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Analysis of dietary and nutritional recommendations of adapted graphic instruments for bariatric and metabolic surgery

Tatiana Souza Alvarez[1], Lilian Cardia[2], Carina Rossoni[3],Ligia Cardoso dos Reis[4] , Maria Carolina Batista Campos von Atzingen[5], Roseli Oselka Saccardo Sarni[6]

[1]Clinical nutritionist and Professor of the Nutrition Course at the FMABC University Center, PhD in Health Sciences from FMABC, Brazil
[2]Clinical Nutritionist, Postdoctoral Program, Department of Gastroenterology, Faculty of Medicine, University of São Paulo, Brazil
[3]Clinical Nutritionist, Institute of Environmental Health, Faculty of Medicine, University of Lisbon, Portugal
[4]Nutritionist, Municipal Department of Education of São Paulo, Brazil
[5]Nutritionist, Department of Nutrition, School of Public Health, University of São Paulo, Brazil
[6]Physician, Full Professor at the FMABC University Center, Brazil

ABSTRACT

OBJECTIVE

To evaluate the effectiveness of five graphic tools utilized in bariatric surgery in comparison to the most recent international dietary guidelines and recommendations

METHODS

The research was conducted using an ad hoc procedure, specifically a survey of publications between 2000 and 2025 that provided graphic representations of nutritional guidance that were consistent with dietary recommendations for patients undergoing bariatric surgery. The focus was on guidelines on eating behavior and protein intake.

RESULTS

The analysis revealed that all of the instruments under consideration have a nutrient-centered approach, failing to consider behavioral factors that influence dietary patterns.

CONCLUSIONS

While the instruments assessed are consistent with dietary guidelines for the enhancement of dietary patterns, it is imperative to tailor recommendations to the specific circumstances of the postoperative period and the type of surgical procedure.

KEYWORDS

Dietary Guidelines; Bariatric Surgery; Eating Behavior.

Corresponding author:
Tatiana Souza Alvarez
Nutrition Course at the FMABC University Center
Av. Príncipe de Gales, 821, Vila Príncipe de Gales, Santo André/SP, Brazil, Zip Code: 09060-650
Email: tatiana.alvarez@fmabc.net
Orcid: 0000-0002-8034-2902

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INTRODUCTION

According to the 9th Global Report of the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO), in 2023, 593,500 bariatric procedures were performed, including primary and revision surgeries in 37 countries.[1]

Dietary recommendations after bariatric surgery are based on the progression of diet consistency and the prevention of nutritional deficiencies. Among the recommended favorable behaviors are eating 4 to 6 small meals a day, chewing food well, consuming foods of different textures, stopping eating when feeling "comfortably satisfied," prioritizing the consumption of solid foods, limiting sugar intake to avoid dumping syndrome, avoiding carbonated beverages, avoiding drinking during meals, and adopting mindful eating techniques.[2,3,5,6]

The initial development of nutritional recommendations was based on the characteristics of classic surgical techniques, which were supported by long-term evidence. The American Society for Metabolic and Bariatric Surgery (ASMBS) issued its initial set of specific nutrition guidelines for bariatric surgery in 2008. These guidelines were subsequently revised in 2013. For Roux-en-Y gastric bypass de-Roux (RYGB), vertical gastrectomy (VG), biliopancreatic procedures (BPD), and duodenal switch (DS), these guidelines recommend consuming 60 to 90 grams of protein daily (1.0 to 1.5 g/kg of ideal weight, or roughly 25% of total caloric intake), along with 45% carbohydrates and 30% fats.7 The protein recommendation of 60 to 80 g/day for RYGB and VG was maintained in the subsequent guidelines that came after this publication. In the event of BPD/DS, a 30% increase in protein intake is recommended due to malabsorption, resulting in an average protein intake of 90 to 120 g/day, which may ultimately reach 2 g/kg of ideal weight.

In 2019, Bhandari et al. presented a standardization of bariatric and metabolic procedures with the support of IFSO. This standardization encompasses new variations of classic and emerging techniques that still lack long-term randomized studies in the field of nutrition to define specific recommendations.[3,4,7-10]

Guidelines are divided regarding the specific recommendations for the consumption of other macronutrients, including carbohydrates and lipids, during the postoperative period. Despite the surgical technique, Tabesh et al. (2019) recommend a minimum intake of 50 g/day of carbohydrates, preferably complex carbohydrates.[3]

A reduction in caloric intake that is compatible with the chronicity of obesity and the constraints imposed by the size of the gastric pouch is necessary for bariatric and metabolic surgery, regardless of whether it is RYGB or GV. Consequently, it is advised to consume 1,500 to 1,800 kcal of energy per day for the first twelve months following surgery.[2,3,5]

It is recommended that protein-rich foods be prioritized over those that are high in carbohydrates or lipids to fulfill these recommendations. This is since they serve as the primary essential nutrients necessary in this context, promote thermogenesis, and contribute to the preservation of muscle mass. The preservation of lean mass is critically dependent on the quality of the protein consumed, particularly due to its essential amino acid content, particularly leucine, which is present in foods such as soy, eggs, meat, lentils, and cheese.[5,11] However, individuals who have undergone bariatric and metabolic surgery frequently have an insufficient and irregular protein intake.

The condition may be influenced by a variety of factors, including anatomical and functional changes, such as reduced hydrochloric acid production, which impedes protein digestion and the absorption of micronutrients that are dependent on gastric pH, and intestinal bacterial overgrowth, which can exacerbate gastrointestinal symptoms and impair nutrient bioavailability. Additionally, food intolerances may result from changes in gastric capacity and accelerated emptying.[5,11]

In addition to these factors, the risk of protein and micronutrient deficiencies in the postoperative period is also elevated by low adherence to continuous nutritional supplementation. These factors can lead to metabolic imbalances, such as sarcopenia. An insufficient protein intake and a return to pre-surgery eating habits that are high in carbohydrates and lipids can impede weight loss or even promote weight recurrence.[5,12,13]

Systematic nutritional monitoring is essential for individuals who are undergoing bariatric surgery, as it is essential for ensuring that they have sufficient nutritional status, preventing deficiencies, and optimizing their clinical outcomes. Educational resources can make a substantial contribution to the enhancement of patients' understanding of the dietary and behavioral modifications that are necessary during the postoperative period, as evidenced by the fact that they are applicable in both individual consultations and group interventions. [14]

The graphic tools that have been developed and adapted to the context of bariatric and metabolic surgery are emphasized in this scenario. These tools that are designed to emphasize the significance of consuming an adequate amount of food sources and protein supplementation during the post-surgical period.[11,14,17]

Given the importance of tools that facilitate the clinical practice of nutritionists in the monitoring of individuals undergoing bariatric procedures, the objective of this article was to examine the dietary aspects that are included in graphic representations that have been adapted for bariatric surgery, as described in scientific publications.

METHODS

The study design was the result of an ad hoc process. The primary objective of this non-systematic review was to specifically analyze graphic representations of nutrition for bariatric surgery, with a particular focus on the protein group. Consequently, the scope was broadened to encompass the examination of dietary guidelines for bariatric surgery that are addressed in these graphic instruments.

The search for available material was conducted in electronic databases, specifically in the Medical Literature Analysis and Retrieval System Online (MEDLINE), accessed via PubMed, covering the period from 2000 to 2025. After the initial identification, the studies were assessed for eligibility through the screening of titles and abstracts. Those meeting the criteria were analyzed in full text and classified as included or excluded. Original articles presenting graphic instruments aimed at nutrition education for individuals undergoing bariatric surgery, published in English or Spanish, were included. The graphic representations discussed in this study originate from the original articles, in compliance with copyright laws.

The variables included in the analysis of each graphic representation were the format of the instrument, the food groups represented, the nature of the recommendations (qualitative or quantitative), and the presence of additional non-food guidelines. These latter recommendations encompassed healthy habits, including the consumption of sweets and alcoholic beverages, regular physical activity, and maintaining hydration.

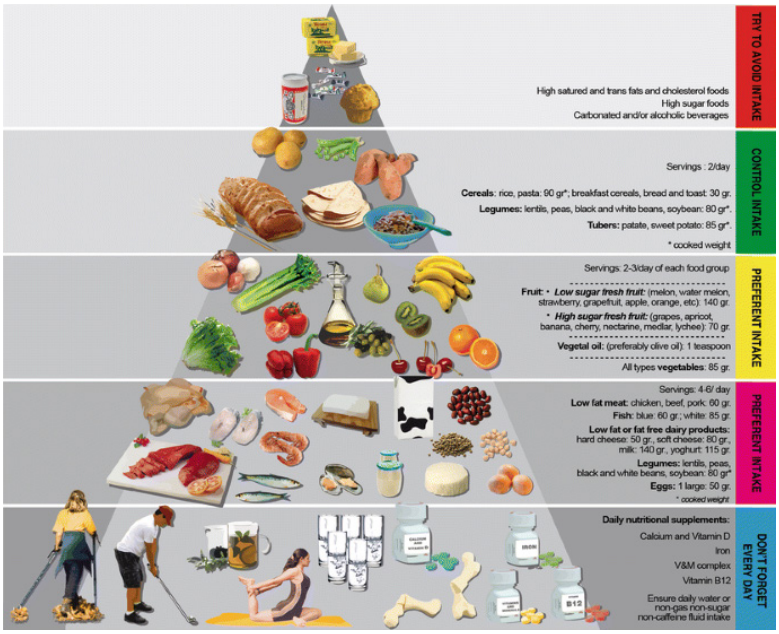
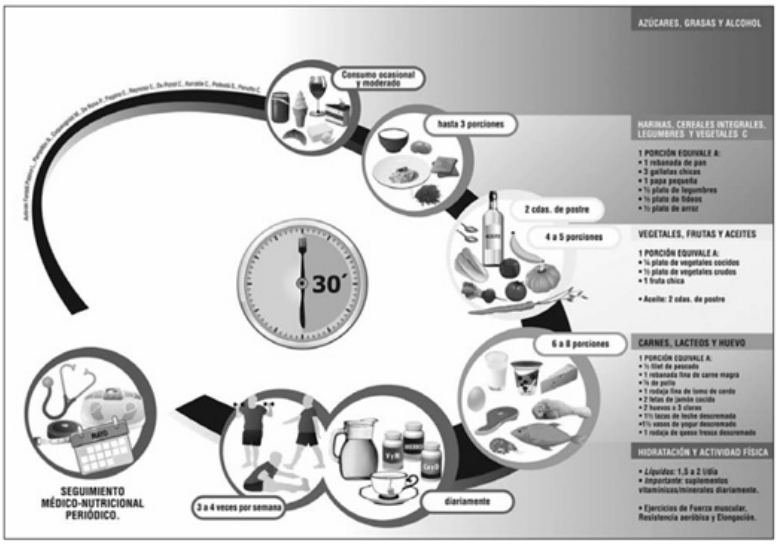
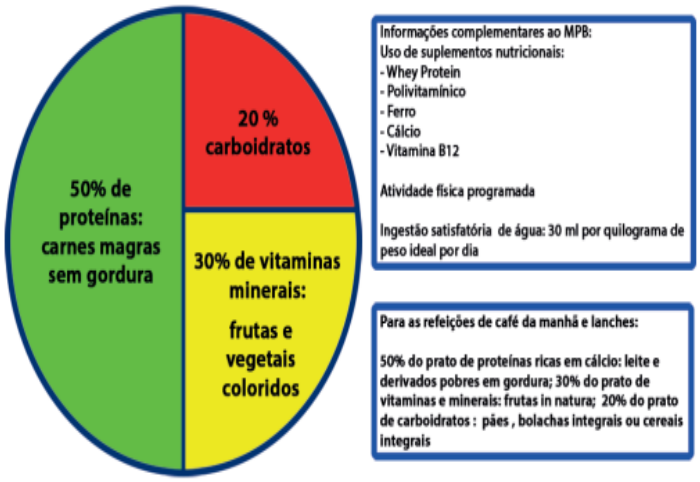
RESULTS AND DISCUSSION

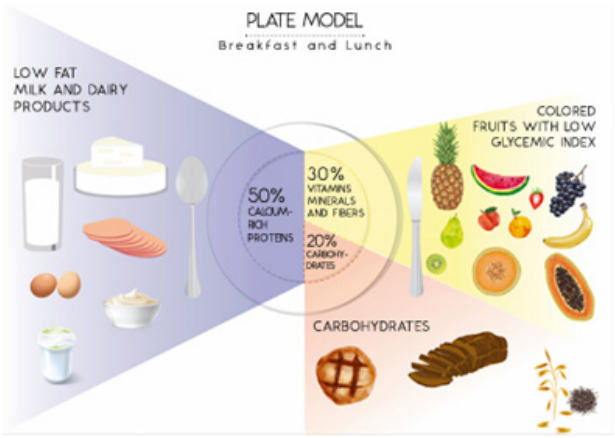
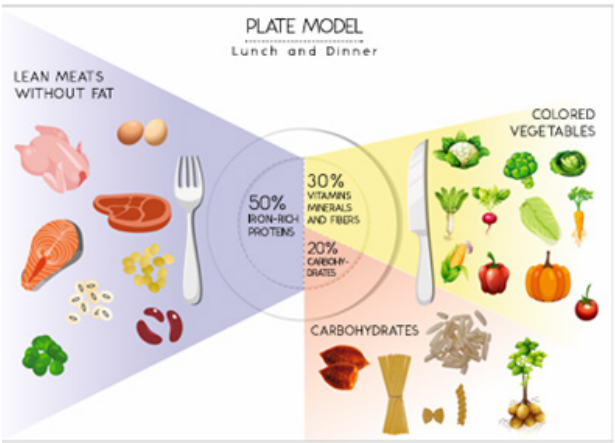
This study presents the systematization of data referring to food groups and eating behavior covered in each graphic representation, organized according to the year of publication (Figure 1). The publications analyzed were published by researchers from Argentina, Brazil, the United States of America, and Mexico between 2010 and 2020. The instruments analyzed revealed significant heterogeneity in format, covering food pyramids, model plates, and other image icons, with a variation of 3 to 6 food groups. Although some of these instruments were developed based on official dietary guidelines and included recommendations related to eating behaviors, in addition to nutritional guidelines, there was a lack of standardization in the form of representation, as well as in the level of detail of the recommendations. Additionally, it was found that all the instruments analyzed were based on US guidelines for bariatric surgery. [2,8,9]

Although this alignment offers consistent scientific support,

it may also restrict the instruments' applicability in various contexts, as it fails to account for the sociocultural, economic, and epidemiological uniqueness of other populations. This discrepancy suggests that the use of these models as a tool for food and nutrition education in diverse settings is at risk of poor adherence to guidelines, reduced clinical effectiveness, and fragility.

Figure 1: Features of graphical instruments

Graphical representation	Summary	Food groups	Authors
	• Food pyramid developed for BGYR, six months after surgery, based on a similar tool developed for the American population.	• Meat, legumes, eggs, milk, and skimmed dairy products; • Fruits, vegetables, and greens; •Whole grains, tubers, and pasta; • Oils, fats, sugars, carbonated drinks, and alcoholic beverages.	Moizé (2010) [14]
	• Oval-shaped figure with 12 specific recommendations following bariatric surgery, as per the Argentine Food Guide	• Meat, legumes, eggs, milk, and skimmed dairy products; • Fruit, vegetables, greens, and olive oil; • Whole grains, tubers, and pasta; • Oils, fats, sugars, carbonated drinks, and alcoholic beverages.	Pateiro (2014) [11]
	• Model plate for main meals (lunch and dinner) is depicted in the graphic image.	• Meat, legumes, eggs, milk, and skimmed dairy products; • Fruits, vegetables, and greens; • Whole grains, tubers, and pasta.	Cambi (2018) [15]

 	• Two graphic images for meals (breakfast, lunch, and dinner) after bariatric surgery.	• Meat, legumes, eggs, milk, and skimmed dairy products • Fruits, vegetables, and greens • Whole grains, tubers, and pasta	Flores (2020)[17]
	• Graphic image containing all phases of dietary transition in the postoperative period.	• Meat, eggs, milk, and skimmed dairy products; • Legumes; • Fruits; • Vegetables; • Whole grains, tubers, and pasta; • Oils and fats.	Cambi (2019) [16]

Source: The authors (2025)

The publication by Moizé et al., which was published in 2010, is based on the conventional American pyramid (The Food Guide Pyramid, 2005). However, the United States dietary guidelines have been revised to include a visual representation of the model plate, known as "My Plate," which was published in 2012. Therefore, the graphic representation by Moizé et al. is outdated in relation to current guidelines. Conversely, Pateiro, Cambi, and Flores employ the model plate as an educational tool in their graphic representations. Pateiro et al.'s publication features an oval-shaped graphic image that is derived from the Food Guide for the Argentine Population.[11,14-19]

Cambi et al. (2018 and 2019) have proposed bariatric plate that adopt a nutrient-centric approach and

incorporate elements that are included in the dietary guidelines of several countries, including Brazil, Canada, and Uruguay. These dish models organize meals by combining different thereby emphasizing the diversity of foods within each group.[15,16]

None of the graphic images analyzed is classified according to the degree of processing of the foods. As a result, the principles of these instruments do not prioritize the consumption of minimally processed foods, despite the fact that the consumption of ultra-processed foods is frequently linked to obesity and overweight.15,16,20-23 Foods are classified into four categories: fresh, minimally processed, culinary ingredients, and ultra-processed, as per the NOVA classification, which was introduced by the Food Guide for the Brazilian Population (2014). Based on biological, social, environmental, and cultural factors, this guide discourages the consumption of ultra-processed foods, which are associated with excessive calorie consumption, eating patterns that are challenging to regulate, and, as a result, excessive weight gain.[24]

Farias et al. assessed the food consumption of individuals undergoing RYGB and discovered that processed and ultra-processed foods accounted for 50% of their total caloric intake. To discourage the consumption of ultra-processed products and facilitate the maintenance of weight loss, it is imperative to evaluate the quantity and variety of foods consumed in postoperative dietary guidance, as well as the degree of processing.[25]

Flores et al. (2020) base their work on the official Mexican dietary guidelines "Plato del Bien Comer," the ASMBS guidelines, and graphic reference tools from Argentina and Brazil.[9,11,15,17] The study presents five graphic representations: four detail each phase of the post-surgical diet, while the fifth offers an integrated view of all phases. The publications of Pateiro, Cambi, and Flores are consistent with the recommendations of their respective national guidelines.[11,15-17]

In 2023, the Brazilian Guide to Nutrition in Bariatric and Metabolic Surgery was published, which included the guidelines proposed by Cambi et al. for snacks and main meals.[16,17,26]

The number of food groups suggested by the different instruments varies from three to seven, according to most dietary guidelines in the Americas. National and international dietary guidelines, as well as specific guidelines for bariatric surgery, serve as the foundation for guidelines regarding eating behavior following surgery. ls into three main meals and two snacks, with a minimum duration of 30 minutes; practicing mindful eating; chewing properly and consuming small amounts of food; restricting fluid intake during meals; maintaining adequate hydration; engaging in regular physical activity; limiting alcoholic and carbonated beverages; and daily supplementing with protein and multivitamin supplements, as illustrated in Table 1. [2-4,18-21]

The study conducted by Flores et al. (2020) evaluated the comprehension of graphic instruments by administering a self-assessment questionnaire to 51 participants. Ninety percent of the participants reported that they were able to comprehend the graphic images. The use of sectioned utensils (plate and bowl) to represent the appropriate portion size for each food group was observed in another study, which involved patients undergoing bariatric surgery and cognitive behavioral therapy. Before and after the intervention, there was a substantial decrease in emotional eating, which was correlated with the use of the model plate and dietary guidance.[17,27]

All current surgical techniques are addressed by current guidelines and consensus statements. Moizé et al. (2010) specifically cover RYGB in their study of graphic instruments, whereas Cambi et al. (2019) concentrate on the intragastric balloon (IB) and endoscopic gastroplasty (EG). These instruments are used for a wider range of techniques, including restrictive and mixed ones, both in the literature and in clinical practice.[4,11,15-17]

In their publications, Moizé and Pateiro offer quantitative menus that are accompanied by the corresponding macronutrient calculations. The energy intake is approximately 1200 kcal per day, with 25% protein, 45% carbohydrates, and 30% lipids. The dietary recommendations that correspond to the graphical representations are detailed (Table 1). The most comprehensive reference on protein distribution among the main food groups is the study by Moizé et al. (2010), which recommends 4 to 6 servings of protein daily. Protein supplementation is included when clinically indicated.[11,14]

Table 1: Dietary and behavioral recommendations for individuals undergoing bariatric and metabolic surgery

DIETARY GUIDELINESS	GRAPHICAL REPRESENTATIONS				
	Moizé (2010)[14]	Pateiro (2014)[11]	Cambi (2018)[15]	Cambi (2019)*[16]	Flores (2020)[17]
Evolution of diet consistency in the postoperative period	No	No	No	Yes	Yes
Energy recommendation (kcal/day)	1200	1273	1200	1000 - 1200	---
Protein recommendation (g/day)	60	60 – 120	60 – 80	60 – 80 (EG) 50 – 60 (IB)	90
Carbohydrate Recommendation (%/day)	45%	45%	45%	45% (EG) 50% (IB)	---
Lipids Recommendation (%/day)	30%	30%	30%	30%	---
Daily protein supplementation	Yes	Yes	Yes	Yes	Yes
Daily use of multivitamins and minerals	Yes	Yes	Yes	Yes	Yes
Guidance on hydration	1.8 liters/day	1.5 – 2.0 liters/day	30 ml/kg/day	30 ml/kg/day	1 – 1.5 liters/day
Guidance on regular physical activity	Yes	Yes	Yes	Yes	Yes

Source: prepared by the authors. * EG: Endoscopic Gastroplasty, BI: Intragastric Balloon

The use of supplements as a strategy to achieve the daily protein goal is recommended by all authors analyzed in relation to protein supplementation. However, Cambi and Baretta (2018) are the first to emphasize the specific type of whey protein supplement, which is diluted in water or skim milk and is available in isolated or hydrolyzed form. The utilization of hydrolyzed whey protein supplements is recommended in the subsequent publication by Cambi et al. (2019). Supplementation should be initiated by the third postoperative day and maintained indefinitely, according to the majority of authors. The daily recommended intake of protein is 25 to 30 g in portions that contain between 100 and 200 calories, and formulas with a carbohydrate content of less than 15 g.3,7,11,15-17,28

Nutritional guidance associated with protein supplementation is a critical aspect of postoperative care for individuals who have undergone bariatric surgery. Nevertheless, the necessity of developing strategies that encourage the acceptance and adherence to long-term nutritional objectives is underscored by the fact that adherence to adequate protein consumption tends to decrease over time. In this context, it is advisable to prepare foods that are high in protein and fiber and low in simple carbohydrates and lipids to optimize satiety, preserve lean mass, and contribute to sustained weight loss.4,6,29

The daily administration of multivitamin and mineral supplements is recommended in all the analyzed references. To fully satisfy daily nutritional requirements, these supplements should include at least two-thirds of the nutrients that correspond to 100% of the Recommended Dietary Allowances. They should be consumed with an appropriate amount of food. Due to the elevated risk of nutritional deficiencies and their potential clinical repercussions, it is crucial to underscore the necessity of rigorous monitoring of minerals such as calcium, zinc, and iron, as well as vitamins A, D, and B complex, particularly in women of childbearing age and individuals undergoing malabsorptive surgical procedures. The guidelines for bariatric procedures offer comprehensive nutritional recommendations for the majority of surgical techniques, with a focus on postoperative care and clinical follow-up through biochemical tests.[3,7,8,11,14-16,28]

The graphic tools that have been created for individuals who are undergoing bariatric surgery necessitate a critical evaluation of their applicability in clinical practice. Nevertheless, modern dietary recommendations employ a more comprehensive perspective on healthy eating, which considers biological, social, cultural, and environmental factors. Throughout the postoperative period, the focus should be on promoting sustainable, informed, and conscious food choices to promote patient autonomy.[20]

The evaluation of food consumption in this patient population is a critical instrument for the development of personalized meal plans that prioritize protein sources and incorporate all food groups. The estimation of food intake is facilitated through these graphical tools, which are collected from food composition tables and specialized dietary calculation software.[29,30]

To optimize adherence to recommendations and address the patient's unique requirements, it is imperative to incorporate variables such as appetite, taste perception, and food preferences into personalized nutritional guidance, in addition to quantifying consumption. [3,4,8,31]

This is the first publication to analyze dietary graphics specifically for individuals who have undergone bariatric surgery, according to the most recent available information. They are beneficial not only for clinical practice, as they enhance nutritional management, but also for public policy development, as they encourage interdisciplinary collaboration among healthcare teams. By offering transparent and easily accessible information in a standardized and effective manner, these tools facilitate the implementation of edu cational and nutritional guidance actions, thereby contributing to the standardization of dietary interventions in clinical and community settings.

FINAL CONSIDERATIONS

Despite the substantial expansion of the literature on nutrition and bariatric surgery in recent decades, this literature review demonstrates that there are still a limited number of publications that employ graphical tools, particularly in the context of the postoperative period's progression of diet consistency.

It is imperative to encourage patients' autonomy in selecting high-quality protein foods that are rich in prebiotic and probiotic fibers over high-calorie foods and to promote their understanding of food groups through the use of these tools.

It has been noted that the visual icons that are available in the literature generally adhere to traditional, nutrient-centered approaches, which prioritize the classification of foods based on their nutritional profile. Food consumption patterns are directly influenced by eating patterns, which are often disregarded in representations of healthy eating.

Individualized nutritional guidance should be provided, considering the clinical characteristics of the patient, the surgical technique, and the unique requirements of each individual. This guidance should prioritize the consumption of fresh or minimally processed foods and reduce the intake of ultra-processed foods in accordance with current health promotion guidelines. We propose the implementation of supplementary research utilizing graphic instruments to evaluate the efficacy of nutritional interventions and prevent weight recurrence in patients who have undergone bariatric surgery. This research should be conducted with a large sample size in the late postoperative period.

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