Recommendations for a sustainable food guide for the Brazilian population: consensus among experts

Recomendações para um guia alimentar sustentável para a população brasileira: consenso entre especialistas

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ABSTRACT

This study aimed to develop recommendations for a sustainable dietary guide for the Brazilian population. Using a qualitative methodology and the Delphi technique, the research was conducted in two phases: a literature review and expert evaluation. Initially, 23 recommendations were proposed, addressing food production, origin, processing, consumption habits, and resource conservation. In the second phase, 17 experts rated each recommendation's importance and feasibility. All recommendations were accepted (mean score > 3.5), with the highest ratings for proper waste disposal, recyclable packaging, and food waste reduction. Recommendations like consuming foods from sustainable systems and self-cultivation were deemed less feasible. The findings support the development of public policies and dietary guidelines that align with the Sustainable Development Goals. Current guidelines rarely integrate economic, social, and environmental sustainability. This study helps fill that gap by offering a structured framework for promoting healthy and sustainable eating habits in Brazil.

Keywords: Sustainable Dietary Guidelines. Public Food Policies. Sustainable Eating. Delphi Consensus Technique. Food Systems.

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RESUMO

Este estudo teve como objetivo desenvolver recomendações para um guia alimentar sustentável voltado à população brasileira. Utilizando uma metodologia qualitativa e a técnica de consenso Delphi, a pesquisa foi conduzida em duas fases: uma revisão da literatura e a avaliação por especialistas. Inicialmente, foram propostas 23 recomendações, abordando a produção de alimentos, sua origem, processamento, hábitos de consumo e conservação de recursos. Na segunda fase, 17 especialistas avaliaram a importância e a viabilidade de cada recomendação. Todas as recomendações foram aceitas (pontuação média > 3,5), sendo as mais bem avaliadas o descarte adequado de resíduos, uso de embalagens recicláveis e redução do desperdício de alimentos. Já recomendações como o consumo de alimentos provenientes de sistemas sustentáveis e o cultivo do próprio alimento foram consideradas menos viáveis. Os resultados contribuem para o desenvolvimento de políticas públicas e diretrizes alimentares alinhadas aos Objetivos de Desenvolvimento Sustentável. As diretrizes atuais raramente integram a sustentabilidade econômica, social e ambiental. Este estudo contribui para preencher essa lacuna ao oferecer um guia estruturado para promover hábitos alimentares saudáveis e sustentáveis no Brasil.

Palavras-chave: *Guia Alimentar Sustentável. Políticas Públicas de Alimentação. Alimentação Sustentável. Técnica de Consenso Delphi. Sistemas Alimentares.*

1 INTRODUCTION

The current food system is designed to uphold hegemony in economic and political systems and inequalities in the distribution of resources, such as education, public safety, and health. This model of food production is a major cause of multiple environmental problems, including the loss and degradation of natural resources such as drinking water and soil, environmental destruction driven by increased greenhouse gas emissions, and deforestation and biodiversity reduction resulting from the centralisation of agricultural inputs, means of food production, technology, and capital in transnational corporations (Bezerra; Paula, 2021; Brito, 2023; Von Braun *et al.*, 2021; Who, 2019). It is estimated that the food system accounts for about a third of greenhouse gas emissions in developed countries (Crippa *et al.*, 2021). Climate change and the increased frequency of extreme weather events have generated serious impacts on the food supply chain, affecting input costs, market prices, and food security (Oriekhoe *et al.*, 2024). Furthermore, food production, processing, distribution, supply, marketing, preparation, and consumption have undergone significant changes that aggravate social, economic, and environmental damage (Martinelli; Cavalli, 2019).

Agricultural conventionalisation, urbanisation, and globalisation have increased the consumption of ultra-processed foods, leading to the erosion of traditional food cultures. This nutritional panorama presents our society with two challenges. On the one hand, populations are experiencing growing rates of hunger and malnutrition due to low food diversity and micronutrient content, even among those who have their energy needs met (Dangour *et al.*, 2012). Thus, the dominant food system is failing to ensure global food security, despite claims that increased food production justifies unsustainability (De Pellegrini, 2022). On the other hand, societies are facing growing rates of overweight and obesity, associated with diets rich in fat, sugar, and salt and poor in nutrients and fibre (Popkin, 2018; Qaim, 2017).

Another contributor to the global food crisis is the shift from food production to commodity or fuel production, facilitated by the expansion of monocultures at the expense of traditional food crops (Reis; Neto, 2014). Demarcating land for traditional peoples and communities is essential to preserving the existence of traditional agroecological practices (Pacheco; Porto; Rocha, 2013). Although some of the United Nations' (UN) Sustainable Development Goals (SDGs) aim to increase the yield and income of smallholder farmers, current economic investments are predominantly focused on the agribusiness model. This situation perpetuates a cycle of climate change and social injustices, offering scant opportunity for significant structural transformations (Lara; Cohen, 2023).

The food system is responsible not only for nutritional problems (e.g., malnutrition, overweight, and chronic non-communicable diseases) but also for social and economic challenges related to food production and environmental problems (Triches, 2021). For instance, the 25% to 30% contribution of the food system to greenhouse gas emissions intensifies climate change. In fact, given their widespread prevalence worldwide, malnutrition, obesity, and climate change are considered pandemics and collectively referred to as a Global Syndemic (Swinburn *et al.*, 2019). Agricultural standardisation and industrial livestock production decrease agrobiodiversity, affect soil fertility and biological pest regulation, and increase the use of pesticides and fertilisers, causing harm to ecosystems (Auestad; Fulgoni, 2015; Dal Soglio, 2016; Marques; Fuinhas; Pais, 2018) and the health of farmers and consumers (Carneiro *et al.*, 2012; Dal Soglio, 2016; Muhammad *et al.*, 2020).

Given the unsustainability of the prevalent food system and its impacts on climate change, resource scarcity, environmental degradation, loss of biodiversity, and rising rates of malnutrition and diet-related non-communicable diseases, the European Commission Directorate-General for Research and Innovation proposed the Food 2030 initiative. It suggests integrating primary production and food processing sectors with retail, distribution, and food consumption. This integration aims to connect research, innovation policies, and business models and promote relevant social, institutional, and governance innovations to drive changes in the food system (Varzakas; Smaoui, 2024).

Eating patterns are both a cause and a consequence of food systems (Meybeck; Gitz, 2017; Neufeld *et al.*, 2021). When consumers have the option of making choices, their food patterns have the potential to influence the global food system (Martinelli; Cavalli, 2019). Understanding the factors influencing food choices is essential for designing interventions and recommendations aimed at improving food systems and fostering new eating habits (Chen; Antonelli, 2020). In this manner, it becomes possible to instrumentalise and shape both the food choices of the population and the development of public policies that promote food accessibility (Martinelli; Cavalli, 2019). Motivating citizens to modify their eating habits requires a deep understanding of these issues, the impacts of their choices, and the positive alternatives available. Ultimately, it implies enhancing citizens' choice-making skills (Costa Carvalho *et al.*, 2021).

It should be noted that ensuring access to information for the population is a goal pursued by countries committed to achieving the SDGs by 2030 (The United Nations, 2015). The initiative emphasises the importance of including sustainability recommendations in dietary guidelines. There is a need for collaboration between developed and developing countries to achieve the Sustainable Development Goals (SDGs), particularly SDG 2: Zero Hunger (Yeong *et al.*, 2021). According to the UN Food and Agriculture Organisation (FAO, 2022), there is an evident need to incorporate sustainability considerations into food policies and population education programs. Presenting this information in the form of food guides has been strategic to integrate recommendations and address sustainability issues across economic, cultural, environmental, and nutritional dimensions, given the potential political and social implications of these documents.

However, studies assessing dietary guidelines from various countries worldwide have shown that sustainability is still incipient in the messages directed to the population (Bermejo *et al.*, 2023; Fabri *et al.*, 2021; FAO, 2022). The impacts of food choices on the social, environmental, and economic aspects of the food system are related to the sustainable dimension, as exemplified by the consumption of fresh and/or natural foods, valorisation of local foods and food identity, consumption of foods produced by family farmers and smallholder farmers, preference for plant-based foods, respect for seasonality, valorisation of organic and agroecological foods, environmental protection, waste reduction, consumption of fair trade foods, solidarity economy, reduction of food waste, consumption of local foods, and use of short marketing channels (Fabri *et al.*, 2021; FAO, 2022). Despite including more information on sustainability than other guides (FAO, 2016b), the Dietary Guidelines for the Brazilian Population (DGBP) focuses its recommendations on food processing (Martinelli; Cortese; Cavalli, 2020), without emphasising the differences between fresh foods and industrialised foods rich in fats, sugars, and sodium (Monteiro

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et al., 2023). The information presented may lead to uncertainty regarding the definitions used to categorise foods based on their degree of processing and nutritional implications (Monteiro *et al.*, 2022). Furthermore, research highlights that the success of sustainable dietary guidelines also depends on effective communication strategies, including clear language, audience segmentation, and the use of social media and practical tools to enhance public engagement (Culliford; Bradbury; Medici, 2023). In light of these issues, this study aimed to compile recommendations for a sustainable diet to be used for the development of a dietary guide aimed at the Brazilian population.

2 METHODS

2.1 STUDY DESIGN

A descriptive qualitative exploratory study was carried out (Contandriopoulos, 1997) to inform the development of recommendations for a sustainable food guide based on the systematic use of existing knowledge. A qualitative approach was adopted in the search for documents and food guides to identify different points of view and interpretations, highlight key information, and show the realities described in different sources (Stake, 2011). This research is also exploratory in nature. As such, it provides an overview of themes or facts to increase the researchers' familiarity with the problem at hand, contributing to developing, clarifying, and modifying concepts and ideas through the assessment of factors and implications (Gil, 2008). The study was divided into two phases: (i) preparation of an initial model of recommendations, including the identification and design of sustainable food recommendations; and (ii) application of the Delphi expert consensus method to assess the relevance and feasibility of the proposed recommendations.

2.2 PREPARATION OF THE INITIAL MODEL OF RECOMMENDATIONS

For identification of recommendations for a sustainable diet in the literature, this study updated the scoping review carried out by Martinelli (2018). The purpose of the scoping review was not to assess the quality of available information; instead, it sought to understand the sustainability recommendations found in documents aimed at promoting the adoption of sustainable food practices among the population (Arksey; O'malley, 2005).

Source documents were identified from searches in the Scopus, PubMed, and Google Scholar databases. A manual search in the reference lists of the selected papers complemented this strategy. The following search terms were used: *sustainable diet* or *sustainable nutrition* or *sustainable food* or *wholesome diet* or *wholesome nutrition* combined with *principles* or *recommendation*.

This scoping review, which incorporated the searches conducted by Martinelli (2018) and the updated searches, included 16 publications (5 articles and 11 documents) published between 1986 and 2022. Discrepancies in the selection process were discussed with the research team until a consensus was reached. For extraction of characterisation data, a spreadsheet was created containing information on the type/purpose of the document (government guides to healthful eating targeted at the population, government reports with recommendations on the construction of food guides, scientific articles with a review and discussion approach, and guidelines published by non-government institutions), scope (governmental/non-governmental), year of publication, and country/region. Of the selected publications, six were government guidelines, three were government reports, five were review/discussion articles, and two were non-government guidelines. One document was published before 2009, two between 2009 and 2011, six between 2012 and 2014, three between 2015 and 2017, and four between 2018 and 2022. As for the country/region of origin, 12 were from European countries, two from the United States, one from Asia, and one from Oceania.

After the identification of recommendations through the scoping review, an initial model of recommendations was constructed, consisting of the identified recommendations organised into categories defined by the research team and justifications for their inclusion in a dietary guide. Justifications were proposed based on a literature review.

2.3 DELPHI CONSENSUS METHOD

The Delphi method was used to assess the recommendations included in the initial model. This method finds application in several fields of knowledge (HSU; Sandford, 2007). It offers several advantages: ensures the anonymity of participants (Okoli; Pawlowski, 2004), can be applied online (Linstone; Turoff, 2002; Okoli; Pawlowski, 2004), and allows the inclusion of geographically distant participants (Wright; Giovinazzo, 2000) at a considerably lower cost compared with other consensus methods (Linstone; Turoff, 2002).

The structured questionnaire used in the consensus workshop was developed based on the scoping review that informed the construction of the initial model of recommendations. The questionnaire was organised into the following five sections: food production, food origin, degree of food processing, food consumption, and conservation of food-related resources. The relevance of recommendations was rated on a Likert scale ranging from 1 (completely irrelevant) to 5 (very relevant). The difficulty in implementing the recommendations was rated on a Likert scale ranging from 1 (very easy) to 5 (very difficult). The experts could also provide suggestions and observations (Joshi *et al.*, 2015). The questionnaire was administered online using Google Forms.

2.4 EXPERT SELECTION

Experts were selected on the Lattes platform of the Brazilian National Council for Scientific and Technological Development (CNPq), a federal agency that supports research, and whose platform compiles academic résumés of researchers in Brazil. For this, an advanced search was conducted using keywords such as sustainability, dietary guidelines, nutrition, safe food, and healthful food. Only Brazilians with a Lattes curriculum updated in 2022 were invited. Researchers identified through the Lattes platform also suggested additional experts with whom they shared knowledge on the theme (Churchill, 1995), in a snowballing fashion (Kish, 2004; Scheaffer, 2012). All experts indicated through this snowballing approach were subsequently verified via the Lattes platform and/or their scientific publications to ensure they had relevant publications in the field. Invitations to participate in the Delphi consensus session were sent via email. The message outlined the research objectives, explained the principles of the Delphi consensus method, and highlighted the importance of their participation (Wright; Giovinazzo, 2000). An informed consent form was also provided. Experts had 30 days to answer the questionnaire.

We invited 100 experts to participate in the Delphi consensus technique. Of these, 50 agreed to participate in the study, but only 23 completed the questionnaire and had their responses included in the analysis (Fig. 1).
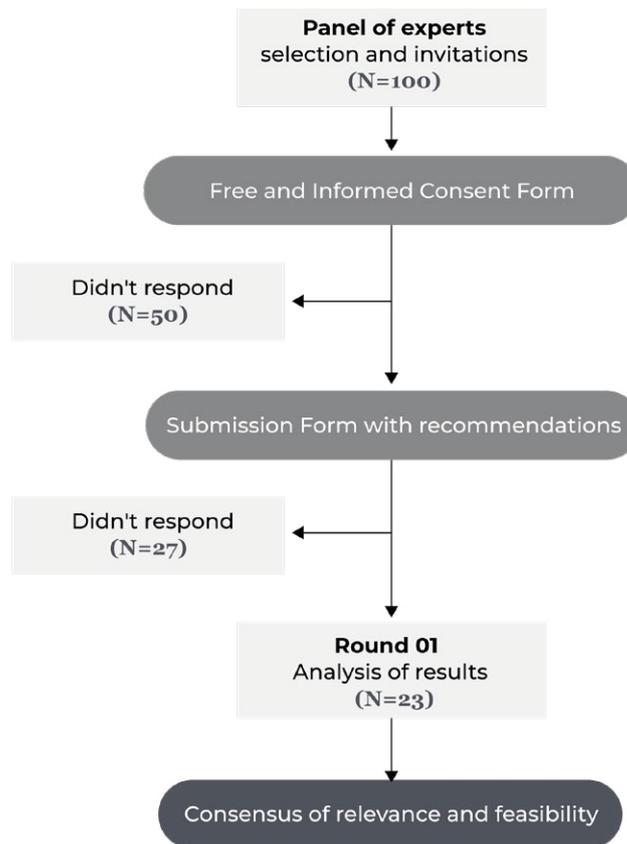
Figure 1 – Flowchart of the operational steps in the one-round Delphi study of recommendations for a sustainable diet

Source: The authors (2025).

This study was approved by the Research Ethics Committee of the Federal University of Santa Catarina and registered under Certificate of Ethical Appreciation Presentation (CAAE) number 68205322.0.0000.0121.

2.5 DATA ANALYSIS

Quantitative data were analysed using Excel spreadsheets. Measures of central tendency (mean, median, and mode) and levels of dispersion (standard deviation and interquartile range) are commonly determined in Delphi studies. These statistical techniques contribute to presenting information about the collective judgments of respondents (HSU; Sandford; 2007). The means and standard deviations of the relevance and feasibility scores of each recommendation were calculated.

Recommendations were accepted or rejected based on the mean and standard deviation of relevance scores attributed by experts. A recommendation was accepted when the mean score was either equal to or greater than 3.5 or less than 3.5, but with a standard deviation of less than 1. The higher the score, the greater the importance attributed to the recommendation. The feasibility of implementing recommendations was evaluated on the basis of the mean scores. The difficulty of implementation of recommendations was classified as follows: low, if the mean score was equal to or lower than 1.66; intermediate, if the mean score ranged from 1.67 to 3.33; and high if the mean score was greater than 3.33 (Chu; Hwang, 2008; Martinelli, 2018). Analysis of the responses of the first round indicated that a consensus had been reached.

3 RESULTS

Table 1 presents the characteristics of the 16 publications identified through the scoping review, published between 1986 and 2022. Among these, four were government guidelines, three were government reports, five were scientific articles with a review or discussion approach, and four were non-governmental guidelines. These documents formed the basis for identifying recommendations to be included in the initial model submitted to expert evaluation.

Table 1 – Description of documents included in the literature review

General characteristics of selected studies		n
Document type	Government guidelines	4
	Government reports	3
	Scientific articles with a review/discussion approach	5
	Non-government guidelines	4
Year of publication	Before 2009	1
	2009 to 2011	2
	2012 to 2014	6
	2015 to 2017	3
	2018 to 2022	4
Region/country	Europe (Nordic countries, $n = 2$; Mediterranean Europe, $n = 1$; Western Europe, $n = 4$; Central Europe, $n = 2$)	12
	North America (United States)	2
	Asia (Qatar)	1
	Oceania (Australia)	1

Source: The authors (2025).

Table 2 presents the recommendations for a sustainable diet identified in the reviewed publications, published between 1986 and 2022. A total of 23 recommendations were extracted and grouped into five thematic categories. The first category encompasses recommendations that promote the consumption of food from sustainable production systems. The second category is associated with the origin of food, including topics such as preference for local food and adoption of fair trade principles. The third category comprises recommendations related to the degree of food processing, promoting the choice of products with reduced packaging and healthy ingredients—the fourth category groups recommendations addressing food groups and dietary diversification. Finally, the fifth category includes recommendations on the minimisation of food waste, preservation of natural resources during storage and preparation, transportation, and waste management.

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Table 2 – Recommendations for a sustainable diet identified through a scoping review

Category	Recommendations
Food production	Consume foods produced in an agroecological manner
	Consume organic foods
	Consume foods from sustainable agricultural systems
	Consume foods produced by family farmers
	Consume animal source foods and derivatives from sustainable farming systems
	Consume foods that preserve agrobiodiversity
	Avoid foods that contain or are produced from genetically modified organisms
	Consume seasonal foods
Food origin	Consume locally produced foods
	Buy fair trade foods
	Grow your own food
Degree of food processing	Consume fresh and/or natural foods
	Consume and prepare foods and meals using healthy ingredients
	Consume foods with reduced packaging and/or recyclable packaging
Food consumption	Consume nutritionally adequate foods
	Consume a variety of foods
	Reduce the consumption of animal-source foods
	Choose plant-based foods
	Consume foods and preparations that value food culture, traditional foods, and traditional cuisine
Conservation of food-related resources	Reduce food waste
	Ensure the environmentally adequate disposal of organic and recyclable waste
	Save energy and water during food storage and preparation at home
	Use active means of transportation to purchase food

Source: The authors (2025).

Overall, a total of 23 recommendations regarding sustainable diets were synthesised from documents published up to 2022. These recommendations were the basis of the initial model, which was evaluated by experts. The majority of experts were from South and Southeastern Brazil (34.78 %), followed by the Northeast (17.39%), Central-West (8.7%), and North (4.35%). The academic background of experts included Health Sciences, Social Sciences, and Agricultural Sciences. Table 3 shows the results of expert assessment of the 23 recommendations for a sustainable diet. All recommendations were accepted. The mean relevance scores attributed to recommendations were greater than 4, except for "Grow your own food," which had a mean score of 3.83. Of note, "Ensure the environmentally adequate disposal of organic and recyclable waste" was attributed a mean score of 5.00.

Table 3 – Relevance scores of recommendations for a sustainable diet, as assessed by an expert panel

Recommendation	Mean	Standard deviation	Decision
Ensure the environmentally adequate disposal of organic and recyclable waste	5.00	0.00	Accepted
Reduce food waste	4.96	0.20	Accepted
Consume foods with reduced packaging and/or recyclable packaging	4.96	0.20	Accepted
Consume foods produced in an agroecological manner	4.92	0.28	Accepted
Consume organic foods	4.92	0.28	Accepted
Consume foods from sustainable agricultural systems	4.92	0.28	Accepted
Consume fresh and/or natural foods	4.92	0.28	Accepted
Buy fair trade foods	4.91	0.41	Accepted
Consume and prepare foods and meals using healthy ingredients	4.87	0.34	Accepted
Consume foods produced by family farmers	4.83	0.48	Accepted
Consume foods and preparations that value food culture, traditional foods, and traditional cuisine	4.79	0.51	Accepted
Consume locally produced foods	4.79	0.51	Accepted
Consume nutritionally adequate foods	4.67	0.70	Accepted
Avoid foods that contain or are produced from genetically modified organisms	4.62	0.71	Accepted
Save energy and water during food storage and preparation at home	4.62	0.87	Accepted
Consume seasonal foods	4.62	0.97	Accepted
Consume animal source foods and derivatives from sustainable farming systems	4.54	0.93	Accepted
Consume foods that preserve agrobiodiversity	4.5	0.83	Accepted
Consume a variety of foods	4.5	0.88	Accepted
Reduce the consumption of animal-source foods	4.42	0.83	Accepted
Choose plant-based foods	4.37	0.92	Accepted
Use active means of transportation to purchase food	4.25	0.94	Accepted
Grow your own food	3.83	1.20	Accepted

Source: The authors (2025).

The feasibility of applying the recommendations was also assessed. No mean was lower than 1.66; that is, no recommendation had a low difficulty of implementation. Most items received mean scores of 1.67 to 3.33, indicating intermediate difficulty. The following recommendations were deemed difficult to implement: "Consume animal source foods and derivatives from sustainable farming systems," "Grow your own food," "Avoid foods that contain or are produced from genetically modified organisms (GMOs)," "Consume foods that preserve agrobiodiversity," "Buy fair trade foods," "Consume foods produced in an agroecological manner," "Consume organic foods," and "Consume foods from sustainable agricultural systems," with mean scores equal to or greater than 3.33 (Fig. 2).
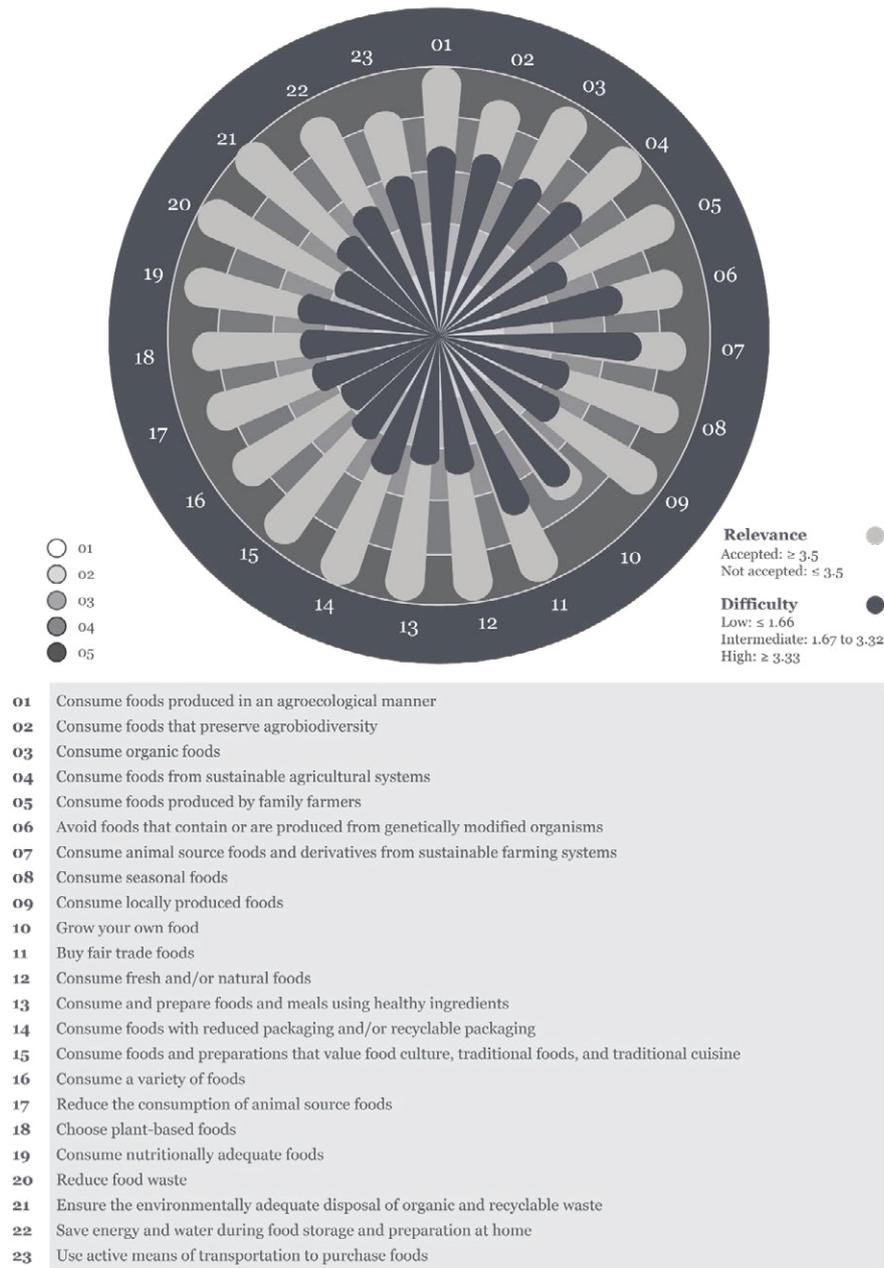
01 Consume foods produced in an agroecological manner
02 Consume foods that preserve agrobiodiversity
03 Consume organic foods
04 Consume foods from sustainable agricultural systems
05 Consume foods produced by family farmers
06 Avoid foods that contain or are produced from genetically modified organisms
07 Consume animal source foods and derivatives from sustainable farming systems
08 Consume seasonal foods
09 Consume locally produced foods
10 Grow your own food
11 Buy fair trade foods
12 Consume fresh and/or natural foods
13 Consume and prepare foods and meals using healthy ingredients
14 Consume foods with reduced packaging and/or recyclable packaging
15 Consume foods and preparations that value food culture, traditional foods, and traditional cuisine
16 Consume a variety of foods
17 Reduce the consumption of animal source foods
18 Choose plant-based foods
19 Consume nutritionally adequate foods
20 Reduce food waste
21 Ensure the environmentally adequate disposal of organic and recyclable waste
22 Save energy and water during food storage and preparation at home
23 Use active means of transportation to purchase foods

Figure 2 – Experts' scores on the relevance and difficulty in implementing recommendations for a sustainable diet

Source: The authors (2025).

4 DISCUSSION

A total of 23 recommendations were identified and grouped into the following: food production, food origin, degree of food processing, food consumption, and conservation of food-related resources. The highest importance was unanimously given to the environmentally adequate disposal of organic and recyclable waste. Next, the most relevant recommendations were the consumption of food with reduced or recyclable packaging and the reduction of food waste. The environmentally adequate disposal of solid and organic waste includes their reuse, recycling, composting, recovery, and energy use, among others. These actions contribute to preventing damage or risks to public health and safety and minimising adverse environmental impacts. Such practices are described in the National

Solid Waste Policy established by Law No. 12,305, August 2, 2010, determining the disposal methods approved by the National Environment System (Sisnama), the National Health Surveillance System (SNVS), and the Unified System of Attention to Agricultural Health – Suasa (Brasil, 2010). For example, good waste disposal practices aim to prevent an increase in phosphorus concentration in freshwater and soil systems, which can lead to eutrophication (Sustain, 2013). The recommendation had a mean feasibility score of 2 (standard deviation of 1).

A reduction in food waste was considered the second most relevant recommendation and the second easiest to apply. This action was defined by the EAT-Lancet expert commission as one of the five strategies for Great Food Transformation, aiming to ensure a healthy diet for the entire global population within sustainable production limits by 2050 and beyond (Swinburn *et al.*, 2019; Willett *et al.*, 2019). The concern for reducing the use of packaging and selecting products with biodegradable or easily disposable packaging was also among the most relevant (Brasil, 2006; FAO, 2016a). Of note, packaging plays a crucial role in extending food expiration dates and minimising the waste of certain foods (Serra-Majem *et al.*, 2020). For these cases, efforts should be aimed at developing new forms of packaging from recycled materials, nanomaterial coatings, and edible films (Von Braun *et al.*, 2023).

The consumption of foods produced by agroecological or organic systems was considered of great relevance. However, this recommendation was deemed difficult to apply by experts. Organic production was regulated in 2003 through Federal Law No. 10,831 (Brasil, 2003) and in 2007 through Federal Decree No. 6,323 (Brasil, 2007). Agroecological practices, which have gained prominence in recent years, were considered a government priority in 2012, with the creation of the National Agroecology and Organic Production Policy (Pnapo) through Decree No. 7,794 (Brasil, 2012). This led to the development of the 2013–2015 National Plan of Agroecology and Organic Production (Planapo), representing a historical milestone for social movements, civil society organisations, and rural entities (Sambuichi *et al.*, 2017). Despite the existence of specific legislation, some of the difficulties pointed out by experts regarding the consumption of organic or agroecologically produced foods (means of 3.38 and 3.45, respectively) were the cost and difficulty in obtaining organic product certification, the difficulty in finding organic foods in small retail establishments, and the price of such foods. Some experts suggested grouping organic and agroecological foods and argued that agroecological production is more sustainable than organic production.

Pesticides and fertilisers may harm the ecosystem (Auestad; Fulgoni, 2015; Dal Soglio, 2016; Marques; Fuinhas; Pais, 2018) and the health of farmers and consumers (Carneiro *et al.*, 2012; Dal Soglio, 2016; Muhammad *et al.*, 2020). In Brazil, their use is encouraged, as revealed in the latest dossier of Friedrich *et al.* (2021). The authors identified incentive laws, credit and tax exemption policies, withdrawal of resources for supervision, control, and monitoring, and suppression of regulations, such as the amendment of Law No. 6,299/2002 in 2018, which concerns pesticide regulation (Friedrich *et al.*, 2021).

According to the guidelines of the World Health Organisation (Who, 2019), the importance of recommending the consumption of food produced by sustainable agricultural systems (mean score of 4.88) is aligned with the need to develop public policies for production chain management, aiming to protect natural resources (Cediel, 2023; Von Koerber; Bader; Leitzmann, 2017) and address climate change (Gil *et al.*, 2015; Sustain, 2013; Willett *et al.*, 2019). This is crucial to ensure access to safe, nutritious, high-quality food that respects cultural diversity, supports the local economy, and promotes the health of humans, plants, and animals (Sustain, 2013).

The recommendation to consume food from sustainable agricultural systems is in line with the DGBP (Brasil, 2006). This practice can reduce the environmental impact of food production and transportation by decreasing carbon dioxide emissions and optimising the use of land, water, and energy resources (Bastian; Buro; Palmer-Keenan, 2021; Fogelberg, 2013; Sustainable Development Commission, 2009; Von Koerber; Bader; Leitzmann, 2017). It is directly related to the recommendation of consuming foods from fair trade, also deemed highly relevant (mean score of 4.88). Fair trade promotes social and cultural benefits (Bastian; Buro; Palmer-Keenan, 2021; GCSD, 2013; Serra-Majem *et al.*, 2020; Sustainable

Development Commission, 2009), contributing to the local economy and the fight against poverty (Gil *et al.*, 2015; Serra-Majem *et al.*, 2020; Sustain, 2013; Von Koerber; Bader; Leitzmann, 2017). Furthermore, sustainable food production and fair trade help protect natural resources and biodiversity (Bastian; Buro; Palmer-Keenan, 2021; Sustainable Development Commission, 2009) and oppose the use of slave labour, which has been observed in some farms of large economic conglomerates in Brazil (Girardi *et al.*, 2022).

The consumption of fresh and/or natural foods is related to the degree of food processing. Fabri *et al.* (2021) stated that this recommendation is frequently cited in dietary guidelines. Here, it was considered relevant by experts (mean score of 4.88). The regulation and labelling of ultra-processed foods may contribute to controlling their consumption by the population. Regulation should concern not only industrial processing but also food diversity and monoculture systems, promoting a shift toward agroecological food production (Northcott *et al.*, 2023). The degree of processing must be considered when evaluating the healthfulness of foods, along with other criteria, such as production system and ingredients. Therefore, the recommendation to consume and produce foods and preparations with healthy ingredients is highly relevant (mean score of 4.82). Attention should be given to family agribusinesses that prioritise the food matrix and use raw materials from local family farms, potentially producing safer, more healthful, and more sustainable food (Gomes *et al.*, 2019; Martinelli; Cavalli, 2019; Martinelli *et al.*, 2020). Given that processing is linked to food technology, this concept may not consider processing practices carried out in domestic contexts, nor does it address crucial aspects of food safety, such as food preservation and distribution (Monteiro *et al.*, 2022).

The recommendations to consume nutritionally adequate foods and a variety of foods were also deemed relevant (mean scores of 4.67 and 4.5, respectively) and feasible (mean scores of 2.75 and 2.04, respectively). Recommendations regarding nutritional aspects of food are predominant in dietary guidelines (Martinelli *et al.*, 2020). As defined by FAO, sustainable diets must be nutritionally adequate, culturally acceptable, accessible, economically fair, safe, and healthy, in addition to protecting and respecting biodiversity and ecosystems (Burlingame; Dernini, 2012). The fact that a variety of foods can be produced in a sustainable manner, particularly fruits and vegetables, makes it possible for nutritional requirements to be met (Garnett; Strong, 2015).

Avoiding foods that contain or are produced from GMOs was deemed relevant (mean score of 4.92). This recommendation agrees with the consumption of organically produced foods. The insertion of pesticide-resistant genes in food promotes resistance to pests and weeds and the loss of biodiversity. As a result, ecosystems may become unbalanced, further increasing the demand for pesticides (Cavalli, 2001; Friedrich *et al.*, 2021; Martinelli; Cavalli, 2019). Such practices may also lead to genetic contamination of creole seeds with biological materials (Carneiro *et al.*, 2012; Friedrich *et al.*, 2021; Martinelli; Cavalli, 2019; Nodari; Guerra, 2001), pollen, or genetically modified grains along the food production chain, from production and harvesting to storage, transport, and industrial processing (Price; Cotter, 2014). Opting for sustainably produced food helps mitigate greenhouse gas emissions, enhances ecosystem resilience, and promotes equitable access to resources (Oriekhoe *et al.*, 2024).

The recommendation to save energy and water when storing and preparing food at home was considered relevant (mean score of 4.62) and feasible (mean score of 2.58). The energy used to cook and refrigerate food at home may have a significant impact on sustainability compared with the energy used along the food supply chain. Some practical applications include optimisation of the use of ovens and the choice of foods that do not require refrigeration (Fogelberg, 2013; Sustainable Development Commission, 2009). Water is a finite resource that requires energy for its purification and, in some cases, packaging and transportation (Serra-Majem *et al.*, 2020; Sustain, 2013). Some experts underscored the need for educational campaigns and suggested replacing "consumption" with "rational use."

Also noteworthy are the recommendations to consume seasonal, locally produced, and family-grown foods that value food culture and traditional cuisine. Preference for seasonal foods is a well-accepted recommendation in the literature. This practice aims to reduce the environmental impact of food production

by respecting the preferred season for growth (Garnett; Strong, 2015; Sustain, 2013), minimising the need for storage (Fogelberg, 2013). These foods have better nutritional properties and require less processing (Brasil, 2014; Sustainable Development Commission, 2009). The consumption of seasonal foods, according to experts (mean score of 4.62), can promote the choice of locally produced products that are part of the traditional cuisine (Bastian; Buro; Palmer-Keenan, 2021). Such foods tend to be fresher, travel shorter distances, and contain fewer chemical additives. This approach can encourage food diversification, ensuring a greater variety of nutrients in the diet and contributing to biodiversity preservation (Poulain, 2012; Sustainable Development Commission, 2009). Unconventional food plants and native foods are highly relevant in this context (Kinupp; Barros, 2008; Martinelli *et al.*, 2020; Termote *et al.*, 2014).

The importance of reducing the consumption of animal source foods (mean score of 4.42) is related to the environmental impact of animal husbandry. Animal production systems contribute to climate change, soil degradation, greenhouse gas emissions, water pollution, and biodiversity loss (Fogelberg, 2013; Serra-Majem *et al.*, 2020; Who, 2019; Willett *et al.*, 2019). A diet free of animal products can minimise greenhouse gas emissions and land use by up to 50%. However, complete withdrawal is not always possible; therefore, it is recommended to eat meat and other animal-source products in moderation, in view of the high global demand for these products (Hallström; Carlsson-Kanyama; Börjesson, 2015). When choosing animal source products, consumers should select those produced by sustainable farming systems, such as livestock–forest or crop–livestock–forest systems (Costa *et al.*, 2018). Animal welfare issues (Sustain, 2013) are also relevant. However, as underscored by experts, it is difficult to convey information on this matter to consumers. Thus, this recommendation was deemed difficult to implement. Fish and seafood consumption must be aligned with local availability and culinary traditions, by the 14th SDG (UN, 2017). Care must be taken to prevent overexploitation of fisheries, incidental catching of endangered and vulnerable species, contamination of the marine environment with algae, and excessive use of antibiotics. It is also necessary to prioritise the generation of work and local income, ensuring the technical training of employees (GCSD, 2013; Sustain, 2013; Sustainable Development Commission, 2009).

Preferring foods of plant origin was deemed as relevant (mean score of 4.37) and similarly feasible (mean scores of 2.67 and 2.42) as minimising the consumption of animal source foods. Plant-based diets may help ensure food security, particularly those based on less processed plant materials (Bastian; Buro; Palmer-Keenan, 2021; GCSD, 2013; Sustainable Development Commission, 2009; Willett *et al.*, 2019). Commercially available plant-based alternatives often contain high levels of sodium. Little is known about their content of important nutrients such as iron, zinc, and vitamin B12 (Romão *et al.*, 2023). As argued by some experts, this recommendation could also encompass issues related to agroecological, organic, and GMO-free production systems.

Although the recommendation "grow your own food" had the lowest agreement, it is important to highlight that urban and peri-urban agriculture practices have been expanding worldwide in various modalities, including community, school, and household gardens. These initiatives are recognised for contributing to food and nutrition security, environmental sustainability, and social cohesion. Urban gardens are an alternative for promoting food security by providing fresh food for personal consumption or local sale, and they can serve domestic, collective, or educational purposes (Larsson; Giritli, 2024). The relevance of these practices is also reflected in the United Nations Sustainable Development Goals (United Nations, 2015), which promote urban gardening as a strategy for sustainable food systems.

Two other, less relevant recommendations were consuming foods that preserve agrobiodiversity and using active means of transportation to purchase food (mean scores of 4.5 and 4.25, respectively). Experts suggested combining the recommendation to choose foods that preserve agrobiodiversity with that regarding the consumption of foods of agroecological origin. Another suggestion was to incorporate issues related to sociobiodiversity. Agrobiodiversity refers to the diversity of resources used in agriculture, whereas sociobiodiversity encompasses the use and management of these resources, along with the knowledge and culture of traditional populations and family farmers (Burle; Ferreira, 2022).

It is known that means of transportation based on fossil fuels have an impact on the environment and that the use of active transport for the purchase of food can boost the local economy (Fogelberg, 2013; Sustainable Development Commission, 2009; Willett *et al.*, 2019). Nevertheless, some experts questioned the inclusion of this recommendation. The possibility of removing it from the guide was suggested, given the variation in individuals' ability to transport purchases and the existence of food deserts.

Recent modelling studies have shown that while transitions to healthy and sustainable diets can improve dietary quality and environmental outcomes in the long term, they may initially pose affordability and resource-related trade-offs, particularly for emerging and developing economies (Deng *et al.*, 2025), such as Brazil. This underscores the importance of region-specific strategies and international support to make these transitions viable.

5 CONCLUSION

This study defined recommendations to be included in a sustainable food guide for the Brazilian population using expert assessment. Adequate disposal of organic and recyclable waste, reduction of food waste, and consumption of food products with reduced or recyclable packaging were considered the most relevant and easiest to implement. The most difficult recommendations were related to individual food cultivation, use of active transportation means for food purchase, and consumption of foods that preserve biodiversity. The recommendations can guide public policies and enhance the understanding and decision-making of the Brazilian population regarding food production methods and selection criteria, with a focus on sustainability issues that extend beyond nutritional aspects.

This study has some limitations. The recommendations were described in general terms, and although they target the Brazilian population, each region has its own particularities. Such differences may require tailoring the recommendations to each population and evaluating their feasibility of application. Although online research methods have certain limitations, such as the lack of group discussions, the adopted technique was deemed effective in minimising shifts in opinions among experts. It is noteworthy that the adopted method can also be applied with experts who possess knowledge beyond the academic field.

Additionally, the literature review was based on searches conducted in Scopus, PubMed, and Google Scholar, which are widely used in international scientific research and include a significant number of Latin American publications, particularly Scopus. However, region-specific databases such as SciELO, Redalyc, Latindex, and Dialnet Plus were not included, which may have limited the regional diversity of the recommendations mapped. Furthermore, the review considered publications available up to the year 2022. As the volume of research on sustainable diets and food systems has grown significantly in recent years — including in Brazil — it is possible that more recent evidence could lead to the identification of new or updated recommendations. Future studies are encouraged to include regional databases and to update the literature search to reflect the current state of the field, which may influence both the recommendations proposed and their relevance or feasibility.

Despite these limitations, the methodology adopted was appropriate to achieve the study's objective, namely to identify and assess expert consensus on recommendations for a sustainable dietary guide for the Brazilian population. It is important to note that this study represents an initial approximation to the topic and does not allow for comparative analyses by region or institutional profile due to the limited and uneven distribution of respondents. As a future research agenda, we suggest conducting studies that validate, adapt, and stratify these recommendations in specific regional and sociocultural contexts and among different population groups. This will support the development of more tailored public policies and educational strategies aligned with the diverse realities of Brazil.

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