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Review

The Evaluation Methods of Menus in University Restaurants: A Scoping Review

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Abstract: University restaurants promote the health and well-being of students and the broader university community by providing balanced, affordable meals that enhance food and nutritional security. This scoping review aimed to map and systematize the methods used for menu evaluations in university restaurants, focusing on quantitative, qualitative, and mixed approaches. From 3118 database records and 64 gray literature sources, 70 studies met the inclusion criteria: 46% used qualitative methods, 33% quantitative, and 21% mixed. This review emphasizes the need for standardized, innovative frameworks integrating nutritional adequacy, user satisfaction, and sustainability. These advancements enhance research and operations in university restaurant management, supporting sustainability and public health.

Keywords: food services; menu; menu planning; food quality; sustainability; university restaurant

1. Introduction

University dining services are community foodservice facilities that play a central role in promoting students' health and well-being, since upon entering higher education, students may negatively alter their eating habits due to new behaviours and social relationships [1]. Other segments of society may also be positively impacted by university dining services, including the broader academic community, faculty, administrative staff, workers, and the general public. These dining services provide balanced and affordable meals that can make a significant contribution to the food and nutritional security of these populations [2,3].

In this context, student assistance policies assume a fundamental role: beyond ensuring access to and retention of socioeconomically vulnerable students in higher education, they are articulated with the management and improvement of food services. From this perspective, the provision of adequate and affordable meals constitutes one of the core axes of student retention and a strategy to ensure food and nutritional security within the university environment [4,5].

In Brazil, the National Student Assistance Policy, enacted into law in 2024 (Ministry of Education, 2024), guarantees support and maintenance for socioeconomically vulnerable groups with the aim of securing their continued attendance at public higher-education institutions. Given this articulation between access, retention, and the promotion of adequate nutrition, it is essential to understand how the menus offered contribute to nutritional quality, sustainability, and alignment with institutional healthy-eating guidelines, thereby reinforcing the need for their systematic evaluation [4,6]. Internationally, universities in various countries organize student dining services as essential components of wellbeing policies, underscoring the relevance of these services and supporting the pertinence of studies that investigate menu quality and management [6].

Defined as an operational tool, the menu establishes the foods intended to meet individual or collective nutritional needs (Federal Council of Nutrition [7]. Its development involves careful planning, cost control, attention to hygiene and sanitation practices, and a detailed analysis of each preparation, including total and per-capita values of macronutrients and micronutrients. Thus, to ensure effective menu planning and rigorous evaluation, it is necessary to ground practice in recent references on the technical development of menus for foodservice operations, addressing operational planning, cost control, selection and standardization of ingredients

and preparations, and methods to quantify the nutritional composition of meals [5,8]. These aspects are essential for assessing the quality and quantity of menus produced across all foodservice operations.

In the management of menus in university dining services, it is essential to employ methods encompassing diverse approaches, such as analyses of nutritional quality and user acceptability [9]. However, the heterogeneity of these methods can hinder comparisons between results and the implementation of continuous improvements [10]. Menu analysis methods used in foodservice operations vary widely and may include descriptive qualitative assessments, frequency analyses of food groups, nutrient-density methods, checks for compliance with dietary guidelines, and score-based instruments. Each approach therefore, differs in complexity, nutritional focus, level of detail, and the type of indicator employed, which underscores the importance of understanding their applications and limitations [4,5].

Given the relevance of the topic, this scoping review aims to map and systematize the methods used to evaluate menus in university dining services, offering a comprehensive overview of current practices and identifying gaps in the literature to guide future research. This study will provide insights into the approaches employed and serve as a basis for improving evaluation processes, with the objective of enhancing nutritional quality and promoting more sustainable and healthy eating practices within the university setting.

2. Materials and Methods

This study adopted a scoping review described according to the recommendations of the PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation [11]. This study was previously registered on the Open Science Framework platform (https://osf.io/ajzuc/ (accessed on 18 January 2026).

Following PRISMA-ScR recommendations, the research question was structured using the PCC (Population–Concept–Context) framework:

(1) Population (P): Menus from university restaurants
(2) Concept (C): Menu evaluation methods (quantitative, qualitative, or mixed)
(3) Context (C): Studies published in scientific databases and gray literature

Research question: "What methods have been used to evaluate menus from university restaurants, and how are these methods characterized (quantitative, qualitative, or mixed) in the scientific and gray literature?"

2.1. Data Source and Search Strategy

The search for information was conducted using the electronic databases PubMed, Embase, LILACS, WHOLIS, WPRIM, IBECS, SES-SP, VERTINDEX, LIS, PAHO, PAHOIRIS (via the Virtual Health Library) and gray literature. The review was conducted until 13 June 2024. No language restrictions were applied during the search process.

The list of terms identified in MeSH (medical subject headings), Emtree, or DeCS (health sciences descriptors) used to search for articles was as follows: "Restaurants", "Food Service", "Menu Planning", and "Food Quality". The information search strategy included combining the descriptors and using Boolean indicators "OR" and "AND". The search strategy is present in Table S1. For search in DeCS, the correspondence between Portuguese, Spanish, and French was also used. Furthermore, a manual search was performed on all the included study reference lists to identify potential local studies.

2.2. Outcomes

The main results were the method of menu evaluation for university restaurants. To determine how the menu evaluation methods are characterized, whether they are quantitative, qualitative, or mixed evaluation methods. The following were classified as quantitative methods, including measurements of macronutrients and/or micronutrients and/or number of portions and/or portion size and/or rest-ingestion and/or leftovers. The qualitative methods include the classification NOVA criteria and/or quality scores using scales and/or sensory aspects (color, texture [consistency], aroma, appearance, harmonization), and/or evaluation of menu acceptance and/or seasonality and/or integral use of food. Finally, the mixed methods encompassed both the quantitative and qualitative approaches.

2.3. Eligibility Criteria

Primary articles, monographs, dissertations, or theses that have evaluated menus in university restaurants quantitatively, qualitatively, or mixed were included.

We excluded cover letters without results, protocol studies without results, narrative, integrative, systematic reviews, meta-analysis, rapid review, scoping review, overview, living review; studies in which menu evaluation has not been carried out; studies carried out in other types of restaurants such as commercial restaurants, school restaurants or canteens, institutional restaurants (Long-Term Care Facilities and/or nursing homes, day-care centers, halfway houses—hostels and/or shelters [for women, pregnant women, puerperal women, adolescents], homes for drug addicts, orphanages, hospital and/or outpatient restaurants), popular restaurants; unrelated topics;

assessment of individual or population food consumption; analysis in animal populations or in vitro (cells or tissues). No restrictions were imposed on the dates or places of publication.

2.4. Study Selection and Data Extraction

We uploaded the electronic search results from the defined databases to the Rayyan Qatar Computing Research Institute app for systematic reviews [12]. Two reviewers independently screened titles and abstracts. These reviewers independently assessed each eligible study to determine whether it met the inclusion criteria. A third independent reviewer addressed any discrepancy.

The research team prepared and applied a data extraction spreadsheet to summarize the following data from the studies: reference (name and year of publication of the study), title, journal, objectives, study period (weeks), food service studied, type of menu (meals: lunch/dinner/snacks), instruments or references used to menu evaluation method, menu evaluation axis (quantitative/qualitative/mixed) and main results.

3. Results

A total of 3118 studies were identified in electronic databases, and 64 studies in other sources of gray literature. After the removal of 184 duplicates, 3000 titles and abstracts were screened. Of these, 136 records were assessed in full text—74 from databases and 62 from gray literature sources. In total, 66 studies were excluded according to the eligibility criteria (see Table S2). Following full-text assessment, 70 studies were included in this scoping review (Figure 1).

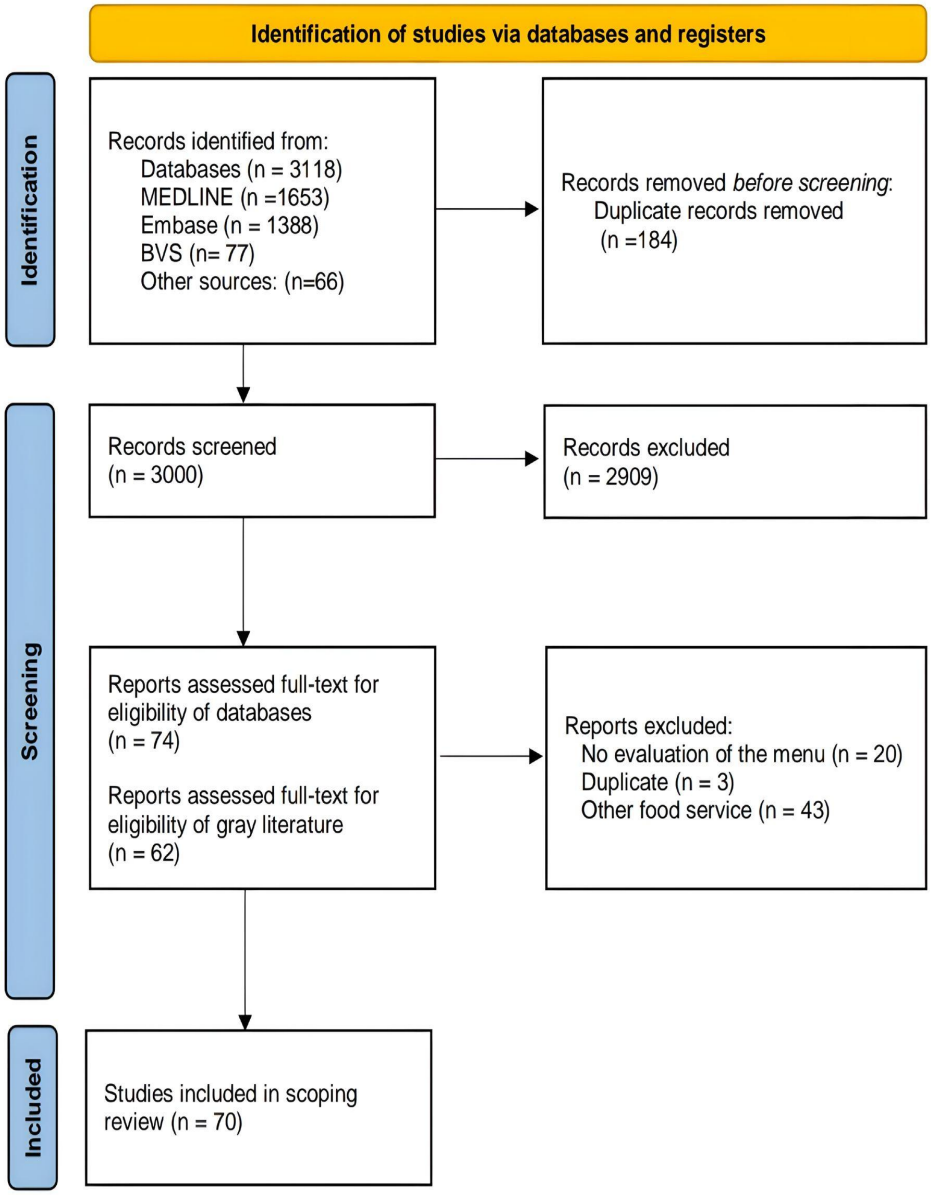

Figure 1. Flowchart for the selection of studies, 2024.

The geographic distribution of included studies showed a predominance of research conducted in Brazil (n = 62), while eight studies were carried out in other countries as follows: United States (n = 2), Malaysia (n = 2), China (n = 1), Iran (n = 1), Turkey (n = 1), and Uruguay (n = 1). Table 1 summarizes the main characteristics of the included studies. Regarding the type of meal evaluated, 51% (n = 36) analyzed lunch only, 36% (n = 25) evaluated both lunch and dinner, 7% (n = 5) did not specify the meal type used in the menu assessment, 5% (n = 3) assessed breakfast, lunch, and dinner, and a single study (1%) evaluated lunch and snacks. Concerning the target population served, 32 studies (46%) focused exclusively on university students; 6 studies (8%) assessed students and staff; 14 studies (20%) evaluated students, staff, and visitors; and 18 studies (26%) did not specify the population evaluated. With respect to the methods used to assess menus, 31 studies (44%) employed qualitative methods, 23 studies (33%) used quantitative methods, and 16 studies (23%) applied mixed-method approaches combining qualitative and quantitative techniques.

Because of the high concentration of Brazilian studies, the generalizability of the findings to other regional contexts may be limited, since regulatory, cultural, and organizational aspects of university foodservices vary between countries and can influence both the methods employed and the results obtained. In light of this, caution is warranted when extrapolating the results beyond the Brazilian context, and there is a clear need for further research in diverse countries to strengthen the international representativeness of the available evidence.

According to the qualitative methods for menu evaluation, 15 studies used only the Qualitative Analysis of Menu Preparations (AQPC). Additionally, other studies incorporated complementary analyses, such as the evaluation of Regional Foods (n = 4) and the assessment of the frequency of types of preparations and specific foods on the menu, aiming to go beyond the AQPC (n = 3). Furthermore, 2 studies evaluated only nutritional components. Moreover, 18 studies assessed menu satisfaction and acceptability among diners, 1 study applied the SERVQUAL and Five Gaps model, and finally, 1 study utilized a validated questionnaire by food group for menu planning.

One study used both the Qualitative Analysis of Menu Preparations (AQPC) and the Meal Quality Index (IQR), and therefore was reclassified as a mixed method.

Regarding the quantitative methods, a total of 14 studies were evaluated that measured some form of environmental footprint, whether combined with other methods or not. It was found that 1 study assessed only the carbon footprint, 3 studies assessed only the water footprint, and we categorized as environmental footprints those that included carbon, water, and ecological footprints, which were used in 1 study. Associations with these methods were found, such as the evaluation of carbon footprint, technical preparation sheets, and correction factor (n = 1); water footprint and technical preparation sheets (n = 1); environmental footprints, waste, and rest-ingestion (n = 1); water footprint, technical preparation sheets, and correction factor (n = 1); water footprint, ABC curve, correction or cooking factor, and correction factor waste generation (n = 1); water and carbon footprints, nutritional components, cost, and technical preparation sheets (n = 2); water and carbon footprints, waste, rest-ingestion, and cost (n = 1); and water footprint, greenhouse gases, nutritional components, and edible part index residues (n = 1).

Additionally, regarding the quantitative methods, it was identified that 7 studies assessed the Rest-Ingestion Index, 4 studies assessed production, consumption, waste, and rest-ingestion, and 1 study also included cost, assessing production, consumption, waste, rest-ingestion, and cost. 1 study assessed waste and rest-ingestion, 2 studies involved the evaluation of nutritional components, 1 study assessed nutritional components and correction factor, and finally, 1 study assessed nutritional components, waste, and rest-ingestion. Lastly, 4 studies evaluated technical preparation sheets, 2 studies combined technical preparation sheets and nutritional components, and 1 study assessed technical preparation sheets and correction factors.

Table 2 outlines the menu evaluation methods used and provides the references on which the authors based their qualitative, quantitative, or combined analyses. In total, 47 studies included some qualitative evaluation method, and 38 included some quantitative method, which could be applied either independently or in combination.

Table 1. Characteristics of included studies.

Reference	Title	Journal	Type of Meal	Customer	Menu Evaluation Method
Abadia et al., 2021 [13]	Dietary habits and satisfaction levels of students using the university restaurant at the Federal University of Triângulo Mineiro.	Revista Brasileira de Obesidade, Nutrição e Emagrecimento	Lunch and Dinner	University students	Qualitative
Almeida and Seabra (2021) [14]	Carbon footprint of menus offered by public educational institutions in Rio Grande do Norte.	Repositório Institucional da Universidade Federal do Rio Grande do Norte—Graduate thesis	Lunch	University students	Quantitative
Amorim et al., 2020 [15]	Qualitative evaluation of the menus of a university restaurant in São Luís—MA.	Repositório Institucional da Universidade Federal do Maranhão—Graduate thesis	Lunch	NI	Qualitative
Araújo et al., 2017 [16]	Quality analysis in a university restaurant using the SERVQUAL tool.	Exacta	Lunch	University students, employees and visitors	Qualitative
Araújo et al., 2019 [17]	Customer satisfaction at the university restaurant on the JK campus of the Federal University of the Jequitinhonha and Mucuri Valleys—UFVJM-MG.	Brazilian Journal of Development	Lunch	University students, employees and visitors	Qualitative
Ayeska et al., 2019 [18]	Analysis of food waste in the University Restaurant of a Federal Institution of Higher Education in Piauí.	IX Congresso Brasileiro de Engenharia de Produção	Lunch	University students	Quantitative
Benvindo et al., 2017 [19]	Nutritional quality of menus planned for university restaurants at federal universities in Brazil.	DEMETRA: Alimentação, Nutrição & Saúde	Lunch	University students	Qualitative
Bicalho et al., 2013 [20]	Impact of an intervention to reduce waste in a Food and Nutrition Unit.	Nutrire—Revista da Sociedade Brasileira de Alimentação e Nutrição	Lunch and Dinner	NI	Quantitative
Borges et al., 2019 [21]	Impact of a Campaign to Reduce Food Waste in a University Restaurant.	Engenharia Sanitária e Ambiental	Lunch and Dinner	University students, employees and visitors	Quantitative
Braga et al., 2015 [22]	Evaluation of University Restaurants Using Quality Indicators.	Desenvolvimento em questão	Lunch	NI	Qualitative
Campagnaro et al., 2022 [23]	Evaluation of university restaurant menus in different regions of Brazil: options for vegetarians.	Research, Society and Development	Lunch	University students	Qualitative
Canuto et al., 2019 [24]	Estimation of the correction factor based on the harvest season of the main vegetables and fruits used in the university restaurant of the Federal University of Sergipe (RESUN/UFS).	Brazilian Journal of Development	NI	NI	Quantitative
Carvalho and Furtado (2021) [25]	Avaliação de cardápios de restaurante universitário: uma abordagem a partir do Guia Alimentar para a População Brasileira e do Programa de Aquisição de Alimentos na modalidade Compra Institucional.	Repositório Institucional da Universidade Federal do Estado do Rio de Janeiro—Master's thesis	Lunch and Dinner	University students	Mixed
Casaril, 2020 [26]	Evaluation of university restaurant menus: an approach based on the Dietary Guidelines for the Brazilian Population and the Food Acquisition Program in the Institutional Purchase modality.	Revista Nutrição Brasil	Lunch	University students	Qualitative
Cavalcante et al., 2017 [27]	Customer satisfaction survey at a university restaurant in southwestern Paraná, Brazil.	Revista Brasileira de Obesidade, Nutrição e Emagrecimento	Lunch and Dinner	NI	Qualitative
Chagas et al., 2021 [28]	Acceptability of meal menus in public higher education institutions in Western Bahia.	Brazilian Journal of Health Review	Lunch	University students	Mixed
Chang et al., 2014 [29]	Student satisfaction with the service quality of cafeteria: a structural approach.	International Journal of Business, Economics and Law	NI	University students	Qualitative
Coimbra et al., 2019 [30]	Index of food waste and qualitative evaluation of menu items at a university restaurant in the municipality of Barreiras-BA.	Higiene Alimentar	Lunch	University students	Mixed
Conceição et al., 2021 [31]	Food waste in a university restaurant: assessment by leftover food intake and satisfaction survey.	Revista Simbio-logias	Lunch and Dinner	University students	Quantitative
Costa et al., 2017 [32]	Analysis of the cost of leftover food from the university restaurant at the Federal University of Acre.	South American Journal of Basic Education, Technical and Technological	Lunch	University students, employees and visitors	Quantitative

Table 1. *Cont.*

Reference	Title	Journal	Type of Meal	Customer	Menu Evaluation Method
Coutinho and Ginani (2017) [33]	Case study of the qualitative evaluation of menu preparations in a university food and nutrition unit—AQPC Method.	Repositório Institucional da Universidade Federal de Brasília—Master's thesis	Lunch	University students, employees and visitors	Mixed
Falco et al., 2021 [34]	Environmental Impact of the Menu Served at the UFRJ University Restaurant.	Anais da Jornada Giulio Massarani de Iniciação Científica, Tecnológica, Artística e Cultural	Lunch	NI	Quantitative
Fonseca et al., 2021 [35]	Comparative analysis of menu satisfaction and acceptability of vegetarian dishes in a university restaurant.	Research, Society and Development	Lunch and Dinner	University students	Mixed
Franchini et al., 2023 [36]	Increasing the Consumption of Environmentally Friendly Foods in a University Dining Hall Using Menu Item Placement.	Nutrients	Breakfast, lunch and dinner	University students	Quantitative
Giovanaz et al., 2023 [37]	Assessment of the Water Footprint of Menus Served in a Daycare Center in a Municipality in the Interior of Rio Grande do Norte, Cuité-PB.	Brazilian Journal of Education, Technology and Society	Lunch	University students	Qualitative
Hatjiathanassiadou et al., 2019 [38]	Environmental Impacts of University Restaurant Menus: A Case Study in Brazil.	Sustainability	Breakfast, lunch and dinner	University students and employees	Quantitative
Khaniki et al., 2016 [39]	Assessment of Female Students' Satisfaction with the Quality of Food and Environmental Health at Food Services in Tehran University of Medical Sciences, 2013.	Iranian Journal of Health, Safety & Environment	Lunch	University students	Qualitative
Kilian et al., 2021 [40]	Food and sustainability at university restaurants: analysis of water footprint and consumer opinion.	Sustainability in Debate	Lunch	NI	Mixed
Leonor, Silva, Didini, 2022 [41]	Identification of regional foods and qualitative evaluation of menu items at the university restaurant of the Federal University of Rio de Janeiro.	DEMETRA: Alimentação, Nutrição & Saúde	Lunch and Dinner	NI	Qualitative
Lima and Triches (2021) [42]	Sustainable diets: water and carbon footprint in menus offered at a university restaurant.	XI Jornada de Iniciação Científica e Tecnológica da Universidade Federal da Fronteira do Sul	Lunch and Dinner	NI	Quantitative
Lima et al., 2023 [43]	Reconciling healthy and sustainable menus with lower costs in a university restaurant.	Interfaces Científicas	Lunch and Dinner	NI	Quantitative
Lira et al., 2022 [44]	Evaluation of factors contributing to diners' satisfaction with the service at the university restaurant.	Revista Desafios	Lunch	University students	Qualitative
Maciel et al., 2019 [45]	Gastronomic interventions and analysis of acceptability in a university restaurant in the city of Belém-PA.	Demetra	Lunch	University students, employees and visitors	Mixed
Marten et al., 2011 [46]	Qualitative evaluation of menu preparations in a university restaurant in Pelotas—RS.	Congresso de Iniciação Científica da UFPEL	Lunch	University students, employees and visitors	Qualitative
Martins et al., 2019 [47]	Nutritional composition of menus planned and executed in a University Restaurant.	Repositório Institucional da Universidade Federal de Ouro Preto—Graduate thesis	Lunch and Dinner	University students and employees	Quantitative
Massarollo et al., 2019 [48]	Evaluation of food waste in a university restaurant in the municipality of Francisco Beltrão-PR.	Revista Brasileira de Obesidade, Nutrição e Emagrecimento	Lunch	University students, employees and visitors	Quantitative
Miquelanti et al., 2022 [49]	Quantitative and qualitative analysis of menus at the University Restaurant in Belo Horizonte (MG).	Research, Society and Development	Lunch	University students, employees and visitors	Mixed
Morte et al., 2021 [50]	Qualitative evaluation of the menus of a university restaurant.	Revista Univap	Lunch and Dinner	University students	Qualitative
Nogueira and Pereira, 2019 [51]	Evaluation of meal production in institutional school restaurants from a sustainability perspective.	Repositório Institucional da Universidade Federal do Rio Grande do Norte—Master's thesis	NI	NI	Mixed
Oliveira and Tavares (2017) [52]	Evaluation of the perceived quality of service offered by the central university restaurant of the Federal University of Rio de Janeiro using a two-dimensional matrix.	Repositório Institucional da Universidade Federal do Rio de Janeiro—Graduate thesis	Lunch and Dinner	University students	Qualitative

Table 1. *Cont.*

Reference	Title	Journal	Type of Meal	Customer	Menu Evaluation Method
Paião (2021) [53]	Sustainable Diets: Nutritional Analysis and Water Footprint in Menus from a Federal University Restaurant	Repositório Institucional da Universidade Federal da Fronteira Sul (UFFS), Campus Realeza, Paraná—Graduate thesis	Lunch and Dinner	NI	Quantitative
Pereira et al., 2020 [54]	Evaluation of calories and macronutrients in the menus of a university restaurant at a federal educational institution.	Journal of Medicine and Health Promotion	Breakfast, lunch and dinner	University students	Quantitative
Pereira et al., 2022 [55]	Qualitative analysis of menu preparations in a university restaurant: impact of using products from family farming.	Revista Desafios	Lunch	University students and employees	Qualitative
Rabelo et al., 2022 [56]	Sustainability in Institutional Restaurants: Campaign for Waste Reduction and Analysis of the Influence on Customer Acceptability.	REUNIR—Revista de Administração, Contabilidade e Sustentabilidade	Lunch	University students, employees and visitors	Mixed
Ramalho and Calado (2015) [57]	Nutritional adequacy of menus at a university restaurant in São Luís—MA.	Repositório Institucional da Universidade Federal do Maranhão—Graduate thesis	Lunch	University students	Quantitative
Raman and Chinniah, 2011 [58]	An investigation into higher learning students' satisfaction with food services at university cafeteria.	International Journal of Research in Commerce, It and Management	NI	University students	Qualitative
Rocha and Anjos (2017) [59]	Customer satisfaction: a case study of users of the university restaurant at UFPE CAA.	Repositório Institucional da Universidade Federal de Pernambuco—Graduate thesis	Lunch and Dinner	University students	Qualitative
Rocha et al., 2014 [60]	Qualitative assessment of menus at a university restaurant and risk factors for chronic degenerative diseases.	HU Revista, Juiz de Fora	Lunch	University students	Mixed
Sabbagh et al., 2021 [61]	Qualitative analysis of the menu items at a university restaurant.	Revista Da Associação Brasileira De Nutrição (RASBRAN)	Lunch	University students	Qualitative
Said et al., 2014 [62]	Qualitative evaluation of the menu at a university restaurant in Belém, Pará.	Anais do III Congresso de Educação em Saúde da Amazônia (COESA)	Lunch	University students	Qualitative
Saleki et al., 2023 [63]	The Evaluation of Menus' Adherence to Sustainable Nutrition and Comparison with Sustainable Menu Example in a Turkish University Refectory.	Nutrition & Food Science	Lunch	NI	Mixed
Salvi (2015) [64]	User satisfaction survey of the university restaurant at the Federal University of Santa Maria: An analysis of the Cachoeira do Sul campus.	Repositório Institucional da UFSM	Lunch and Dinner	University students and employees	Qualitative
Santana et al., 2018 [65]	Menu evaluation from the perspective of the new dietary guidelines for the Brazilian population in a public university restaurant in the municipality of Niterói/RJ.	Anais do 12º Congresso Brasileiro de Saúde Coletiva	NI	NI	Qualitative
Santana et al., 2022 [66]	Quantitative and qualitative analysis of the diet of public university students in Western Bahia.	Brazilian Journal of Health Review	Lunch	NI	Mixed
Sasaki and Chamaa, 2014 [67]	Qualitative evaluation of the menu offered at the university restaurant of a higher education institution in Mato Grosso do Sul.	Repositório Institucional da Universidade Federal da Grande Dourados—Graduate thesis	Lunch and Dinner	NI	Qualitative
Silva (2024) [68]	Qualitative evaluation of the menu items at a commercial restaurant on a university campus in Minas Gerais.	Repositório Institucional da UFU	Lunch	University students, employees and visitors	Qualitative
Silva and Carvalho, 2019 [69]	Qualitative Analysis of the Planned and Executed Menu of a University Restaurant.	Repositório Institucional da Universidade Federal de Ouro Preto—Graduate thesis	Lunch and Dinner	University students, employees and visitors	Qualitative
Silva and Pires, 2018 [70]	University restaurant: assessment of food and nutritional safety.	Sistema de Bibliotecas/UFVJM—Universidade Federal dos Vales do Jequitinhonha e Mucuri—Master's thesis	Lunch	University students	Mixed
Silva et al., 2019 [71]	Evaluation panel for menu planning at a university restaurant: a three-year timeline.	Higiene Alimentar	Lunch and Dinner	NI	Qualitative
Soares et al., 2018 [72]	Assessment of food waste during lunchtime at a university restaurant in the state of Piauí, Brazil.	Revista Brasileira de Higiene e Sanidade Animal	Lunch	University students	Quantitative

Table 1. *Cont.*

Reference	Title	Journal	Type of Meal	Customer	Menu Evaluation Method
Souza et al., 2019 [73]	Presence of regional foods and qualitative evaluation of the planned menu in a university restaurant in the Northeast region of Brazil.	Brazilian Journal of Development	Lunch	University students and employees	Qualitative
Spak, 2017 [74]	Application of mathematical modeling to menu planning for university restaurants.	Repositório Institucional da Universidade Tecnológica Federal do Paraná—Doctoral thesis	Lunch	University students	Mixed
Strasburg and Jahno (2016) [75]	Application of Eco-efficiency in the Evaluation of Inputs Consumed by University Restaurants: A Case Study.	Repositório Institucional da Universidade FEEVALE—Doctoral thesis	Lunch and Dinner	University students, employees and visitors	Quantitative
Strasburg and Jahno, 2015 [76]	Menu sustainability: assessing the water footprint of meals at a university restaurant.	Revista Ambiente & Água	Lunch and Dinner	University students	Quantitative
Strasburg et al., 2023 [77]	Nutritional Quality and Impact on the Environment Through Inputs from a University Eatery in Uruguay.	Archivos Latinoamericanos de Nutrición	Lunch and snacks	NI	Quantitative
Teixeira et al., 2021 [78]	Qualitative evaluation of vegetarian dishes on the menus of a university restaurant.	CONBRAN online	Lunch and Dinner	University students	Qualitative
Thiagarajah and Getty (2013) [79]	Impact on Plate Waste of Switching from a Tray to a Trayless Delivery System in a University Dining Hall and Employee Response to the Switch.	Journal of the Academy of Nutrition and Dietetics	Lunch and Dinner	University students, employees and visitors	Quantitative
Vieira, 2015 [80]	Assessment of waste and the supply of dietary fiber in the menu of the university restaurant at UTFPR—Campo Mourão Campus.	Repositório Institucional da Universidade Tecnológica Federal do Paraná (RIUT)—Graduate thesis	Lunch	University students	Quantitative
Wu et al., 2019 [81]	Characteristics, Influencing Factors, and Environmental Effects of Plate Waste at University Canteens in Beijing, China.	Resources, Conservation and Recycling	Lunch and Dinner	University students	Mixed
Zanini et al., 2020 [82]	Reducing food waste: a study in a university restaurant.	Revista Eletrônica de Administração	Lunch and Dinner	University students and employees	Qualitative

Note: Not informed: NI; Mixed: Both qualitative and quantitative methods.

Table 2. Description of menu evaluation methods and their references.

Reference of Study	Qualitative	Reference to the Qualitative Method	Quantitative	Reference to the Quantitative Method
Abadia et al., 2021 [13]	Satisfaction and acceptability	Own structured form		
Almeida and Seabra (2021) [14]			Carbon footprint, technical preparation sheets, and correction factor	[83]
Amorim et al., 2020 [15]	AQPC	[84,85]		
Araújo et al., 2017 [16]	SERVQUAL and Five Gaps model	[86,87]		
Araújo et al., 2019 [17]	Satisfaction and acceptability	Own structured form		
Ayeska et al., 2019 [18]			Production, consumption, waste, rest-ingestion and leftovers	NI
Benvindo et al., 2017 [19]	AQPC and Regional Food Evaluation	[84,85,88,89]		
Bicalho et al., 2013 [20]			Production, consumption, waste, rest-ingestion and leftovers	[90]
Borges et al., 2019 [21]			Production, consumption, waste, rest-ingestion and leftovers	[90]
Braga et al., 2015 [22]	Satisfaction and acceptability	[91,92]		
Campagnaro et al., 2022 [23]	AQPC and frequency of types of preparations and specific foods on the menu	[84,85], and own structured form		
Canuto et al., 2019 [24]			Nutritional components and Correction Factor	[93]
Carvalho and Furtado (2021) [25]	AQPC and Regional Food Evaluation	[85,88]	Technical Preparation Sheet	Own structured form
Casaril, 2020 [26]	AQPC	[84]		
Cavalcante et al., 2017 [27]	Satisfaction and acceptability	Own structured form		
Chagas et al., 2021 [28]	Satisfaction and acceptability	[94]	Rest-Ingestion Index and leftovers	[95,96]
Chang et al., 2014 [29]	Satisfaction and acceptability	Own structured form		
Coimbra et al., 2019 [30]	AQPC	[84]	Rest-Ingestion Index	[95]
Conceição et al., 2021 [31]			Production, consumption, waste, rest-ingestion and leftovers	[90,97]
Costa et al., 2017 [32]			Production, consumption, waste, rest-ingestion, leftoversand cost	NI
Coutinho and Ginani (2017) [33]	AQPC	[84,98]	Technical Preparation Sheet	Own structured form
Falco et al., 2021 [34]			Environmental footprints	[83]
Fonseca et al., 202 1 [35]	Satisfaction and acceptability	[99–101]	Rest-Ingestion Index	[95]
Franchini et al., 2023 [36]			Carbon footprint	[102–106]
Giovanaz et al., 2023 [37]	AQPC	[84,85]		
Hatjiathanassiadou et al., 2019 [38]			Water Footprint	[107–110]
Khaniki et al., 2016 [39]	Satisfaction and acceptability	Own structured form		
Kilian et al., 2021 [40]	Satisfaction and acceptability	Own structured form	Water footprint	[109]
Leonor, Silva, Didini, 2022 [41]	AQPC and Regional Food Evaluation	[84,85]; and its own form for characterizing regional foods		
Lima and Triches (2021) [42]			Water and carbon footprint, nutritional components, cost and technical preparation sheets	[83]
Lima et al., 2023 [43]			Water and carbon footprint, nutritional components, cost and technical preparation sheets	[83]
Lira et al., 2022 [44]	Satisfaction and acceptability	Own structured form		
Maciel et al., 2019 [45]	Satisfaction and acceptability	Acceptability tests for the National School Feeding Program (PNAE) [111]	Rest-Ingestion Index and leftovers	[112]
Marten et al., 2011 [46]	AQPC	[84]		
Martins et al., 2019 [47]			Technical preparation sheets and nutritional components	[113–116]

Table 2. *Cont.*

Reference of Study	Qualitative	Reference to the Qualitative Method	Quantitative	Reference to the Quantitative Method
Massarollo et al., 2019 [48]			Rest-Ingestion Index and leftovers	[95]
Miquelanti et al., 2022 [49]	AQPC	[84,85]	Technical Preparation Sheets, Correction Factor	[117–119]
Morte et al., 2021 [50]	AQPC and frequency of types of preparations and specific foods on the menu	[84,85], and Own structured form		
Nogueira, Josimara Pereira, 2019 [51]	Nutritional components	[113–115]	Water Footprint, Technical Preparation Sheets, Correction Factor	[38]
Oliveira and Tavares (2017) [52]	Satisfaction and acceptability	[120]		
Paião (2021) [53]			Water footprint and technical preparation sheets	[83]
Pereira et al., 2020 [54]			Nutritional components	[120]
Pereira et al., 2022 [55]	AQPC	[84,85,88]		
Rabelo et al., 2022 [56]	Satisfaction and acceptability	[121]	Rest-Ingestion Index and leftovers	[90]
Ramalho and Calado (2015) [57]			Technical preparation sheets and nutritional components	[113,122–125]
Raman and Chinniah, 2011 [58]	Satisfaction and acceptability	Own structured form		
Rocha and Anjos (2017) [59]	Satisfaction and acceptability	[126]		
Rocha et al., 2014 [60]	IQR and Nutritional components	[127]	IQR and Nutritional components	[128,129]
Sabbagh et al., 2021 [61]	AQPC	[84]		
Said et al., 2014 [62]	AQPC	[84]		
Saleki et al., 2023 [63]	Nutritional components	[130]; [131]	Water and carbon footprint, waste, leftovers and cost	[109,132]
Salvi (2015) [64]	Satisfaction and acceptability	Own structured form		
Santana et al., 2018 [65]	Nutritional components	[88]		
Santana et al., 2022 [66]	AQPC	[84,85]	Technical Preparation Sheet	[113,124,133,134]
Sasaki and Chamaa, 2014 [67]	AQPC	[84,85]		
Silva (2024) [68]	AQPC and frequency of types of preparations and specific foods on the menu	[50,84,85,135–137]		
Silva and Carvalho, 2019 [69]	AQPC	[84,85]		
Silva and Pires, 2018 [70]	ANVISA checklist	[138]	Technical Preparation Sheet	[113,133]
Silva et al., 2019 [71]	AQPC	[84,85]		
Soares et al., 2018 [72]			Rest-Ingestion Index and leftovers	[139,140]
Souza et al., 2019 [73]	AQPC and Regional Food Evaluation	[84,85,88]		
Spak, 2017 [74]	Validated questionnaire by food group	[141,142]	Nutritional components	[113,143]
Strasburg and Jahno (2016) [75]			Water Footprint, ABC curve, Correction or Cooking Factor, Correction Factor Waste Generation	[93,108,109,144].
Strasburg and Jahno, 2015 [76]			Water Footprint	[108,109]
Strasburg et al., 2023 [77]			Water footprint, Greenhouse gases, Nutritional components, Edible Part Index residues	[108,109,144,145]
Teixeira et al., 2021 [78]	AQPC	[84]		
Thiagarajah and Getty (2013) [79]			Waste and leftovers	NI
Vieira, 2015 [80]			Nutritional components, waste re-ingestion and leftovers	[90,146,147]
Wu et al., 2019 [81]	Satisfaction and acceptability	Own structured form	Environmental footprints, waste and leftovers	[148–156]
Zanini et al., 2020 [82]	Satisfaction and acceptability	Own structured form		

Note: AQPC: Qualitative Analysis of Menu Preparations; IQR: Índice de Qualidade da Refeição; Validated: Used some equation to assess validity; ANVISA: National Health Surveillance Agency of the Federal Government of Brazil; Environmental footprints: It encompasses water, carbon, and ecological footprints.

Table 3 presents the main findings from the analyzed studies, allowing for the identification, in general, that some positive aspects were identified, such as the inclusion of fruits and leafy greens, a low frequency of fried foods and sweets, and the use of cooking techniques that favored methods like roasting and grilling. In terms of variety and acceptance, the menus were generally well-received, particularly regarding visual presentation and color combinations.

However, some negative aspects were noted, including monotony in the color of the dishes and the repeated use of cooking techniques for vegetarian protein dishes, which occurred frequently and impacted the evaluation of the menus. Additionally, the presence of sulfur-rich foods and fatty meats was high in several regions, negatively affecting the nutritional quality of the menus, with these items being rated as fair to poor on many days. Furthermore, high rates of food waste were observed, indicating the need for improvements in both the acceptance and planning of the dishes served.

Table 3. Description of the main results and questions about acceptability found in the studies evaluated.

Reference	Main Results
Abadia et al., 2021 [13]	Acceptability: - Temperature of the meal: 69.33% totally satisfied; - Presentation of the menu: 42.67% totally satisfied; - Variety and taste/temperature: Partially satisfied, with 68.00% and 66.67% respectively; - Quantity of food served, with 22.67% totally dissatisfied; - Size of the portion of meat served: 34.09% dissatisfied; - Variety of food used in the preparations: 26.14% dissatisfied; - Quality and variety of sweets: 14.77% unsatisfactory
Almeida and Seabra (2021) [14]	Higher consumption of red meat, lower supply of chicken, pork, or fish, which corroborate the presence of values that imply environmental damage.
Amorim et al., 2020 [15]	- Fruit Offer: Fruit as a dessert was available on 100% of the days analyzed and was rated as excellent. - Fried Food and Sweets: Fried food, fried food with sweets, and sweets alone were found on 3.8%, 0%, and 0% of the days, respectively, and all were rated as excellent. - Leftovers and Preserved Foods: Leftovers appeared on 84.6% of the days, preserved foods on 19.2%, and monotony in colors on 15.4%, all classified as good. - Cooking Techniques for Vegetarian Protein Dishes: These techniques were repeated 69.2% of the time and were rated as poor. - Repetition of Preparations: Repetition of dishes or ingredients was observed every day, with 76.9% of the days showing repetition of the cooking techniques for the main protein dish. - Sulfur-Rich Foods: Present in 100% of the menus. - Offering of Fatty Meats: Fatty meats were offered on 80.8% of the days and were rated as very poor. - Cooking Techniques: The most commonly used techniques for main protein dishes were plating (64.1%) and roasting (17.9%). For vegetarian protein dishes, braising was the most common technique (53.8%), followed by roasting (26.9%).
Araújo et al., 2017 [16]	Diversity of the menu, compliance with the specifications of the invitation to tender, considering suggestions and queuing: Negative and poor customer satisfaction.
Araújo et al., 2019 [17]	Acceptability: - From 0 to 7, the average score for service expectations was 4.65 and for satisfaction it was 4.43. - The majority of users considered cleanliness (92.5%), service (86%), price (85.5%), variety (84%), menu (82.5%), lighting (63%), drinks (62.5%) and location (59.5%) to be important elements; However, after the meal, the highest levels of satisfaction were with the method of payment (77.5%) and cleanliness (75.5%), while the highest levels of dissatisfaction were related to price (64.5%), location (45.5%), variety (31.5%) and menu (29.5%). - With regard to the meal itself, the percentage of individuals satisfied with the healthy food on offer (59%), the quantity of the portion (58.5%), presentation (56.5%), followed by temperature (49.5%), taste (43%) and variety (39%).
Ayeska et al., 2019 [18]	More than 50% of users wasted food. Despite the fact that the majority of participants wasted very little food, it was noted that there was an amount of leftovers on the trays. Some of the most wasted items were salad, farofa, rice, and feijoada.
Benvindo et al., 2017 [19]	- Fruit Offerings: The Southeast, Midwest, and Northeast regions had the highest fruit offerings, while the North and South regions had regular offerings.

Table 3. *Cont.*

Reference	Main Results
Benvindo et al., 2017 [19]	- Salads and Leafy Greens: There was an adequate supply of leafy greens in the salads, but a monotony in the colors of the menus was noted. - Sulphur-Rich Foods: There was an inadequate supply of sulphur-rich foods. - Meat and Desserts: The supply of fatty meats was controlled, and regarding desserts, the Midwest only offered fruit, while the Northeast had a higher frequency of sweets. - Fried Food: There was a greater use of fried food in the Center-West region.
Bicalho et al., 2013 [20]	A significant reduction in the amount of food wasted, both on the consumer's plate (leftovers) and at the food distribution counter (leftovers), demonstrates the positive effects of the awareness campaign.
Borges et al., 2019 [21]	Significant reduction in waste, even with the increase in food production, demonstrates the positive effects of the campaign to train staff and raise awareness among diners.
Braga et al., 2015 [22]	Acceptability: - Analysis of the "Menu", "Physical Environment", "Price", and "Service" indicators revealed non-compliant items that negatively impact the user experience, while the price was evaluated as almost compliant, but still requires adjustments.
Campagnaro et al., 2022 [23]	- Positive Aspects: These included fruit and leafy vegetables. - Negative Aspects: Sweets, fried foods, and sweets associated with fried foods were present, with ratings ranging from fair to excellent. - Evaluation: The assessment of the monotony of colors and sulfur-rich foods ranged from regular to poor.
Canuto et al., 2019 [24]	Although some vegetables (lettuce, carrots, and peppers) and fruits (pineapples and oranges) showed variations in the correction factors, there was no significant influence from the harvest season, indicating that the high loss rates may be related to factors such as inadequate handling, available equipment, and operator skills.
Carvalho and Furtado (2021) [25]	- Leafy vegetables: Daily supply; - Fruit: Few fruit options, present only two days a week with little variety; - Processed and ultra-processed foods: Offered daily, which is classified as "very bad"; - Desserts: The absence of sweets is a positive point; - Sweetened juices and fried foods: These are present and are highlighted as negative aspects; - Substitute for animal protein: Textured soy protein was frequently used; - The potential for integrating local family farming production into the menus of the RUs stands out, given the scenario of family farmers located close to the university.
Casaril, 2020 [26]	- Leafy Greens: Leafy greens, such as lettuce, were offered daily and were present 100% of the days (n = 132). - Canned Food: The availability of canned food was low, with only 6.81% served as a garnish. - Color Combination: The combination of colors on the menus was inadequate, with 40.9% of the days (n = 54) showing similar colors. - Sulfur-Rich Foods: The presence of sulfur-rich foods was noted on 33.4% of the days (n = 44). - Fruit as Dessert: Fruit was offered as a dessert on 24.2% of the days (n = 32). - Fried Foods: The number of fried foods was 27.3% (n = 36), with a higher proportion of meat preparations (20.5%). - Fatty Meat: The amount of fatty meat was 42.4% (n = 56), which is considered high compared to other studies (37.5% and 15.6%).
Cavalcante et al., 2017 [27]	- Dissatisfaction: Repetition of pork, inadequate hygiene of the UAN and its utensils, variety of preparations, improvement in seasoning, and appearance of food. - Satisfaction: Food temperature.
Chagas et al., 2021 [28]	- Rest-Ingestion: The average rest-ingestion rate was 7.3%, which is considered acceptable but indicates a need for improvement. Acceptability: - All attributes of the menus demonstrated acceptability above 51%. The highest ratings were for presentation (88.98%) and color combination (86.97%), while the lowest ratings were for taste (78.75%) and consistency (77.55%).

Table 3. *Cont.*

Reference	Main Results
Chagas et al., 2021 [28]	- Taste had the greatest influence on the overall quality of the menus.
Chang et al., 2014 [29]	Acceptability: - Student satisfaction with the university cafeteria is influenced more by the quality of the food than by factors such as service, fair prices, and ambiance.
Coimbra et al., 2019 [30]	- Leftovers: The percentage of leftovers was considered adequate. - Food Supply: There was a high supply of sulfur-rich foods, fatty meats, and fried foods. - Survey Findings: The survey indicated a daily supply of leafy vegetables and fruit, as well as dishes with a variety of colors.
Conceição et al., 2021 [31]	The leftover-ingestion index had increased and was above the levels considered unacceptable by the literature, with waste at levels considered very bad for the Unit. Acceptability: - The persistent low acceptance of the menus throughout the week was directly related to the rice, garnish, and main course, especially in terms of taste, appearance, and quantity.
Costa et al., 2017 [32]	804.4 kg of food was wasted, equivalent to 12% of the total served, enough to feed 1435 people. The cost of leftovers over the period was R$5725.92, with a daily average of R$572.59, exceeding the cost of producing lunch at the university restaurant. Waste was associated with lower acceptance of repetitive menus.
Coutinho and Ginani (2017) [33]	- Absence of fried foods, sweets, and industrialized preserves: 92% of the menus were classified as very satisfactory; - Preparation techniques (29%), fatty meats (39%) and sulphur-rich foods (39%): Showed significant repetition; foods such as feijoada and sulphur-rich vegetables contributed to these indices. - Leafy vegetables and fruit: A daily supply of leafy vegetables (100%) and a high frequency of fruit (89%).
Falco et al., 2021 [34]	Beef-based preparations had the highest footprint (carne à lisboeta and almôndega ao sugo), with a negative environmental impact.
Fonseca et al., 2021 [35]	Among vegetarians, the ovolacto-vegetarian diet predominated (80.4%). Acceptability: - The general acceptance of the preparations was positive (score 4, I liked it), except for the aroma/flavor of some dishes (score 3, indifferent). - Food waste was considered to be high. - The acceptability index was satisfactory (>70%).
Franchini et al., 2023 [36]	- Before the intervention: The most chosen food categories were cheese (27% and 25%), pork (18% and 17%) and poultry (15% and 14%) for products with a high to medium carbon footprint (66% and 58%), and fruit (11% and 11%) and vegetables (15% and 17%) for foods with a low carbon footprint (37% and 42%). - After the intervention: Legumes, cereals, and nuts were the foods with the biggest increase, followed by vegetables, plant-based cheese, and fruit. Among foods of animal origin, eggs and certified sustainable fish options also increased, and no significant change was recorded for beef and plant-based options.
Giovanaz et al., 2023 [37]	- Excellent rating: Fried food, fruit, leafy greens, fatty meat, jam, jam with fried food, brown rice, and the vegetarian option; - Good: Offer of acidic juice with acidic fruit and the presence of preserves in the salad; - Fair: Food with the same colors; - Bad: Sulphur-rich foods and carbohydrate-based garnishes; - Bad: Regional foods on offer.
Hatjiathanassiadou et al., 2019 [38]	The conventional standard menu had the largest water footprint due to the use of animal products in its composition. Regarding the origin of the food, most of it comes from the state where the restaurant is located, which can be considered a positive factor in the search for sustainable food production.
Khaniki et al., 2016 [39]	Acceptability: - Appearance of the Food: 48% rated it as average. - Taste of Food: 41% rated it as poor.

Table 3. *Cont.*

Reference	Main Results
Khaniki et al., 2016 [39]	- Food Temperature: 44% considered it hot. - Quantity of Food: 47% rated it as good.
Kilian et al., 2021 [40]	Vegetables have a smaller water footprint than animal products. Acceptability: - There are differences between the RUs in terms of satisfaction with the price paid, eating habits and the range of vegetarian options on offer, with RU1 showing greater satisfaction than RU2 in these respects. RU1 has a greater diversity of ovolacto-vegetarian dishes and a higher percentage of vegetarian dishes, demonstrating greater customer satisfaction.
Leonor, Silva, Didini, 2022 [41]	- Fried Foods: Fried meats, fried food with jam, canned salad, repetitions of preparation techniques, repetitions of preparations, and fried foods were classified as excellent due to their occurrence of 0%. - Fruit as Dessert and Leafy Salad: Both were rated as excellent (93%). - Color Repetition: This was rated as fair. - Sulfur-Rich Foods: These were rated as bad (81%). - Fatty Meat: Rated as excellent (7%). - Sweet Desserts: Rated as good (15%), as they were offered once a week. - Regional Foods: There was a predominance of foods from the Northeast, Southeast, and South regions of Brazil.
Lima and Triches (2021) [42]	Vegetarian menus have lower environmental footprints, reduced costs, and provide most nutrients adequately, but require attention to some specific ones. Omnivorous menus, on the other hand, can be adjusted by reducing the amount and frequency of meat, especially beef, to improve environmental and economic impacts.
Lima et al., 2023 [43]	Vegetarian menus presented: - Lower water and carbon footprints. - Lower cost compared to omnivorous menus. - Lower average calories and nutrients such as proteins, lipids, zinc, phosphorus, vitamin B3, and vitamin B12. - Vitamin B12 is the biggest nutritional concern. - Lower bioavailability of iron and zinc and lower quality of protein consumed. - Lower amounts of cholesterol and saturated fats, promoting better lipid profiles. - Omnivorous menus - More costly. - Larger environmental footprint, mainly due to beef consumption. - Higher amounts of macro and micronutrients. - High biological value proteins, with better absorption of iron and zinc. - Higher levels of saturated fats and cholesterol.
Lira et al., 2022 [44]	- Salad Variety: The variety offered in the salad has a positive impact on satisfaction. - Salad Quantity: The quantity of salad available is also an important factor. - Visual Presentation of Beans: The visual presentation of the beans contributes to satisfaction. - Drink Quality or Variety: The quality or variety of the drink influences overall satisfaction. Acceptability: - Taste: Taste influenced the acceptance of nine preparations. - Visual Aspect: The visual aspect impacted the acceptance of six preparations. - Diners' Satisfaction: Diners' satisfaction with the university restaurant is related to the composition of the menu.
Maciel et al., 2019 [45]	There was a reduction in the levels of leftovers, and the values remained below 10%, in line with recommendations. There were no dirty leftovers in the main dishes after the interventions, and this was indicative of greater acceptance and less waste.

Table 3. *Cont.*

Reference	Main Results
Maciel et al., 2019 [45]	Acceptability: - After the interventions were carried out, an improvement in the appearance and taste of the food was identified, due to changes in the cutting, preparation, and hydration of proteins, the use of spices and ingredients to enhance flavor and texture (e.g., Bahian sauce, coconut milk, soy sauce). Acceptability ratings increased to over 85% after the interventions. There was an improvement in the expressions "I liked it" and "I loved it" (+8% for menu 1 and +9% for menu 2). And menu 3 had its acceptability maintained above 85%, guaranteeing its permanence on the menu.
Marten et al., 2011 [46]	- Offer of leafy greens: daily presence in 100% of the menus. - Sulphur-rich foods: classified as rich when two or more preparations with a high sulphur content were offered daily. - Desserts: higher frequency of sweets (60%) compared to fruit (40%). Fruit was offered twice a week, while sweets were offered three times. - Fried food: present in 50% of the menus, including meat and fried garnishes. The combination of sweets + fried food was low (25%). - Fatty meats: high frequency (75%), with meats such as sausages, hamburgers, and chicken thighs with skin. - Predominant preparation methods: Stews were the most used (70%), due to their yield and ease. Frying appeared in 40% of the preparations, which is considered high. Baking had a low frequency (15%).
Martins et al., 2019 [47]	The average caloric value of the planned and executed lunch and dinner respectively, exceeded the nutritional needs proposed by the recommendations. The diet followed by university students, based on lunch and dinner, has characteristics of low consumption of fruit, vegetables, and legumes.
Massarollo et al., 2019 [48]	There was less acceptance of the beef, which can be attributed to its quality, reflected in the price and frequency of supply, and in general, the leftovers were acceptable according to the literature. The leftovers from the trays could feed 16 people a day, totaling 161 people in 10 days, representing a loss of R$811.44 over the period due to waste.
Miquelanti et al., 2022 [49]	- Fried Food: The use of fried food was excessive in the vegetarian menu, while it was considered low in the meat menu. - Food Supply: The supply of fruit was rated as regular, and the supply of leafy greens was rated as excellent. There were no salads with preserves as the main ingredient, indicating care is being taken with nutritional quality and avoiding indirect sodium. - Sweets: The supply of sweets associated with fried foods was significant on the vegetarian menu, with a weekly frequency of 75%. In contrast, the meat menu had no sweets at all, and the overall presence of sweets was considered regular.
Morte et al., 2021 [50]	- Leafy Vegetables and Fruit: There was a high frequency of leafy vegetables and fruit. - Fried Foods: There was a low frequency of fried foods, fatty meats, and fried sweets. - Color and Sulfur-Rich Foods: A high frequency of similar colors and foods rich in sulfur was noted. - Fruit Ratings: Fruit and fruit-based preparations were rated as good (78.2%) and excellent (92.3%). - Leafy Vegetables: Leafy vegetables had a high frequency, present on 86.5% to 97.6% of days. - Color Repetition: The repetition of colors in dishes and ovolacto-vegetarian options was high, reaching up to 86.5% of the days at lunch, which was classified as bad. - Sulfur-Rich Preparations: Preparations rich in sulfur were frequent due to the high presence of leafy vegetables. - Fatty Meat Supply: The supply of fatty meats was moderate, with 24.2% of the days at lunch (rated as good) and 9.5% at dinner (rated as excellent). - Common Cooking Methods: The most common cooking methods were roasting, grilling/plate, and stewing. - Carbohydrate Frequency: The frequency of carbohydrates in vegetarian options was high, with 61.1% at lunch and 45.2% at dinner. - Sweets Supply: Sweets were offered about twice a week, according to the contract, with a frequency of 32% at lunch and 35% at dinner.

Table 3. *Cont.*

Reference	Main Results
Nogueira, Josimara Pereira, 2019 [51]	- Financial Investment: The financial investment was greatest in fresh or minimally processed foods (73.4%), followed by processed foods (11.9%), ultra-processed foods (10.8%), and culinary seasonings/ingredients (2.2%). - Nutritional Concerns: Excess sodium was identified in 60.8% of the foodstuffs, excess saturated fat in 46.9%, excess total fat in 43.6%, excess free sugars in 40.1%, and the presence of sweeteners in 16.2%. Only 9.2% of the foods contained genetically modified organisms, and the restaurants did not exclusively purchase organic fresh food. - Water Footprint: In the analysis of the menus, the average water footprint was 2165.8 L of water per meal.
Oliveira and Tavares (2017) [52]	Acceptability: - Positive aspects: Price (95.97%), food quality (57.26%), practicality (50.81%). In relation to the performance of the restaurant, aspects such as "Temperature of the food" (87.1%), "Cleanliness of the counter" (87.1%), "Frequency of healthy preparations", "Access to the restaurant" and "Accessibility" stood out. - Negative aspects: "Waiting time in line", "Arrangement and circulation between tables and chairs", "Options for hand hygiene", "Cleanliness of utensils", and "Speed". Other problems pointed out included limited hand sanitizing options (21.77%), little variety on the menu (especially vegetarian options), and poor quality juices. - Despite this, the majority of respondents considered the overall performance to be positive (79.8%), and satisfaction with the restaurant was high (77.4%), with cost-effectiveness, the quality of the preparations, and healthy options standing out as strong points.
Paião (2021) [53]	Positive aspects - Omnivorous menu: Higher in calories, with a greater supply of proteins and nutrients such as lipids, phosphorus, zinc, and vitamins B3 and B12, which are essential for various metabolic functions. It offers a greater diversity of protein sources. - Vegetarian menu: Lower water footprint, suitable for low-calorie diets and reduced consumption of fats (saturated and trans). Negative aspects - Omnivorous menu: High water footprint, especially due to the consumption of red meat. - Vegetarian menu: Lower intake of nutrients such as proteins, vitamins B3 and B12, and zinc. Dependence on foods such as soy and a limited variety of protein options, especially in menus with additional restrictions.
Pereira et al., 2020 [54]	The average amount of calories, protein, and lipids exceeded the recommended quantities, showing a percentage of adequacy above the recommended values. The result closest to adequate was for carbohydrates, but this was below the RDI recommendations.
Pereira et al., 2022 [55]	- Item Classification: No item was classified as bad. - Sweets and Fruit Offerings: Items such as the offer of sweets, fruit, and sweets + fried food were classified as fair (26% to 50% of occurrences). - Other Ratings: The remaining items were rated as good, which is considered a positive result. - Fruit and Sweets Supply: Fruit was offered four times a week, representing 57.1% of occurrences, while sweets were offered on 12 days (42.9%). - Food Combination Flaws: Flaws were identified in the combination of foods, affecting the visual aspect. - Sulfur-Rich Foods: Sulfur-rich foods were identified on 50% of the days. - Fatty Meat Supply: Fatty meats were offered on 25% of the days. - Fried Food Frequency: Fried food was identified on 39.3% of the days.
Rabelo et al., 2022 [56]	- Satisfactory leftover intake: On 83% of the days evaluated, the leftover values were considered acceptable (15 to 45 g/person). - Anti-waste campaign: There was no significant impact, with leftover-ingestion rates remaining stable before (34%) and after (44%) the campaign. Acceptability: - General acceptance of the menus: Above 70% on all the days evaluated, with an overall average index of 84%. - Main course: 82% acceptance. - Garnishes: 78% acceptance.

Table 3. *Cont.*

Reference	Main Results
Rabelo et al., 2022 [56]	- Preparations with low acceptability were identified in 4.2% of the main dishes ("Meatballs in sauce") and 16.6% of the garnishes ("Braised zucchini", "Pasta in Bolognese sauce", "Pasta in meatball sauce", and "Garlic and oil pasta").
Ramalho and Calado (2015) [57]	Total Energy Value: - Offered 11.8% above the recommended DRIs for men and 42.7% above for women. - Exceeded the PAT by 14.3%, due to the high per capita usage. Macronutrients: - Proteins: Excessive, especially due to the high supply of meat, rice, and beans. - Lipids: Above what is recommended by the PAT in 60% of the menus, associated with the use of meat. - Carbohydrates: Below that recommended by the PAT, reflecting the high percentage of proteins and lipids. - Saturated fats: Within the recommendation (<10%). Micronutrients: - Vitamin B1, Iron, and Zinc: Offered in adequate quantities. - Vitamin A: Lower than recommended in 25% of menus. - Calcium: Inadequate, in line with national food standards. - Sodium: Up to 5 times higher than recommended, due to the use of industrialized seasonings. - Fiber: Satisfactory, due to the frequent presence of legumes, vegetables, and fruit.
Raman and Chinniah, 2011 [58]	Acceptability: - The majority of students are dissatisfied with the cafeteria's services, with the most significant factor being the quality of the food.
Rocha and Anjos (2017) [59]	Acceptability: Negative aspects: - High price charged for the meal. - The variety of the menu (food and drink) is not satisfactory for consumers. Positive aspects: - Use of masks, caps, gloves, and aprons. - Cleanliness of staff uniforms. - Characteristics of the environment, in terms of adequate lighting. - Adequate storage and display conditions for prepared meals. - Taste of the meals. - Provision of information about the week's menu to customers. Average aspects: - Comfort of the restaurant (pleasant temperature and comfortable chairs). - Accessibility for the disabled. - Appearance of the food.
Rocha et al., 2014 [60]	- There was a wide variation in the calorie intake of the menus (971.4 to 2099.4 Kcal), indicating a lack of standards or systematic calculation. - Sodium was high on all the days analyzed, with an average of 3600 mg only at lunch, exceeding the limits recommended by the WHO (5 g/day). - The protein content exceeded the ideal levels on 92% of the days—The supply of selenium and chromium was insufficient on 100% of the days. - Lipids were adequate on 89% of the days, as were vitamins in general, except for vitamin A and biotin.
Sabbagh et al., 2021 [61]	- Daily Supply: There was a daily supply of fruit, leafy vegetables, and sweets (100%). - Occurrence of Foods: The occurrence of fatty meats was 57.1%, foods rich in sulfur was 47.6%, and monotony of colors was observed on 38.1% of the days. - Fried Foods: Fried foods and foods associated with sweets had a low occurrence (9.5%).
Said et al., 2014 [62]	- Fried Food: There was a low incidence of fried food (8.69%), classified as excellent. - Sweets: There was an absence of sweets and sweets associated with fat, which were also considered excellent.

Table 3. *Cont.*

Reference	Main Results
Said et al., 2014 [62]	- Sausages: There was a high presence of sausages (100%), classified as very bad. - Fruit Provision: The provision of fruit was excellent (100%), also classified as excellent. - Leafy Vegetables: The supply of leafy vegetables was low (8.69%), classified as very bad. - Sulfur-Rich Foods: There was a moderate presence of sulfur-rich foods (43.70%), classified as fair. - Fatty Meat: The supply of fatty meat was low (13.04%), classified as good. - Color Diversity: The diversity of colors on the menu was well evaluated, receiving an excellent rating.
Saleki et al., 2023 [63]	- Sustainable menus based on plant-based foods and less meat had lower carbon and water footprint values, as well as being more balanced and sufficient in micronutrients. - Traditional menus were more expensive and had a greater environmental impact, with high levels of saturated fat, sodium, added sugars, and energy, exceeding the recommended values.
Salvi (2015) [64]	Acceptability: - Positive Aspects: Organization of the buffet (82.5%), hygiene (70.1%), healthy food (60.5%). Uniforms and hygiene (93.75% satisfied/very satisfied), quick food replacement (97.5%), and affordable prices (91.25% satisfied). - Negative aspects: Food temperature (72.6% dissatisfied), meat portions (62.6%), dessert (73.8%), and quality of rice (61.3%) and meat (72.5%). Problems are attributed to the low cost of the tender and occasional preparation errors. Cleanliness of trays, glasses, and plates, with 66% dissatisfied due to inadequate hygiene practices.
Santana et al., 2018 [65]	More than half of the menus had a ratio of more than 3:1, which is considered adequate for the nutritional quality of the meals, in terms of the percentage contribution of the VET per food group.
Santana et al., 2022 [66]	- Food Offer: Fruit was offered on 95.65% of the evaluated days, while leafy greens were present in 88.04% of the menus. - Sulfur-Rich Foods: Sulfur-rich foods were found on 76.08% of the days; fatty meats on 28.26%; and sweets on 40.27% of the days, all classified as regular. - Fried Foods: Fried foods were offered on 17.39% of the days, with fried foods combined with sweets on 11.95% of the days. - Positive Aspects: Despite the inadequacies, the menus included positive aspects, such as the offer of fruit and vegetables and the diversity of colors.
Sasaki and Chamaa, 2014 [67]	- Frying: Not used in the University Restaurant. - Daily Offers: Fruit and leafy greens are always available, but sweets are also offered daily, which is considered a negative aspect. - Monotony in Colors: 71% of the menus displayed monotony in the coloring of the dishes. - Sulfur-Rich Foods: Present in 63% of the dishes. - Fatty Meat: 67% of the dishes contained fatty meat. - Simultaneous Absence: There were no sweets and fried foods on the menus at the same time.
Silva (2024) [68]	Positive aspects: - Leafy greens: Offered 100% of the time, rated “Good”. - Sweets and pastries associated with fried foods: Absent from the menu, rated “Good”. - Vegetarian options: Rated “Good”, with a frequent presence on the menu. - Regional preparations: Occurred on 98% of the days, classified as “Good”. Negative aspects: - Fruit: Offered on only 11% of the days, classified as “Bad”. - Monotony of colors: Observed on 100% of the days, rated “Bad”. - Sulphur-rich foods: Present on 100% of days, rated “Bad”. - Fatty meats: Offered on 100% of days, rated “Bad”. - Fried food: Offered on 100% of days, rated “Bad”. - Carbohydrate-based garnishes: Present 100% of the time, also classified as “Bad”.
Silva and Carvalho, 2019 [69]	- Positive Aspects: There was an adequate supply of fruit, leafy greens, and fried foods, with good ratings for both lunch and dinner.

Table 3. *Cont.*

Reference	Main Results
Silva and Carvalho, 2019 [69]	- Negative Aspects: Negative aspects included the presence of identical colors, the inclusion of fatty meat, the offer of processed and ultra-processed foods, and the addition of oil and fat in the preparations, especially at lunch. At dinner, the same inadequacies were observed, along with foods rich in sulfur. The lack of planning was identified as a factor that could negatively affect the nutritional quality of the meals served.
Silva and Pires, 2018 [70]	- Hygienic-Sanitary Evaluation (ANVISA Checklist): Workplace: 100% (satisfactory) Toilets: 66% (fair) Water Care: 100% (satisfactory) Garbage Care: 100% (satisfactory) Food Handlers: 75% (regular) Raw Materials: 100% (satisfactory) Food Preparation: 71.44% (fair) Food Distribution: 83.33% (satisfactory) - Despite the limitations, the analyzed restaurant manages to promote Food and Nutrition Security.
Silva et al., 2019 [71]	- Fruit and leafy greens: Classified as "good" and "excellent", including juices, fresh fruit in salads and desserts, the restaurant prioritized a greater supply of vegetables, fruit, and juices on a daily basis. - Colors on the menus: Evolution from "bad" to "fair" in terms of color monotony. - Sulphur-rich foods: Classified as "fair" and "poor", present in leafy vegetables, pulses, eggs, and fruit. - Sweets on the menu: Offer remained regular between 2015 and 2018, with the highest percentage at dinner (35.4%). - Fried foods and fatty meats: Low supply, classified as "good" and "excellent". - Farinaceous foods: Gradual increase at dinner, classified as "regular" and "good".
Soares et al., 2018 [72]	- Average Waste: The average amount of food wasted was 167.6 g per person, totaling approximately 119 kg per day. - Per Capita of Food Served: The per capita food served was 0.812 kg, also higher than in previous surveys. - Feeding People: The waste generated could have fed 156 people daily. - Waste Rates: Waste rates ranged from 10.53% to 19.83%, classified as bad.
Souza et al., 2019 [73]	Positive aspects: - Fried food: only present on 1 day during the evaluation period, classified as "Good". - Consumption of sweets: Restricted to 1 day, offering fruit popsicles, classified as "Good". - Fatty meats: Absent during the period analyzed, with lean meats being offered, classified as "Good". - Regional foods: Present in 39% of the planned preparations. Negative aspects: - Sulphur-rich foods: Classified as "Bad". - Repetition of colors and canned foods: Classified as "Fair".
Spak, 2017 [74]	- A menu of 10 meals was generated that met most nutritional parameters for micro and macronutrients, except for energy requirements, which needed to be adjusted.
Strasburg and Jahno (2016) [75]	Positive aspects: - Acquisition of inputs: Products of plant origin totaled 632,213.1 kg, providing a better energy ratio in kcal and lower environmental impact compared to those of animal origin. - Eco-efficiency: RU 5 obtained the best eco-efficiency rating in terms of energy, cost, and environmental impact, followed by RUs 3, 1, 2, and 4. - Rational use: The evaluation showed practices that identify waste and promote efficiency in the management of food inputs. Negative aspects: - Animal x plant ratio: Animal products accounted for 70% of the financial cost, above the recommended range (39–58%).

Table 3. *Cont.*

Reference	Main Results
Strasburg and Jahno (2016) [75]	- Environmental impact: A strong positive correlation was found between the consumption of inputs of animal origin (kg) and the water footprint (PH), indicating a greater environmental impact. - Waste: High percentages of food waste related to preparation and leftovers, highlighting the need for preventive strategies. Classification related to the menu: - Distribution of meat: beef (53.48%), chicken (37.26%), and pork (9.26%). - Environmental impact: Animal products contribute significantly to the water and carbon footprint. - Percentage of regional products: Only 39% of typical food from the Northeast.
Strasburg and Jahno, 2015 [76]	- Food Quantification: All foods used were quantified to assess their representativeness in kilograms (kg) and PH. - Plant Origin: Products of plant origin (cereals, legumes, vegetables, and fruit) accounted for 65.5% of the total in kg of fresh products, but only 22.1% of the total PH. - Animal Origin: Animal products accounted for 77.9% of PH, with beef cuts alone comprising 62.2% of this group's total. - Average PH: The average PH per menu preparation was 2099.1 L/day during the evaluated fortnight. - Comparison of PH: On the days when beef was served (6 days), the average daily PH was 2717 L. - Reduction in PH with Chicken: On the days when the protein dish was chicken (4 days), there was a 44.2% reduction in PH, resulting in 1172 L/day compared to the overall daily average per menu.
Strasburg et al., 2023 [77]	Positive Aspects: - Food Diversity: 78 different types of food were used, with 93.17% of this total represented by the AB curve, involving animal and plant products. - Environmental Impact: GHG emissions were reduced by replacing products such as spinach of international origin with more local options. Consumption of plant-based foods performed better in terms of eco-efficiency and environmental impacts, with a smaller water footprint and lower GHG emissions. - Degree of Processing: The majority of foods (over 90%) were unprocessed or ultra-processed, in line with the recommendations of the Food Guide for the Uruguayan Population on the consumption of natural and minimally processed foods. - Sustainability and Local Economy: Buying local food could reduce GHG emissions, as well as benefit the regional economy and strengthen local agriculture. - Nutritional Quality: The menu offers a good variety of foods with adjustments for specific diets, according to users' needs, in line with healthy eating practices. Negative Aspects: - Environmental Impact of Food of Animal Origin: Despite representing a smaller amount in kg (26% of the total), food of animal origin accounted for 69.8% of the water footprint, highlighting the high environmental impact associated with meat consumption, especially beef. - Food waste: A large amount of food waste, especially from fruit and vegetables, due to the disposal of inedible parts such as peels and stalks, generating waste of resources such as water and energy. - GHG emissions from imported products: Food imports, such as processed spinach from Belgium, contributed significantly to GHG emissions, highlighting the environmental impact associated with international food transportation. - Imbalance between Food of Animal and Plant Origin: The proportion of food of animal origin (around 70% of the financial cost) is above the recommended range, which can result in greater environmental impact and less sustainability in the long term.
Teixeira et al., 2021 [78]	- Fruit: Good supply; - Leafy vegetables (raw salad): Poor evaluation, low supply; - Monotony of colors: Fair at 20%; - Sulphur-rich foods: Fair at 38.6%; - Sweets: Good only in 20.5%;

Table 3. *Cont.*

Reference	Main Results
Teixeira et al., 2021 [78]	- Fried food: Absent from menus.
Thiagarajah and Getty (2013) [79]	Positive Aspects: - Reduction in food waste: There was an 18.4% reduction in solid food waste per customer in the trayless system, and liquid waste also decreased, with a 6.8% reduction. - Reduction in Solid Waste: During the trayless week, there was a reduction of 171.46 kg in solid waste. - Ease for Employees: Staff noticed that food preparation and dishwashing became easier, as less food was removed and there were no trays to clean. Negative Aspects: - Lower Number of Customers: The average number of customers per day was 856 in the trayless week, a reduction of 12.6% (124 fewer customers), which may have been an initial reaction to the new system. - Crockery Breakage: The trayless system resulted in more crockery breakage, an issue noted by all the staff, who suggested improvements to the collection of utensils. - Paper waste: There was no reduction in paper waste, which was included in garbage rather than food waste.
Vieira, 2015 [80]	- Food Waste: The university restaurant experiences high levels of waste, with leftovers ranging from 65.77 g to 101.88 g per customer. - Leftovers Per Capita: Leftovers per capita are 124% higher than the appropriate limit. - Nutrient Supply: Although the supply of fiber and vegetables is adequate, the high waste makes it difficult to confirm the actual consumption of these nutrients.
Wu et al., 2019 [81]	Positive aspects: - Reduced waste in specific groups: Students with lower purchasing power wasted significantly less food, 62% less than the general average. PhD students wasted less food than undergraduates and master's students. Negative aspects: - High waste in specific groups: Students with higher purchasing power wasted 30% more than the general average. - More expensive meals generated 89% more waste than the average for cheaper meals. - Worrying environmental impacts: Annual waste could use 2.1% of the city's arable land, contributing to significant greenhouse gas emissions. Acceptability: Contributing factors to waste: - Half of the students attributed waste to the unpleasant food provided by the canteens. - 21% pointed to excessive portions as the cause of waste, reinforcing the need for adjustments to the service. Predictors of waste: - The perception of difficulty in avoiding waste ("PBC") was associated with greater waste generation, indicating the need for behavioral interventions. - Students at higher financial levels prioritized foods with greater nutritional value, but were also more prone to waste. - Motivating factors to avoid waste: Guilt (29%) and a healthy lifestyle (27%) were the main motivators to reduce waste, with variations influenced by education, family, and society. - Practical information for canteens: Food preference (37%) and personal appetite (25%) are determining factors in students' choices, indicating areas for intervention to reduce waste.
Zanini et al., 2020 [82]	Positive aspects - Good food management practices: 81% of employees reported that stalks and peels are only removed when necessary. Food is stored in good conditions, with clean rooms and protected from pests. No significant loss of food due to damp, fungus, or damaged packaging was reported. Raw materials received in good or almost always good condition (93% of responses). - Adequate hygiene conditions: No pests (rats, cockroaches, flies, etc.) in storage areas. Adequate organization of stocks, with food kept off the floor and walls.

Table 3. *Cont.*

Reference	Main Results
Zanini et al., 2020 [82]	Negative aspects - Excess waste generated: 1651.4 kg of total waste in one week. 72.39% of the waste comes from leftover dishes, with lunch being the main source. Buffet leftovers and plate scraps could have served 2667 500g meals. - Inefficiency in scheduling and management: 39% of users find it difficult to predict when they will use the RU. 10% find the scheduling system complicated. - Influence of utensil size on waste: Large plates encourage excessive portions, generating more waste. Large glasses increase juice waste. - Unattractive menu items: Foods such as fish, sausages, and pork have high rejection rates. - Opportunities for improvement in the operation: Serving meats with preparation options or alternatives can reduce rejections. Lack of control over the portions served by the buffet encourages waste.

4. Discussion

4.1. Interpretations of Results

In order to provide adequate nutrition, menus should be planned and evaluated on a regular basis so that adjustments can be made [157]. Some menu evaluation methods are described in the literature as either qualitative [84] or quantitative [127]. In the present review, we found a large number of studies that evaluated the menu using qualitative methods, mainly the Qualitative Evaluation of Menu Preparations (AQPC) method, developed by Veiros et al. (2003). This method assesses the menu in terms of the presence of sulfur-rich foods, sweets, fried foods, fatty meat, fruit, leafy greens, the same colors, and the combination of sweets and fried foods on the same day [84]. The inclusion of fruits and leafy greens, the low frequency of fried meals and sweets, and the use of healthy cooking techniques—all of which are in line with the guidelines for a balanced diet [88] —were the key positive elements found in the menus under study. However, the presence of sulfur-rich foods and the monotony in the color of the menu were the main negative aspects found. Healthy cooking methods and a diverse menu are crucial for a balanced diet because they promote increased diversity and sufficient consumption of macronutrients, micronutrients, and bioactive substances [88]. Furthermore, sulfur-rich foods should not be found in high quantities since they may induce abdominal discomfort [158].

Customer satisfaction was another metric used in some studies to assess menu quality. This evaluation is typically conducted using customer questionnaires, which generally ask about menu diversity, presentation, temperature, and flavor [159]. Although the menus were generally well received in the studies examined in this review, it is difficult to evaluate these findings because different instruments were used to assess customer satisfaction. It is typical for each restaurant to establish its own parameters in order to assess the most appropriate parts for their reality and define the goals to be accomplished, as there are no precise and standardized criteria for evaluating menus from the consumer perspective.

In terms of quantitative methods, some studies assessed the nutritional composition of menus. The studies most frequently assessed energy value, macronutrients, and key micronutrients such as sodium, calcium, and iron. These components were predominantly estimated using food composition tables and nutrient analysis software, with fewer studies using laboratory analyses. Although tables and software are practical and widely accessible, some studies reported discrepancies when compared with analytical methods, indicating potential biases—especially for nutrients with high variability, such as sodium, saturated fats, and fiber. These limitations are relevant given the role of university restaurants in students' daily diets, reinforcing the need for cautious interpretation of nutritional estimates and careful selection of assessment methods.

Nutritional composition can be determined using food composition tables and software, both of which are quick and easy to use during menu planning, as well as through laboratory analyses, as in the study by Ribeiro et al., 2003, which analyzes the moisture, protein, lipid, ash, and carbohydrate content, compared to other food composition tables and software [160].

Another quantitative method employed in the studies was the Rest-Ingestion assessment, which is a criterion that measures the amount of food left on clients' plates after consumption [161]. Food waste was found to be high in the studies that were analyzed. Although several studies quantified plate waste, the metrics and units used were highly heterogeneous—ranging from grams per capita to percentage waste and rest-ingestion indices—which prevented the calculation of comparable mean or median values across studies. Nevertheless, most of these studies reported values exceeding the thresholds considered acceptable in the literature (<10% or <45 g per capita), supporting the classification of plate waste as high [95]. Rest intake is a metric used to assess menu quality because it is related to customers' acceptance of the meal. Thus, meals with a high waste percentage should be rethought or modified during menu planning [5]. However, it is crucial to recognize that, in addition to factors pertaining to the menu's quality (such as the food's presence, preparation method, and sensory elements), other factors may also have an impact on rest-ingestion, such as food's inadequate temperature, the customer's appetite, the use of

subpar utensils and large plates (which encourages the customer to serve more), staff's poor portion control, and the customer's ignorance of the need to reduce food waste [95]. Thus, it is critical to be aware of the components that influence rest ingestion and thoroughly examine their outcomes.

4.2. Implications of Results

Beyond nutritional and sensory aspects, the findings of this review also underscore the increasing importance of environmental sustainability in menu planning. Fourteen studies incorporated measures of environmental footprint—including carbon, water, and ecological footprints—as well as combined analyses that considered costs, waste, and technical recipe sheets. These results add to a robust body of scientific evidence indicating that menus with a higher proportion of animal-source foods are associated with substantially greater greenhouse gas emissions and resource use, whereas patterns dominated by plant-based foods tend to have lower environmental impacts [162,163]. Some studies additionally identified operational advantages related to recipe reformulation, such as cost reductions, improved ingredient utilization, decreased waste generation, and enhanced technical efficiency, particularly when technical recipe sheets are employed as an integrated planning and calculation tool. Accordingly, the joint incorporation of environmental, economic, and operational indicators expands the conception of menu "quality" and offers more robust evidence to support universities seeking to reconcile nutritional adequacy, practical feasibility, and environmental responsibility, thereby facilitating decision-making aligned with global sustainability targets [164,165].

The inclusion of regional food was used in other research to qualitatively evaluate the menu, and some authors discovered that the offer of these foods was not very varied. This is a bad outcome because having local foods on the menu could help with sustainability, preserving the local population's identity and eating habits, and cutting expenses [166,167]. It could also help local development and the value-adding of the region's food [19].

Based on the above, it is possible to observe that different methods were utilized in the studies to evaluate the menus. There is no consensus on the best protocol for menu analysis in the literature [168], and most menu assessment instruments lack a validation process to ensure they reflect what is desired to be evaluated [169]. It is noteworthy that, in the Brazilian context and considering the cut-off date of our bibliographic search (13 June 2024), no specific federal legislation uniformly regulating the provision of meals to university students was identified; in large part, the provision and regulation of university dining services were determined by institutional norms, local resolutions, and the student assistance policies of the institutions themselves (e.g., university council resolutions and internal regulations), as well as by initiatives and bills under consideration. It should be noted, however, that after the cut-off date of our search, Law No. 14,914 was enacted on 3 July 2024, which establishes the National Student Assistance Policy (PNAES) and encompasses assistance programmes, including mechanisms to support student food provision, information that updates the Brazilian legal framework. [111]

4.3. Theoretical and Practical Implications

The current review has a limitation in that it lacks a specific term relating to meal production units for college students, so it was required to search for all kinds of food services, which may result in a shortage of studies focusing on this audience. Despite this limitation, this review has as a strength the methodology used, the search approach, and the utilization of several and diverse datasets. Our results provide important insights into the necessity to create public policies that define norms and parameters for supplying meals to college students. Also, universities must devise measures to favor the access to healthy food by students, enabling the formation of eating patterns that will last throughout adulthood [170]. Furthermore, this review contributes to understanding the necessity of future studies assessing menus presented at university restaurants in terms of the various dimensions of quality, as well as developing and validating methodologies for determining the quality of these meals. A comprehensive menu evaluation is required, taking into account both qualitative and quantitative aspects such as nutritional, cultural, and sustainability concerns [157]. The use of these tools will allow for a broader and more careful evaluation of the menus in order to meet the proposed objectives. In addition, these methods will be crucial for identifying problems with the menu and making adjustments, so contributing to assuring meal quality and, as a result, maintaining health and preventing diseases among college students.

5. Conclusions

Various methods (qualitative and quantitative) were used to evaluate menus. Most studies employed nutritional criteria, although they examined different aspects of menu quality. This heterogeneity arises from the lack of consensus on an optimal protocol and the absence of a validated process for these tools.

It is also important to emphasise that, up to the cut-off date of this review (13 June 2024), no public legislation uniformly regulated the provision of meals to university students in Brazil, which likely hampers the standardisation and study of menu quality. Nevertheless, the National Student Assistance Policy (Law No. 14,914/2024) was enacted after that period, establishing national guidelines that may contribute to greater uniformity in food provision within higher education.

In light of the findings, there is a clear need for a mixed-methods instrument that combines quantitative and qualitative approaches and incorporates both the quality and quantity of foods on menus, alongside sustainability

indicators, in accordance with the principles of food and nutritional security. Recent advances—such as the AVACARD instrument and the Mediterranean Diet Compliance Index (MedCIN)—illustrate progress toward integrated, multidimensional tools, providing concrete methodological examples to guide future research and to support the development and validation of comprehensive instruments that address the gaps identified in this review.

Supplementary Materials

The additional data and information can be downloaded at: https://media.sciltp.com/articles/others/260 2041339376339/FSP-25100026-Supplementary-Materials.pdf. Table S1: Indexers used to select publications. Table S2: Full-text excluded articles and reasons. References [171–210] are cited in supplementary materials.

Author Contributions

N.S.G., J.N.P. and M.G.R.: conceptualization, methodology, data curation, investigation writing—original draft preparation; J.C.L., R.d.C.R., B.V.d.C.L. and S.C.L.P.: supervision; validation; writing—reviewing and editing. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

No AI tools were utilized for this paper.

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