced diet. These can also be represented using natural or commercial units (e.g., a slice of bread or a tin) or household measures (e.g., teaspoons or cups) (Società Italiana di Nutrizione Umana (SINU), 2024).

The concept of serving size is gaining increasing importance both nationally and globally, as it is recognized as a key factor in achieving a

balanced diet (Carruba et al., 2023). However, serving size alone does not determine total daily energy intake. Rather, it is the combination of the energy content of each serving and the frequency of consumption that ultimately influences overall dietary energy intake (Higgins et al., 2022). In addition, the frequencies of consumption identify the number of servings to be consumed in a day or week and vary depending on the foods and the characteristics of the individual (age, sex, physical activity, particular physiological conditions) (Consiglio per la Ricerca in Agricoltura e l'analisi dell'Economia Agraria (CREA), 2018). Servings and consumption frequencies, being fundamental aspects for the population's nutrition, are increasingly discussed in the development structure of FBDGs. In accordance with the information and premises presented, the foundation of optimal health lies in a varied, balanced, and well-proportioned diet. This can be achieved by consuming appropriate quantities and adhering to correct frequency guidelines for foods from all food groups. Such recommendations should be incorporated into the dietary guidelines of nations, serving not only as the basis for nutritional policies but also offering guidance to citizens on adopting and maintaining a healthy diet. Additionally, these guidelines should aim to reduce the environmental impact of dietary choices while respecting local traditions and habits. Given this policy context, the harmonization of serving size definitions also holds increasing relevance for the food-labelling sector, where standardized reference quantities are essential for ensuring consistency, transparency, and comparability of nutritional recommendations across countries.

Against this background, the present study aimed to assess whether and how the issues of serving sizes and consumption frequencies are addressed in the FBDGs. Specifically, the purpose of this research was to investigate the nature of recommendations (quantitative or non-quantitative) provided in global FBDGs regarding serving sizes and consumption frequency. Similarities as well as differences and gaps will be assessed highlighting areas where definitions may vary significantly between national guidelines. A proposal of evidence-based strategies for harmonizing serving size and consumption frequency recommendations at least within the same geographical macro-region (e.g., Europe) will be proposed. The policy impact of this work is related to the possibility of improvement of clarity and effectiveness in promoting healthy eating behaviours through FBDGs, while also informing future efforts toward greater alignment between dietary guidance and food-labelling practices.

2. Materials and methods

2.1. FBDG collection

All the FBDGs were collected from the FAO dietary guidelines repository (available at <https://www.fao.org/nutrition/education/food-based-dietary-guidelines>). The search and data collection began in February 2023 and was last updated in March 2024. During the screening process, additional searches were conducted in other online open sources (e.g., Google) to ensure that the documents obtained from the FAO repository were the latest versions of the guidelines.

FBDGs were considered for the analysis according to the following inclusion criteria: I) presence of official FBDGs or at least one related document (e.g., graphical guide, public leaflet, brochure, or extended scientific dossier) either in the FAO online repository or linked through an official national website. When two or more documents were available, we prioritized the version intended for the general public; if this was not available, we referred to the extended scientific dossier. When more than one public-facing document existed, information was cross-checked for consistency. In cases where two documents were available and each contained only partial information, data from both sources were matched and merged to obtain complete details on serving sizes and recommended consumption frequencies; II) availability of an English or Italian version of the document; III) having the general population as the target group rather than specific age groups; IV) being a

national policy document. Conversely, FBDGs were excluded if they were published only in a language other than English or Italian, if they were developed exclusively for specific target groups (e.g., children), or if they were regional versions while country-specific national FBDGs were available.

Included FBDGs were classified according to the level of detail provided in their dietary recommendations, as follows:

1. quantitative guidelines that provided precise serving sizes for each food group;
2. semi-quantitative guidelines that provided detailed quantity recommendations, but not consistently across all food groups;
3. qualitative guidelines that did not report numerical values, offering only general recommendations.

It is important to underline that, in this paper, the term “serving size” was used preferentially to avoid confusion with the concept of “self-selected portion”, which corresponds to how much food a person chooses to eat at one time.

2.2. Data collection

To better display the whole set of recommendations gathered in tables, all the data was categorized as quantitative, semi-quantitative, or non-quantitative. For each of these categories, all the information was reported categorizing food groups as: “plant-based foods” (including grains and breads, potatoes and starchy tubers, fruit, vegetables, legumes, nuts, and seeds); “animal-based foods” (including meat, fish, eggs, milk, and dairy products) and “other foods” (including foods like fats and oils, sugar and sugary foods, salt and salty foods, and alcoholic beverages and water).

2.2.1. Qualitative information definition, screening and collection

Qualitative information collected included the publication year, the official name of the guidelines, the document language, availability of the “find text” search function, and the document type (PDF, informative brochure, posters, flyers, and online web pages). These details were gathered for all the nations present in the FAO repository.

2.2.2. Quantitative information definition, screening and collection

The quantitative information collected was the quantities in standard units of measure or household measures (e.g. cups, tablespoon, etc.) for each serving size of food or food group, and frequency of consumption for the reported serving size. All documents were scanned for the presence of keywords using the “find text” function, and manually when the search function was unapplicable due to the obsolescence of the document's format (e.g., scanned documents transformed in PDF). The keywords entered in the find text bar were: “portion”, “portion size”, “serving”, “serving size”, and “frequency of consumption”. All the searched words were verified to be present in the appropriate context. Other information, such as definition of individual serving sizes for single foods or food groups, consumption frequencies, and differentiation of consumption frequencies and/or individual servings, were collected. The whole set of data was independently gathered by three authors and later compared for consistency in the obtained information.

3. Results

3.1. Formats of the collected FBDGs

The FAO repository included a total of 100 documents (Fig. 1), distributed in the following geographical areas: 11 countries in the *Africa* region, 18 countries in the *Asia and the Pacific* regions, 6 countries in the *Near East* region, 34 countries in the *Europe* region, 29 countries in the *Latin America and Caribbean* region, and 2 countries in the *North America* region (Table 1). Relative documents were downloadable for each country, except for Mongolia and Nepal for which no link to any document was present. A total of 98 documents were downloaded. Among them, 37 documents were excluded since neither an English, nor an Italian version was available, and 1 document relative to Cambodia was excluded since only recommendations pertaining exclusively to the school-age children/adolescents were displayed. Regional recommendations such as the *Food Dome Dietary Guidelines for Arab Countries* (covering Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen, (Rishmawi, 2015) or the *Nordic Nutrition Recommendations* (Denmark, Finland, Iceland, Norway, and Sweden), were not included since many of them had national food policy document available on the

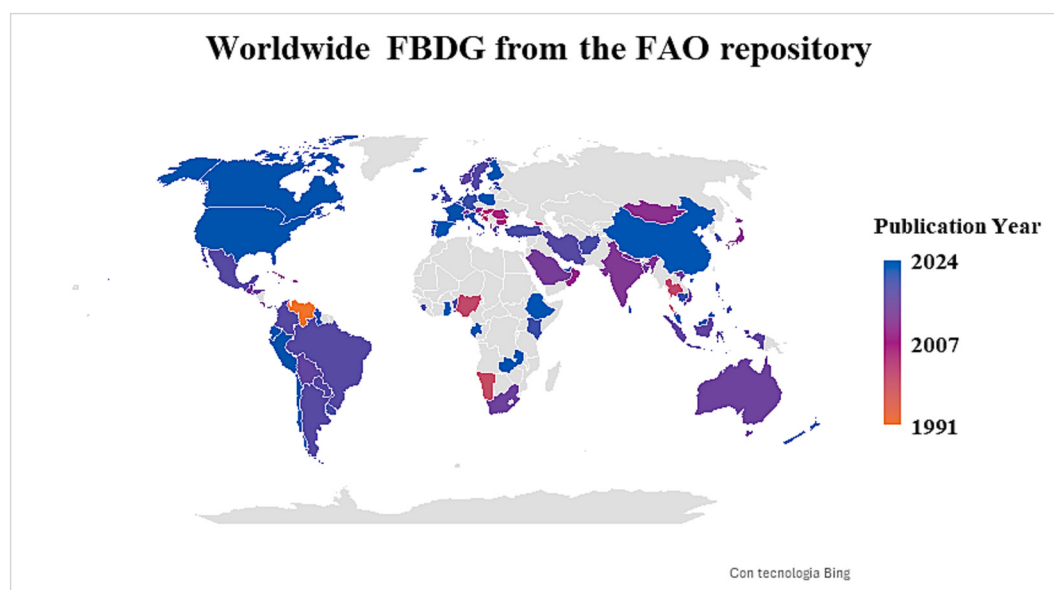


Fig. 1. Worldwide FBDG available in the FAO repository as of March 2024 ($n = 100$) are color-coded to highlight publication periods: orange for 1991–2007, purple for 2007–2012, and blue for 2013–2024. The documents span from Venezuela's 1991 publication to Ghana's in 2023. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Table 1

Screening of all the documents included according to quantitative on non-quantitative recommendations, divided by continent, and for income levels.

	Quantitative (N = 35)	Semi-quantitative (N = 16)	Non-quantitative (N = 9)
<2010	N = 7	N = 2	N = 5
2011–2019	N = 17	N = 12	N = 4
>2020	N = 11	N = 2	N = 0
Europe	N = 11	N = 9	N = 0
Africa	N = 5	N = 2	N = 2
Asia and Middle East	N = 12	N = 4	N = 1
North America	N = 2	N = 0	N = 0
Latin America and Caribbean	N = 5	N = 1	N = 6
High Income	N = 16	N = 12	N = 2
Low income	N = 3	N = 1	N = 0
Upper middle income	N = 9	N = 3	N = 6
Lower middle income	N = 7	N = 0	N = 1

FAO online database. For this reason, 60 FBDGs documents were finally included in the analysis of the present work. In some cases, alongside the official document, a graphical representation of the recommendations intended for the public was also provided. This was the case of Ethiopia, Namibia, Sierra Leone, Australia, Bangladesh, China, Japan, Philippines, Republic of Korea, Sri Lanka, Thailand, Qatar, Saudi Arabia, France, Greece (available only online), Netherlands, Spain, Switzerland, Antigua and Barbuda, and the United Kingdom. The countries for which only the detailed policy document was available included Kenya, Nigeria, South Africa, Zambia, Afghanistan, India, New Zealand, Lebanon, Oman, Albania, Belgium, Bulgaria, Italy, Turkey, Belize, Brazil, the United Kingdom, Canada, and USA. Countries that provided only a brief English version for the public or a brochure included Fiji, Seychelles, Denmark, Georgia, Germany, Greece, Ireland, Israel, Malta, Norway, Bahamas, Barbados, Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.

3.2. Serving size and consumption frequency recommendations

As reported in Fig. 2, quantitative recommendations on serving size and frequency of consumption was observed in 35 FBDGs, while semi-quantitative recommendations was found in 16 FBDGs (i.e., partial recommendations such as numerical data only for frequencies, servings, or certain food groups). In nine FBDGs, only qualitative

recommendations were found, with no indication of serving size or frequency of consumption. All the servings retrieved in the studied FBDGs are shown and synthesized in the Supplementary Tables. Supplementary Tables 1a, 1b, and 1c refers to quantitative FBDGs. Supplementary Tables 2a, 2b, and 2c show data of semi-quantitative FBDG while Supplementary Tables 3a and 3c present non-quantitative recommendations. Supplementary table 3b is absent due to missing information. In detail sub-tables “a” refer to plant-based foods, sub-tables “b” to animal-based foods, and sub-tables “c” to other foods. The food items included in the plant-based, animal-based and other foods groups are defined in the section.

3.3. Data collection

3.3.1. FBDGs with quantitative recommendations

The three big gatherings to collect all the quantitative recommendations relative to serving sizes and consumption frequencies were made according to the nature of the foods: “plant-based foods”, “animal-based foods”, and “other foods”. Among the FBDGs reporting quantitative descriptions of servings ($n = 35$), a high variability was observed, mainly regarding the modalities used to express the amounts of different foods (e.g., amount per day or per week) or in terms of how specific food items (e.g., milk, yogurt, cheese) or food groups (e.g., dairy products) were expressed. All this information can be consulted in Supplementary Tables 1a, 1b and 1c. For example, in Kenya's FBDGs, serving sizes were provided in mixed modalities, with some food groups expressed in grams (g) or milliliters (mL) and others in household measures (e.g., cups, teaspoons, a handful, etc.). Milk and dairy products were among the food groups showing the greatest variability (Supplementary table 1b). For instance, Zambia's FBDGs recommended a daily intake of one serving of milk and one of dairy products, corresponding to 245 g per serving of milk, 200 g per serving of yogurt or fermented milk, and 40 g per serving of aged cheese. On the other hand, Italy's FBDGs suggested a daily consumption of three servings of milk and yogurt (1 serving = 125 g) and three servings of aged cheese (1 serving = 50 g) or soft cheese (1 serving = 100 g) per week. Similarly, the recommendations for grains, cereals, bread, and tubers exhibited substantial variability depending on the staple carbohydrate sources and cultural habits (Supplementary Table 1a). For example, Japan's FBDGs recommended six servings of rice per day (1 serving = 150 g of cooked rice), while Mexico's FBDGs suggested a daily intake of five to six servings of corn tortillas (1 serving = 30 g) or bread. In contrast, Italy's FBDGs recommended three to four servings of grains or pasta daily (1 serving = 80 g of cooked pasta or 50 g of bread), reflecting the Mediterranean dietary tradition. Such differences highlighted the influence of local food availability and cultural

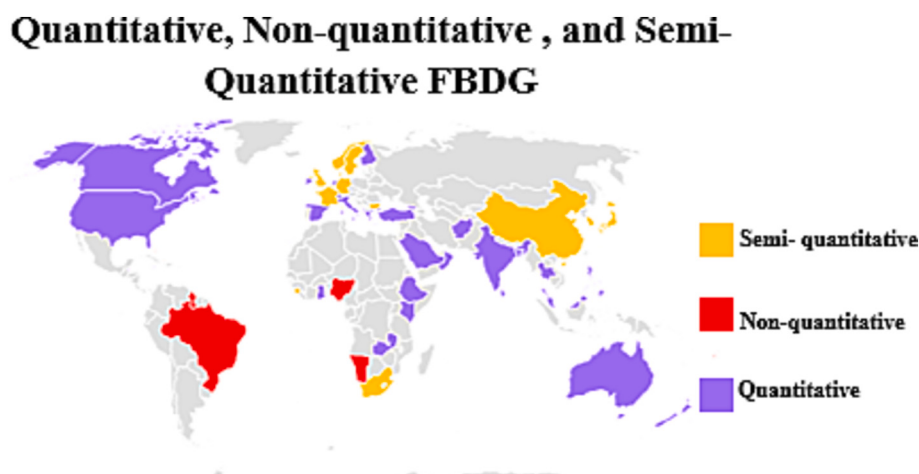


Fig. 2. Worldwide FBDG included from the FAO repository ($n = 60$) are color-coded to highlight publication types: violet for quantitative, red for non-quantitative, and yellow for semi-quantitative. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

preferences on dietary guidelines worldwide. It should be noted that for some plant-based and animal-based categories, a small serving unit is reported. In this case, the frequency of consumption is higher, since it may serve as a multiplier of the unit to obtain a final serving, and then to indicate how many times to include it in the diet. For example, in Bangladesh or India the serving for grains corresponds to 30 g while the frequency of consumption is equal to 9–15 servings per day. Moreover, in the United States of America, the reference unit for meat and fish is reported as one ounce for both the categories, and the frequency of consumption corresponded to 26–31 or 8–10 ounces (oz) per week, respectively. This means that some of the frequencies recommended in these two examples could be used to create the final serving, while the remaining ones to calculate the number of times to consume that type of food during a larger timespan (e.g. a day or a week).

3.3.2. FBDGs with semi-quantitative or partial recommendations

The 16 FBDGs with partial recommendations on serving size or consumption frequency varied in terms of the typology of details that were provided. The information of these guidelines can be consulted in Supplementary Tables 2a, 2b and 2c. Some countries, such as South Africa and China, recommend food quantities as total daily amounts. In the FBDGs of Qatar and Belgium, quantities are provided in grams only for specific food groups. For instance, the Belgian guidelines recommend, “Eat at least 125 g of whole-grain products every day”. In the Bulgarian FBDGs document, servings are not quantified, thus quantities and consumption frequencies are provided mainly in a qualitative manner with quantitative recommendations limited to some food groups. Similarly, the Danish dietary guidelines recommend total quantities for certain food groups, while the French guidelines include frequencies (for fruit and vegetables, legumes, dairy products, and fish), serving quantities (only for fruit and vegetables, and nuts), and total intake (e.g. weekly meat consumption), focusing on moderation and balance rather than specific serving sizes. This mixed approach aligns with the French emphasis on flexibility and the cultural enjoyment of food while still promoting healthful choices. The German FBDGs also adopt a mixed approach, providing semi-quantitative recommendations. The German guidelines provide quantitative targets for core food groups such as fruits, vegetables, whole grains, dairy products, fish, and legumes. However, for other food groups like meat, fats, sugary foods, and alcohol, the recommendations are primarily qualitative, emphasizing moderation and healthier choices without quantitative limits. In Israel's FBDGs, recommended intake is provided only as the number of servings per day, with semi-quantitative recommendations in grams or litres provided only for meat (no more than 300 g per week) and water (at least 1.5–2 litres (L) l per day). The Norwegian guidelines provided single serving quantities, total intake, and both qualitative and quantitative consumption frequencies, while the Swedish guidelines included total intake and qualitative consumption frequencies. The UK guidelines, *A Quick Guide to the Government's Healthy Eating Recommendations*, specified serving sizes and consumption frequencies, but not across all food groups. For instance, quantitative recommendations are not provided for the “Potatoes, bread, rice, pasta, and other starchy carbohydrates” group and the “Dairy and alternatives” group. In the *Eatwell Guide* leaflet, the only quantitative recommendations provided pertain to the recommended frequency of fish consumption that is “2 portions of sustainably sourced fish per week, one of which is oily”. South Africa recommends a daily consumption of 400–500 mL of milk, without distinguishing between milk, fermented milk, yogurt, and their derivatives, although the equivalent of serving is provided. Another example is presented by the Belgian guidelines, which advise a daily intake range of 250–500 mL for milk, yogurt, and dairy products without specifying the serving size for a single consumption occasion.

3.3.3. FBDGs with non-quantitative and partial recommendations

Nine FBDGs did not include quantitative intake recommendations, specifically those from Namibia, Nigeria, Fiji, Antigua and Barbuda, the

Bahamas, Brazil, Dominica, Guyana, and Saint Lucia. Instead of definite serving sizes or numeric recommendations, these guidelines provided qualitative instructions, using general terms such as “consume every day,” “consume regularly,” or “reduce intake.” This qualitative approach provides general guidance on encouraging or limiting specific food groups, without prescribing exact quantities. Detailed information for each guideline is available in Supplementary Table 3a and 3c.

3.4. Similarities and differences among the documents

The FBDGs available in the FAO repository display considerable heterogeneity, providing quantitative, qualitative, combined, or partial dietary recommendations. Specifically, the quantitative details of serving sizes and consumption frequencies are not always specified across all countries' documents, and when included, they are sometimes lacking in detail. Besides the differences in the provision of recommendations, some guidelines exhibit inconsistencies in the recommended values and units of measure within the same document. For instance, Ghana shows inconsistencies between the serving sizes and consumption frequencies reported in the text and those presented in the tables, in South Africa, one of the first chapters dedicated to fruits and vegetables specifies that a single serving for adults corresponds to 80 g to be eaten 5 times per day; however, later in the document the individual daily serving of fruits and vegetables becomes 2 cups of fruit and 2½ cups of vegetables. Zambia's FBDGs faces a similar issue, with different quantification of serving of the same food group across the document. Concerning European countries, discrepancies were observed in Albania FBDGs providing servings and consumption frequencies, with variations and a different breakdown by age groups in different chapters of the same document. Moving to Saint Kitts and Nevis FBDGs that suggest a daily diet through a table, recommending different daily serving quantities in other parts of the document. For Philippines FBDGs the same discrepancies were present in the text and in the online version of the document, Saint Vincent and the Grenadines FBDGs provided a brochure with key elements, including the quantity corresponding to a single serving and consumption frequencies. However, discrepancies arise between this brochure and the “*Facilitators Guide – Food-Based Dietary Guidelines of St. Vincent and the Grenadines*,” as they recommend different daily serving quantities. Guidelines of Thailand, Oman, Finland, Ireland, Malta, Belize, Grenada, Jamaica, Saint Vincent and the Grenadines presented the servings in household units like “slice of bread”. Similar units are used for other foods in other countries, such as “glass of milk”, “slice of cheese”, “small bowl of salad”, “handful of nuts”, or “chicken thigh/wing”, without providing an equivalent quantity in standard units of measure.

3.4.1. Imaging in food-based dietary guidelines

Several FBDGs included graphical elements or images intended to facilitate public understanding of dietary recommendation. However, visual representations varied considerably across countries. In Japan's guidelines, for example, illustrations such as half a fish are used to represent a serving for the “fish and meat dishes” group, or half a hamburger for the “meat” group. These images lack corresponding numerical or weight-based specifications, resulting in vague guidance. Similarly, serving descriptions like “a portion of 3 centimetres” for meat or “a cube of cheese” in the Belize FBDGs are provided without quantitative equivalents, limiting their practical applicability. Differences were also observed in the conversion of household measures into standard units (e.g., grams, millilitres, or ounces), which are sometimes omitted or sourced from national documents outside of the FBDGs. For example, the U.S. uses the “Code of Federal Regulation, Title 21 101.9 – Subpart A” of the FDA, defining a teaspoon as 5 mL, a tablespoon as 15 mL, a cup as 240 mL, 1 fluid ounce (fl oz) as 30 mL, and 1 oz as 28 g. However, discrepancies exist even within the Americas region. For example, Canada considers one cup to be 250 mL, in contrast to the U.S. 240 mL standard. Moreover, many guidelines fail to clearly distinguish

between an ounce (oz), a unit of weight, and a fluid ounce (fl oz), a unit of volume, despite the potential for confusion. To mitigate such inconsistencies, in 2021 Saint Kitts and Nevis, in collaboration with the FAO, published a “Manual of Food Portion Quantification” (Crispim et al., 2021). This Manual is intended to support nutrition education programs by highlighting the importance of appropriate portion sizes for obesity control, food waste reduction, cost management, and meeting nutritional needs across the Caribbean. It includes 121 photos of individual foods and recipes, accompanied by household measurements (e.g., cups, spoons), with 85 photos taken in Saint Kitts and Nevis and 36 in Brazil. All images were captured using a standardized methodology. The Manual provides both the weight of each serving and the volume of all utensils used, offering a visual and quantitative reference. Nevertheless, this manual is not included within the FAO repository page for Saint Kitts and Nevis and has not been officially integrated into the country's food-based dietary guidelines, as it is considered a separate supporting tool rather than part of the core guidelines framework.

3.5. Heterogeneities in delivered recommendations: units of measure and serving sizes

The analysis revealed considerable variability in serving size definitions across countries. These differences were associated primarily with:

1. The state of the food (raw or cooked): for instance, some guidelines specify raw weights, as seen with plant-based foods in Bangladesh, pasta, porridge, and legumes in Jamaica, and fish in Malta or New Zealand. Conversely, other guidelines use cooked measurements, such as for cereals and pasta in Finland, lean meat in Belize, Canada, Ireland and Lebanon, and fish in Afghanistan.
2. The measurement system applied: some FBDGs use weights (e.g., Italy, Kenya, Malta, Spain) while others rely on household measures (e.g., Jamaica, Lebanon, Philippines, Saint Kitts and Nevis).

4. Discussion

The analysis of the FBDGs available through the FAO repository highlights a heterogeneous landscape in both document availability and format across different world regions. Notably, recent documents have shown an increase in the inclusion of quantitative recommendations, while non-quantitative advice on serving size and consumption frequencies has become less common. While 100 documents were initially listed, only 60 could be included after applying inclusion criteria based on language and target population, indicating disparities in accessibility and scope. Exclusion of regional frameworks such as the Food Dome Dietary Guidelines for Arab Countries and the Nordic Nutrition Recommendations reflects an emphasis on nationally tailored guidelines rather than supranational approaches. This is consistent with previous findings suggesting that national FBDGs are generally more aligned with local food availability, cultural dietary practices, and policy priorities (Herforth et al., 2019; Salesse et al., 2024). The diversity in document formats, ranging from comprehensive policy reports to simplified public brochures, suggests significant differences in communication strategies and target audiences among countries. Nations such as Japan, France, and the United Kingdom have integrated both technical and visual elements in their guidelines, providing accessible educational materials for the general public while maintaining detailed technical references for professionals. In contrast, other countries (e.g., Kenya, Italy, Brazil) focus on in-depth policy documents aimed primarily at policymakers or health professionals. Such variation in presentation, accessibility, and content depth indicates a lack of standardized guidance on how dietary recommendations should be communicated internationally. Several FBDGs included graphical elements or images intended to facilitate public understanding of dietary recommendations as widely documented also by Tiboni-Oschilewski et al. (2025), but the clarity and

precision of these visual representations varied considerably across countries. Similar observations have been made by Hughes, Pearson, and Grafenauer (2022), who reported substantial diversity in the structure and dissemination strategies of national FBDGs across regions. This heterogeneity has implications for comparability and implementation. Countries with both detailed and simplified formats may achieve broader public reach and understanding, while those relying solely on technical documentation may face challenges in effectively conveying dietary recommendations to the general population. Furthermore, the coexistence of multiple document types within the same country (e.g., technical reports and public brochures) may enhance accessibility but could also create discrepancies or confusion if messages are not aligned. Overall, the findings highlight the need for international coordination in defining minimum standards for FBDG format and presentation. Furthermore, implementation activities should focus on allocating funding to establish the dissemination of the different types of documents produced, as only some FBDGs have included this kind of operations (Wijesinha-Bettoni et al., 2021; Yoong et al., 2023). These actions will ensure accessibility, cultural relevance, and consistency of public health messaging across nations.

The observed heterogeneity in serving size definitions underscores the influence of cultural, methodological, and measurement factors on national dietary guidelines. Differences in whether foods are weighed raw or cooked, or expressed in grams versus household measures, make direct comparison across FBDGs challenging. Cultural context plays a key role: in some countries, a particular food might be considered a main dish, leading to a larger serving size. In contrast, the same food may be classified as a side dish in other countries, resulting in a smaller recommended unit serving. Or in other cases, smaller unit servings are used due to different strategies to set up recommendations. In these cases, reporting small serving sizes means that these units should be combined to understand the quantity to be consumed in one final serving for an eating occasion, making it more difficult for people to understand the recommendations, which should be accessible to their end users. This variability in cultural classification and differences in serving sizes across food groups was also reported by Carruba et al. (2023) who analyzed dietary guidelines from 24 European and 10 non-EU countries and included Cyprus and the Czech Republic, which were not examined in the present study. One of the findings of the cited paper was related to the observation that serving sizes for foods like pasta and potatoes fluctuate across European nations based on local traditions. (Carruba et al., 2023). Some staple foods, however, exhibit more consistency in serving size across countries, as also observed in similar works, (Comerford et al., 2021) with minor variations. For instance, a single serving of milk is generally agreed to be between 200 mL and 250 mL, although smaller amounts are specified in certain countries, such as Bangladesh and France (150 mL), Italy (125 mL), and Japan, Jamaica, Saint Kitts and Nevis, and Saint Vincent and the Grenadines (120 mL, FDA conversion). For eggs, most countries agree on a single serving as 1 or 2 eggs, but the frequency recommended vary widely, from daily consumption (e.g., Turkey, Seychelles, Sri Lanka, and Bulgaria) to 2–4 servings weekly (e.g., USA, Malta, Italy, India, Greece, and Spain). Quantifying serving sizes in nutritional guidelines plays a crucial role in promoting healthy eating behaviours and preventing chronic diseases. Clear and standardized serving sizes help individuals better understand serving control, align their food intake with dietary recommendations, and avoid an unbalanced food intake both in terms of overeating and insufficient assumption leading to different forms of malnutrition (Liu, Allman-Farinelli, & Rangan, 2024). Quantified serving sizes provide tangible benchmarks for people, enabling them to translate theoretical dietary recommendations into practical daily choices. The examined policy documents agreed that a balanced diet should include foods from all groups in appropriate servings coherently with the recommended consumption frequencies, and that FBDGs should provide this guidance. However, many national dietary guidelines do not comprehensively address serving sizes and consumption frequencies. Even when these

aspects are included, the guidelines often lack clarity and practical advice for implementation resulting in a low adherence to recommendation. Some recent studies show low or declining adherence to national dietary recommendations at the population level. For example, recent Italian data indicate that large proportions of adults fail to meet recommendations for key food groups such as fruit, vegetables, and eggs, while exceeding recommended intakes of sweets and alcoholic beverages (Iacoponi, Cardamone, Di Nucci, Agrimi, & Silano, 2025; Lotti et al., 2024). In this context, a monitoring system across countries using indicators that measure the adherence to FBDGs should be encouraged to identify space for improvements and to develop more tailored recommendations. Moreover, strengthening dietary policies with a greater emphasis on serving sizes and frequency recommendations could improve public understanding of balanced dietary composition. Although dietary guidelines do not explicitly categorize foods as “good” or “bad”, there is a widespread tendency in society to define foods in such terms. Therefore, guidelines should highlight the importance of appropriate quantities and consumption frequencies, helping individuals obtain essential nutrients without excluding specific foods or food groups. Globally, the lack of harmonization in serving size definitions creates confusion and limits the comparability of dietary data. Efforts to standardize these measures could improve public understanding and policy effectiveness, particularly in multicultural and international contexts. Serving size quantification often varies significantly across guidelines, reflecting cultural and dietary differences. Future research should focus on harmonizing these recommendations at least at regional level while ensuring they remain culturally relevant and scientifically accurate. For example, the harmonization system proposed by Eldridge and colleagues for label serving sizes, could be explored and applied also to the servings recommended in the FBDGs (Eldridge et al., 2025). Variations in the recommended serving size and consumption frequencies can also be linked to the method of their derivation. It is envisaged to develop common regional benchmarks for serving sizes based on average serving sizes consumed within the macro-region, leveraging existing dietary surveys e.g. The European Food Safety Authority Comprehensive European Food Consumption Database (<https://data.europa.eu/data/datasets/the-efsa-comprehensive-european-food-consumption-database?locale=en>), and other large-scale dietary intake studies agreed-upon food categories, ensuring consistency across countries while allowing for minor adjustments to local diets.

This heterogeneity is particularly relevant in terms of labelling. According to Gibney et al., (Gibney, Forde, Mullally, & Gibney, 2019) a central feature of nutrition labelling is the reference weight or equivalent used on the label with data on the nutrition content of a packaged food that can be expressed as serving size (in g or mL) or 100 g/mL. Consumers tend to favour nutrient information on food labels when it is displayed based on serving size rather than per 100 g/mL (Kliemann et al., 2018). However, the definition of serving size should not be left to the private sector with the risk that food companies define their own serving sizes on labels, with a serving that does not reflect the actual quantities typically consumed by people and increase the disorientation of consumers. For these reasons there is a need for transnational regional organizations (e.g., EFSA, WHO, FAO, etc.) to establish clear guidance on serving sizes to ensure the information provided to consumers is reliable and supports informed and health-conscious choices. Nonetheless, the serving size harmonization process needs a large collaboration engaging food industry stakeholders, public health organizations and consumer groups to ensure alignment and practical implementation of harmonized serving size and frequency of the recommendations. As stated by Salesse et al., (Salesse et al., 2024) there is also a problem of terminology with the terms “portion” and “servings” used as synonyms in several languages that create further confusion compromising an efficient delivery of the guidance to populations. The incongruence between the two terms underscores the universal importance of distinguishing between personal eating habits (portions) and dietary recommendations (servings) for achieving an optimal diet.

Dietary guidelines are essential public health tools for education and information, covering both prevention and environmental sustainability. However, the environmental aspect is often underestimated in current guidelines as we previously observed. (Martini et al., 2021). Given the variability and heterogeneity in the provided recommendations, there is a clear need to harmonize serving size and consumption frequency recommendations at least at the macro-regional level and this process requires collaboration, data-driven decision-making, and cultural sensitivity. By implementing these strategies, countries can develop consistent, practical, and impactful guidelines that improve dietary behaviours and public health outcomes. The quantification of serving sizes in nutritional guidelines is essential for promoting healthy dietary behaviours and reducing the risk of diet-related chronic diseases. Clear and standardized serving sizes help consumers interpret nutritional information effectively, enabling them to make informed choices and maintain balanced diets. They also facilitate better serving control, which is crucial in addressing global issues such as obesity and over-nutrition (Rolls, 2014).

5. Conclusions

In conclusion, standardizing serving size quantification is crucial for clear and accessible dietary guidelines. Future research should focus on harmonizing these recommendations while ensuring cultural relevance and scientific accuracy. This should also include more explicit consideration of factors, such as sensory perception of portion sizes and cultural eating behaviours, which are central to how individuals interpret and apply serving size guidance. This may involve developing educational resources and enhancing graphical elements in guidelines to improve public understanding and adherence to healthy eating patterns. Standardized serving sizes also promote consistency across food labels, reduce confusion, and facilitate global health policy comparisons. To be effective, they must reflect actual consumption patterns and traditions, and involve collaboration among public health organizations, governments, and industry stakeholders. Finally, it is essential to systematically monitor and follow up on updates to national food-based dietary guidelines to ensure that serving size recommendations remain current, evidence-based, and aligned with evolving nutritional science and population health needs.

CRedit authorship contribution statement

Beatrice Pellegrini: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation. **Federica Grant:** Writing – review & editing, Methodology, Investigation, Data curation. **Lara Chegade:** Writing – review & editing. **Cristian Del Bo:** Writing – review & editing. **Patrizia Riso:** Visualization, Validation, Supervision. **Daniela Martini:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Funding acquisition, Conceptualization. **Laura Rossi:** Writing – review & editing, Validation, Supervision.

Fundings

This work was supported by the Italian Ministry of University and Research under Grant Number PE00000003, Project title “ON Foods - Research and innovation network on food and nutrition Sustainability, Safety and Security-Working ON Foods”, PR and DM thank the Joint Research Center CRC I-WE (Innovation for Well-Being and Environment), Università degli Studi di Milano, and Piano di sostegno alla Ricerca Università Degli studi di Milano, Linea 2 and Linea 6.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodres.2026.119225>.

Data availability

Data will be made available on request.

References

- Almiron-Roig, E., Navas-Carretero, S., Emery, P., & Martínez, J. A. (2018). Research into food portion size: Methodological aspects and applications. *Food & Function*, 9(2), 715–739. <https://doi.org/10.1039/c7fo01430a>
- Carruba, M. O., Ragni, M., Ruocco, C., Aliverti, S., Silano, M., Amico, A., & Nisoli, E. (2023). Role of portion size in the context of a healthy, balanced diet: A case study of European countries. *International Journal of Environmental Research and Public Health*, 20(6), 5230. <https://doi.org/10.3390/ijerph20065230>
- Comerford, K., Miller, G., Boileau, A., Masiello Schuette, S., Giddens, J., & Brown, K. (2021). Global review of dairy recommendations in food-based dietary guidelines. *Frontiers in Nutrition*, 8, 67199. <https://doi.org/10.3389/fnut.2021.671999>
- Consiglio per la Ricerca in Agricoltura e l'Analisi dell'Economia Agraria (CREA). (2018). *Linee guida per una sana alimentazione - Dossier scientifico*. Roma: Centro di Ricerca per gli Alimenti e la Nutrizione.
- Crippa, M., Solazzo, E., & Guizzardi, D. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. *Nature Food*, 2, 198–209. <https://doi.org/10.1038/s43016-021-00225-9>
- Crispin, S., Granderson, I., Matthew-Duncan, L., Charrondière, U., Jean, F., & Hutchinson, S. (2021). *Manual of food portion quantification - Saint Kitts and Nevis*. Bridgetown: FAO. <https://doi.org/10.4060/cb4844en>
- Eldridge, A. L., Kotzakioulafi, E., Debras, C., Tsai, L. T., Meijer, G. W., Salesse, F., & Gibney, E. R. (2025). Method to define recommended portion sizes for consumer guidance. *European Journal of Nutrition*, 64(1), 62. <https://doi.org/10.1007/s00394-024-03573-x>
- FAO; IFAD; UNICEF; WFP; WHO. (2019). *The state of food security and nutrition in the world. Safeguarding against economic slowdowns and downturns*. Rome: FAO.
- FAO; WHO. (2019). *Sustainable Healthy Diets – Guiding Principles*. Rome: Food and Agriculture Organization (FAO). Retrieved from 978-92-5-131875-1 (FAO), 978-92-4-151664-8 (WHO).
- GBD Collaborators. (2019). Health effects of dietary risks in 195 countries, 1990–2017: A systematic analysis for the global burden of disease study 2017. *Lancet*, 393(10184), 1958–1972. [https://doi.org/10.1016/S0140-6736\(19\)30041-8](https://doi.org/10.1016/S0140-6736(19)30041-8)
- Gibney, M., Forde, C., Mullally, D., & Gibney, E. (2019). Analysis of the national adult nutrition survey (Ireland) and the European food safety authority (EFSA) comprehensive European food consumption database. *European Journal of Clinical Nutrition*, 73(5), 748–755. <https://doi.org/10.1038/s41430-019-0325-0>
- Global Panel on Agriculture and Food Systems for Nutrition. (2016). *The cost of malnutrition: Why policy action is urgent*. London: Global Panel on Agriculture and Food Systems for Nutrition.
- Herforth, A., Arimond, M., Álvarez-Sánchez, C., Coates, J., Christianson, K., & Muehlhoff, E. (2019). A global review of food-based dietary guidelines. *Advances in Nutrition*, 10(4), 590–605. <https://doi.org/10.1093/advances/nmy130>
- Higgins, K. A., Hudson, J. L., Hayes, A. M., Braun, E., Cheon, E., Couture, S. C., & Mattes, R. D. (2022). Systematic review and Meta-analysis on the effect of portion size and ingestive frequency on energy intake and body weight among adults in randomized controlled feeding trials. *Advances in Nutrition*, 13(1), 248–268. <https://doi.org/10.1093/advances/nmab112>
- Hughes, J., Pearson, E., & Grafenauer, S. (2022). Legumes - a comprehensive exploration of global food-based dietary guidelines and consumption. *Nutrients*. <https://doi.org/10.3390/nu14153080>
- Iacoponi, F., Cardamone, E., Di Nucci, A., Agrimi, U., & Silano, M. (2025). Food consumption and comparison with Italian dietary guidelines: Results from ARIANNA cross-sectional survey. *International Journal of Food Sciences and Nutrition*, 76(7), 736–747. <https://doi.org/10.1080/09637486.2025.2562441>
- IPCC. (2019). *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems*. Intergovernmental Panel on Climate Change. Retrieved from <https://www.ipcc.ch/srcc1/>.
- Kliemann, N., Kraemer, M., Scapin, T., Rodrigues, V., Fernandes, A., Bernardo, G., & Proença, R. (2018). Serving size and nutrition labelling: Implications for nutrition information and nutrition claims on packaged foods. *Nutrients*, 10(7). <https://doi.org/10.3390/nu10070891>
- Liu, Q., Allman-Farinelli, M., & Rangan, A. (2024). Portion size norms of discretionary foods and eating settings: A repeated cross-sectional study. *Nutrients*, 16, 3670. <https://doi.org/10.3390/nu16213670>
- Livingstone, M. B., & Pourshahidi, L. K. (2014). Portion size and obesity. *Advances in Nutrition*, 5(6), 829–834. <https://doi.org/10.3945/an.114.007104>
- Lotti, S., Napoletano, A., Tristan Asensi, M., Pagliai, G., Giangrandi, I., Colombini, B., ... Sofi, F. (2024). Assessment of Mediterranean diet adherence and comparison with Italian dietary guidelines: A study of over 10,000 adults from 2019 to 2022. *International Journal of Food Sciences and Nutrition*, 75(3), 336–343. <https://doi.org/10.1080/09637486.2024.2313979>
- Martini, D., Tucci, M., Bradfield, J., Di Giorgio, A., Marino, M., Del Bo', C., & Riso, P. (2021). Principles of sustainable healthy diets in worldwide dietary guidelines: Efforts so far and future perspectives. *Nutrients*, 13(6), 1896. <https://doi.org/10.3390/nu13061827>
- National Heart. (2013). Lung, and Blood Institute (NHLBI). September 30). Serving sizes and portions. Retrieved April 23, 2025, from <https://www.nhlbi.nih.gov/health/educational/wecan/eat-right/distortion.htm>.
- NCD-RisC. (2024). Worldwide trends in underweight and obesity from 1990 to 2022: A pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. *Lancet*, 403(10431), 1027–1050. [https://doi.org/10.1016/S0140-6736\(23\)02750-2](https://doi.org/10.1016/S0140-6736(23)02750-2)
- Phelps, N. H., Singleton, R. K., Zhou, B., Heap, R. A., Mishra, A., Bennett, J. E., & Bixby, H. (2024). Worldwide trends in underweight and obesity from 1990 to 2022: A pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. *The Lancet*, 403(10431), 1027–1050. [https://doi.org/10.1016/S0140-6736\(23\)02750-2](https://doi.org/10.1016/S0140-6736(23)02750-2)
- Rishmawi, M. (2015). *The league of Arab states: Human rights standards and mechanisms towards further civil society engagement: A manual for practitioners*. Open Society Foundations & Cairo Institute for Human Rights Studies.
- Rolls, B. (2014). What is the role of portion control in weight management? *International Journal of Obesity*, 38, S1–S8. <https://doi.org/10.1038/ijo.2014.82>
- Salesse, F., Eldridge, A. L., Mak, T. N., & Gibney, E. R. (2024). A global analysis of portion size recommendations in food-based dietary guidelines. *Frontiers in Nutrition*, 11(1476771). <https://doi.org/10.3389/fnut.2024.1476771>
- Società Italiana di Nutrizione Umana (SINU). (2024). *Livelli di Assunzione di Riferimento di Nutrienti ed energia per la popolazione italiana (LARN): V Revisione*. Milano: Biomedica.
- Swinburn, B., Kraak, V., Allender, S., Atkins, V., Baker, P., Bogard, J., & Howden, M. (2019). The global syndemic of obesity, undernutrition, and climate change: The lancet commission report. *The Lancet*, 393(10173), 791–846. [https://doi.org/10.1016/S0140-6736\(18\)32822-8](https://doi.org/10.1016/S0140-6736(18)32822-8)
- Tiboni-Oschilewski, O., Biasini, B., Merloni, B., Merloni, F., Rosi, A., & Scazzina, F. (2025). A global overview on sustainability representation in iconographies from food-based dietary guidelines and other institutional sources. *International Journal of Food Sciences and Nutrition*, 1–15. <https://doi.org/10.1080/09637486.2025.2578452>
- U.S. Department of Agriculture, & U.S. Department of Health and Human Services. (2020). *Dietary guidelines for Americans, 2020–2025* (9th ed.) <https://www.dietaryguidelines.gov>.
- WHO. (2024). April 23. Malnutrition: Retrieved from. World health Organization: https://www.who.int/health-topics/malnutrition#tab=tab_1.
- Wijesinha-Bettoni, R., Khosravi, A., Islas Ramos, A., Sherman, J., Hernandez-Garbanzo, Y., Molina, V., Vargas, M., & Hachem, F. (2021). A snapshot of food-based dietary guidelines implementation in selected countries. *Global Food Security*, 29, Article 100533. <https://doi.org/10.1016/j.gfs.2021.100533>
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., & Murray, C. J. (2019). Food in the anthropocene: The EAT-lancet commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)
- Yoong, S. L., Turon, H., Wong, C. K., Bayles, L., Finch, M., Barnes, C., ... Wolfenden, L. (2023). An audit of the dissemination strategies and plan included in international food-based dietary guidelines. *Public Health Nutrition*, 26(11), 2586–2594. <https://doi.org/10.1017/S1368980023001714>