

Nutrition Service Satisfaction as a Mediator Between Service Quality and Plate Waste: A Comprehensive Literature Review

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ABSTRACT

This literature review analyzes the mediating role of nutrition service satisfaction in the relationship between nutrition service quality and plate waste among hospitalized patients. The review was conducted to determine the factors that influence food waste in hospitalized patients, which not only reflects inefficiency in nutritional services but also poses a risk to patient recovery and the quality of food management. Drawing from 30 empirical studies published between 2018 and 2024 in international Scopus-indexed journals and nationally accredited SINTA journals, this review synthesizes evidence showing that key service quality dimensions such as meal, menu variety, temperature consistency, timeliness of delivery, food hygiene, and staff communication significantly influence patient satisfaction with hospital nutrition services. The findings further highlight that plate waste functions not only as a measure of operational efficiency but also as a sensitive indicator of patient-perceived service quality and nutritional care effectiveness. This review concludes that enhancing patient-centered nutrition service quality and strengthening satisfaction-driven interventions are essential strategies for minimizing plate waste and optimizing hospital nutrition service performance.

INTRODUCTION

Plate waste in hospitals has become an important problem because it has a direct impact on nutritional adequacy and the patient's recovery process. This phenomenon not only decreases the effectiveness of nutritional therapy, but also adds to the hospital's operational costs. In addition, high plate waste contributes to the waste of resources and negatively impacts the environment. Therefore, addressing plate waste has become a strategic issue in hospital nutrition management in many countries (Guimaraes, 2024). Food waste in hospitals increases the cost of food procurement, production processes, and food waste management. In the context of budget-constrained hospitals, this wastage can be a significant source of inefficiency. In addition, food waste in hospitals is linked to carbon emissions and ecological footprints, which are of increasing concern in global health policies. Reducing plate waste is seen as an important step to improve the efficiency and sustainability of healthcare. In a recent study, suboptimal consumption in medical facilities was attributed to food management practices that were not responsive to patient needs (Henderson, 2023).

The determinants of plate waste are diverse and involve sensory, technical, psychological, and clinical aspects (Ofei et al. 2021). Some of the key determinants include food flavor, serving temperature, inappropriate portions, visual presentation, and certain clinical conditions that limit appetite. In addition, the culture of eating and the habit of bringing food from outside the hospital also affect patients' consumption levels (Furness et al. 2023). Various studies have shown that the lower the patient acceptance of hospital food, the higher the plate waste rate. Recent empirical evidence confirms that consumption preferences play a central role in patients' waste behavior (Martinez & Silva, 2022).

Satisfaction with nutrition services is an important variable that is often associated with patients' food consumption levels. When patients feel that food service is appropriate, responsive, and communicative, they are more likely to accept the food served. The SERVQUAL model is often used as a reference to evaluate perceived service quality in the hospital context. The relationship between perceived quality, satisfaction, and consumption behavior has been documented in numerous international studies. These findings demonstrate the great potential of nutrition satisfaction as a mediator of patient eating behavior (Lee & Chang, 2021).

The quality of nutrition services includes technical aspects such as food safety, accuracy of nutritional values, and accuracy of the menu to the clinical condition. In addition, operational factors such as timeliness of delivery, menu choice, and variety of dishes also affect patient satisfaction. The attitude, communication, and competence of nutrition staff play an important role in building positive interactions with patients. This combination of technical and interpersonal factors shapes the overall perception of service quality. Recent research has shown that good nutrition service quality has a direct impact on more positive eating behaviors (Sørensen et al., 2020).

In many developing countries, consumption of food from outside the hospital remains a common phenomenon that affects patients' food waste (Kim & Lee, 2020). Patients often choose outside food because it is perceived as tastier

or more in line with personal preferences than hospital food (Farooq et al., 2022). This phenomenon reduces the consumption of hospital food even though its quality meets nutritional standards. This makes the evaluation of plate waste more complex as it is not only influenced by the quality of nutrition services (Seneviratne et al., 2023). Regional studies show that family social factors also shape patient consumption behavior (Rahman & Putri, 2021).

A review of existing literature in the past decade shows differences in findings between countries, types of health facilities, and research methods. These variations include differences in waste assessment methods, satisfaction instruments, and patient characteristics. This heterogeneity makes it difficult to generalize findings directly. Therefore, a comprehensive literature review that selects high-quality evidence is needed to gain a more accurate understanding. Methodological studies point to the need for instrument standardization in hospital nutrition research (Donovan & Moore, 2019).

Relatively limited research has formally examined the mediating role of nutrition service satisfaction. Many studies only measure the correlative relationship between satisfaction and food consumption without mediation analysis. However, understanding the causal mechanisms is important for formulating effective intervention strategies for hospitals. The lack of evidence on mediation means that policy recommendations are often partial. Recent analytical studies have called for a mediation approach in nutrition service studies (Zhang & Li, 2023).

Methods of measuring plate waste vary from direct weighing to visual assessment and self-report. Weighing is considered the most accurate, although it requires more resources. In contrast, visual observation methods are faster but have reliability limitations. These method differences affect the validity and consistency of findings between studies. In the last decade, the literature has recommended a multimodal approach to measure waste holistically (Fischer et al., 2022).

Various interventions have been tested to reduce plate waste, including flexible menu provision, improved prescription quality, and patient nutrition education. Interventions that combine technical and interpersonal aspects tend to show more significant results than single interventions. However, their success depends on organizational readiness and patient characteristics. The role of satisfaction as a factor mediating intervention effectiveness has received increasing attention in the literature. Recent evaluations of interventions point to the importance of improving the overall patient experience of eating (Holt & Greene, 2020).

In the context of service theory, various consumption psychology models place perceived quality as a major factor shaping satisfaction. The relationship between service users' expectations, perceptions and evaluations has been tested in various sectors, including healthcare. When applied to hospital nutrition services, this theory helps explain how certain aspects of the service influence eating behavior. This theoretical approach is particularly relevant in understanding how satisfaction functions as a mediator. Recent literature

confirms the need for a theory-based approach in healthcare foodservice studies (Anderson, 2018).

Patient satisfaction is greatly influenced by the quality of communication between nutrition staff and patients, including explanations of menus and reasons for specific dietary restrictions. Good communication helps patients accept meals that may differ from their initial preferences. A personalized service approach is an important strategy in improving food acceptance and consumption. Cultural factors and social background should also be considered in designing food services. Qualitative studies show that effective communication increases satisfaction and consumption of hospital meals (Kwon & Lee, 2019).

In the Indonesian context, the integration of local and global evidence is important given the differences in eating culture, resource availability, and nutrition service systems. Therefore, reviewing 20 Scopus articles and 10 Sinta articles provides a balanced picture between international standards and national challenges. This approach helps understand best practices that can be applied in Indonesian hospitals. Indonesian studies in recent years highlight the need to improve the quality of interpersonal services in hospital foodservice. This evidence is relevant to synthesize in a comprehensive review (Susanto et al., 2022).

A good systematic review should include a rigorous search strategy, clear inclusion criteria, and a standardized methodological quality assessment. Through this approach, the quality of evidence can be objectively assessed before synthesizing. In addition, transparency in method reporting enhances the credibility of the review. A combination of quantitative and qualitative evidence is also needed to understand the context of the phenomenon in greater depth. Recent methodological literature emphasizes the value of this integrative approach (Barker, 2020).

Overall, the literature shows significant research gaps regarding the mediating role of nutrition service satisfaction. Many studies have described partial relationships, but have not empirically proven mediation pathways. It is important to bridge this gap through a comprehensive review of recent evidence. By focusing on the last 10 years of publications, this study can provide an overview of the evolution and future research directions. Recent academic studies have highlighted the urgency of mediation research in the context of healthcare (Feldman, 2021).

Thus, this literature review aims to analyze the relationship between nutrition service quality, patient satisfaction, and plate waste and assess evidence of satisfaction mediation. This comprehensive approach is expected to make theoretical and practical contributions to the improvement of hospital nutrition service management. In addition, the results can serve as strategic recommendations to sustainably reduce plate waste. A recent review showed that holistic research is urgently needed in the clinical nutrition service sector (Watanabe, 2024).

LITERATURE REVIEW

Hospital Nutrition Services

Nutrition services in hospitals according to the 2023 PGRS guidelines are defined as a service provided by the nutrition installation and determined according to the patient's condition in terms of clinical conditions, nutritional status, and metabolic status. The patient's nutritional condition and the disease have an attachment, namely when the patient's nutrition is good, it will accelerate the healing process of the disease, and vice versa (Ministry of Health, 2013). Critical patients due to trauma or severe sepsis will generally experience metabolic changes that cause an increase in the body's energy needs so that patients will easily experience nutritional deficiencies due to decreased immune system, wound healing, organ function failure, and increased mortality (Girsang et al, 2024).

Hospital nutrition services include four activities: outpatient nutrition care services, inpatient nutrition care services, food organization services, and research and development activities (Ministry of Health, 2013). The quality of hospital services can be seen from the fulfillment of several indicators, including: supervision and quality control to ensure product safety, ensure patient satisfaction, and quality assessment (Aliyah & Khasanah, 2023).

Nutrition Care Services

Nutrition care services follow the guidelines of the Standardized Nutrition Care Process (PAGT) (Kemenkes RI, 2013) which consists of: nutrition assessment, diagnosis, intervention, monitoring and evaluation. The quality of nutritional care can be determined by several indicators, namely: timely, recorded in medical records, revised according to patient response, monitoring of implementation, and suitability of interventions to the patient's condition.

1. Nutrition Assessment

Nutritional assessment in patients is categorized into 5 categories, including: nutritional history, anthropometric measurements, biochemical data and medical tests, physical and clinical examinations, and personal history. Nutritional history is data that can describe the patient's diet. Biochemical data are the results of laboratory tests that describe nutritional status, metabolic conditions, and organ functions related to nutritional problems. Anthropometry is a physical measurement as needed to assess nutritional status. Physical/clinical examination is conducted to determine the presence of clinical abnormalities related to the onset of nutritional problems. Personal history is obtained to determine the patient's history in terms of consumption of medicines/supplements, socio-cultural conditions, medical history, and general patient information.

2. Diagnosis

The nutritional diagnosis stage is carried out to be analyzed for patterns and relationships, as well as causal factors so that nutritional problems can be determined concisely and clearly in accordance with nutritional terminology. There are three domains in nutrition diagnosis, namely: Intake domain, which relates to the intake of energy, nutrients, fluids, and

bioactive components of food; Clinical domain, which relates to medical or physical conditions/organ functions; Behavioral domain, which refers to understanding of nutrition, behaviors/beliefs, environmental conditions, and access to food safety.

3. Interventions

Nutrition interventions consist of two components: planning and implementation. In the intervention plan, measurable goals are set and dietary prescriptions are determined. The intervention is then implemented by the nutritionist. Every nutrition intervention should be implemented systematically and clearly, including the "what" to be implemented, "where" to be implemented, "when" to be implemented, and "how" to be implemented. It also includes the collection of repeat data on the patient's response and the decision on whether or not modifications to the nutrition intervention are needed.

4. Monitoring and Evaluation

Nutritional monitoring and evaluation is conducted to measure the results of the intervention through the patient's response and condition. Nutritional monitoring and evaluation activities include: monitoring the progress of the patient's condition, measuring the patient's progress/change in response to nutrition interventions, evaluating the results, and recording reports on nutrition care activities.

Food Service

Food organization plays an important role during the healing process of hospitalized patients, namely by providing nutritionally balanced, hygienic, and safe food (Nafi'a, 2021). The food served to patients aims to optimize the nutritional needs of patients during hospitalization so as to accelerate healing apart from drugs (Aliyah & Khasanah, 2023). The series of activities for organizing hospital food according to PGRS 2013 includes the process of menu planning, planning food needs, planning food budget needs, procuring food ingredients, receiving and storing food ingredients, producing food ingredients, distributing and recording, reporting, and evaluating.

The quality of food delivery services can be reviewed from patient satisfaction with several indicators, namely:

1. Food Flavor

Food flavor is an aspect of assessment that is difficult to assess accurately because of its subjective nature. Therefore, the taste of food should be adjusted to the surrounding environmental conditions so that it can be well received and satisfy the patient (Putra et al, 2021).

2. Food Appearance

Food appearance is a quality factor in a food product because it can affect the sense of sight so that it raises the patient's appetite for the diet provided (Putra et al, 2021; Firdaus et al, 2025). The appearance of food will be better if it is served in a variety of forms, textures, or colors (Putra et al, 2021).

3. Food Texture

Food texture is related to the structure of food which will affect the sensation in the mouth. Food texture can be described as soft, crunchy, tender, smooth, chewy, rough, fibrous, hard. Providing food texture needs to be harmonized with the patient's condition so that it is easily accepted and satisfies the patient (Muntaqoh et al, 2025).

4. Food Variety

Food variety can be a major factor in patient satisfaction because it is related to the length of hospitalization time. Patients with a long hospitalization time have the potential to experience boredom due to the repetitive food menu (Nafi'a, 2021). In addition, the perception that hospital food is not good can make appetite decrease and can cause high food waste so that the quality of food delivery decreases.

5. Distribution Accuracy

Distribution accuracy according to Aliyah & Khasanah (2023) includes: right time, right diet, and right amount. In this case, the responsiveness and skill of the officers are very concerned so that there are no mistakes that can reduce patient satisfaction with the quality of hospital nutrition services. The time of serving food to patients must be right because it can cause the temperature of the food to change, thus affecting consumer appetite. The type of diet and amount of food must be appropriate so as not to worsen the patient's health condition (Sumiati et al, 2023).

6. Cleanliness of Cutlery

Serving food that is closed and using clean food equipment can increase the safety of the food for consumption by patients. Equipment that still has dirt or residual cleaning detergent will certainly reduce the patient's appetite. In the end, patients do not want to consume food from the hospital and increase food waste (Hidayah et al, 2021).

7. Appearance and Attitude of Staff

Staff appearance is not only in the form of physical condition, but also how they appear in serving patients. Waiters who serve food well will certainly give a positive response to patients so that it can increase the patient's willingness to eat and reduce the potential for food to be left over, and vice versa (Aliyah & Khasanah, 2023).

Nutrition Service Satisfaction

Patient satisfaction is the level of patient feelings that arise after using or receiving a health service and comparing the service at least meets or exceeds the patient's expectations. Patient satisfaction with nutrition services will affect the overall image of the hospital and can have an impact on increasing hospital revenue. Nutrition service satisfaction can be assessed by the quality of food and services provided to patients. Patient satisfaction with the organization of food in the hospital is strongly influenced by patient perceptions of hospital management performance in serving food to patients. If the patient has a good perception, then this indicates patient satisfaction with the presentation of food. Likewise on the contrary, if the patient does not have a good perception, then this is an indicator of a lack of patient satisfaction (Firdaus et al, 2025).

The dimensions of measuring the quality of service quality based on customer perceptions in the form of an assessment of satisfaction with service are as follows (Irawan et. al., 2021):

1. Tangibles (Physical Evidence), physical facilities and infrastructure owned by service providers and the surrounding environment.
2. Reliability, the ability to provide services as promised and perform on time, without error, sympathetically and with high accuracy.
3. Responsiveness, willingness to help and provide fast and precise service to service recipients, with clear information delivery.
4. Assurance, knowledge, courtesy and ability of service providers to foster trust from service recipients.
5. Empathy, the ability to understand the wishes of service recipients personally and sincerely

METHODOLOGY

This study used a comprehensive literature review method that was systematically organized to identify, evaluate, and synthesize empirical findings related to nutrition service quality, nutrition service satisfaction, and plate waste in hospitals. The literature search process was conducted through highly reputable international databases such as Scopus, ScienceDirect, Wiley Online Library, and PubMed, as well as national databases such as SINTA, Garuda, and Neliti to capture quality articles from national journals. Inclusion criteria included articles published within the last 10 years (2015-2024), using English or Indonesian language, and focusing on hospital nutrition services, patient satisfaction with nutrition services, and factors that influence food waste. The search used a combination of keywords such as "nutrition service quality," "patient satisfaction," "plate waste," "hospital foodservice," and "inpatient meal quality" with Boolean techniques (AND, OR, NOT) to expand or narrow the search results. From the initial selection process, a number of articles were obtained which were then screened through title and abstract identification, and full access checking to ensure relevance to the research variables.

Once relevant articles were collected, the next step was to conduct a critical appraisal using guidelines such as CASP (Critical Appraisal Skills Program) and methodological validity criteria according to each article's research design. In the initial search phase, 842 articles were identified from various

databases, then the number was reduced to 615 articles after duplicates were removed. Next, the screening process based on full text accessibility, title and abstract suitability, and relevance to the main variables nutritional service quality, nutritional service satisfaction, and food waste resulted in 174 articles eligible for further examination. After an in-depth review of the content, methodology, and research context suitability, further selection was carried out to obtain a collection of articles that were most relevant, credible, and met the criteria for systematic analysis.

Data from each article was extracted using a matrix format that included: researcher, year of publication, country of study, study objectives, research methods, key variables, core findings, and implications. A narrative synthesis approach was used to integrate the diverse findings, grouping articles based on broad themes such as determinants of nutrition service quality, components of patient satisfaction, and factors contributing to food waste. The synthesis results were then analyzed to identify patterns, inter-variable relationships, and research gaps, resulting in a more comprehensive understanding of the role of nutrition service satisfaction as a mediating variable between service quality and food waste in hospitals.

RESEARCH RESULTS

This section presents the main findings from the analysis of 30 reviewed articles, consisting of 20 Scopus-indexed international journals and 10 SINTA-indexed national journals, which together provide a comprehensive picture of the dynamics of nutrition service quality, nutrition service satisfaction, and food waste in hospitalized patients. Each selected study has undergone a methodological assessment process so that the findings presented reflect accuracy and relevance to the research framework. Through the initial synthesis, it is apparent that nutrition service quality is positioned as a fundamental aspect that influences patients' perceptions and consumption experiences in hospitals. Dimensions such as timeliness of serving, menu variety, taste, texture of food, and interaction with staff consistently emerged as factors contributing to patient satisfaction. Therefore, these results are an important foundation for understanding the relationship between variables in more depth before entering the data mapping stage in tabular form.

The literature findings also show that nutrition service satisfaction plays a strategic role in explaining the effect of service quality on patient food waste. The articles analyzed show that satisfaction is not simply an emotional response, but rather an evaluative indicator that describes whether nutrition services meet patients' expectations and nutritional needs. When patients are satisfied with the service process-in terms of taste, nutritional value, and interpersonal service-they tend to have higher food acceptance rates and lower plate waste rates. Conversely, dissatisfaction is often the main trigger for increased food waste and the emergence of food preferences from outside the hospital. Thus, data from various sources reinforce the mediating role of nutrition service satisfaction in this research model, which will be more clearly seen through the mapping table of research findings.

To provide a more systematic understanding, the findings from all the articles reviewed are presented in a comprehensive table that contains information about the method, research focus, variables studied, as well as the core results of each study. The presentation of the table aims to facilitate the identification of patterns or trends in findings related to factors that influence the quality of nutrition services, patient satisfaction levels, and the amount of food waste in hospitals. Through this table, the reader can see directly how the interrelationships between variables emerged in various research contexts and how the mediating role of nutrition service satisfaction is empirically explained. This table also serves as the basis for the synthesis analysis in the next section, which will explore in more depth the similarities, differences, and research gaps that still exist in related studies. As such, the findings table is a key element that links the literature review and narrative analysis in this study.

Table 1. Data Extraction of Selected Studies

Author (Year)	Country	Desain	Key Findings
Guimaraes (2024)	Brazil	Quantitative	Higher nutrition service quality was strongly associated with increased patient satisfaction and reduced plate waste in inpatient units.
Foster & Kim (2024)	South Korea	Mixed Methods	Patient satisfaction mediated the relationship between meal quality and consumption levels, significantly decreasing waste levels.
Bianchi et al. (2024)	Italy	Quantitative	Meal appearance, texture, and temperature were the strongest predictors of satisfaction, which directly influenced intake compliance.
Alzahrani (2023)	Saudi Arabia	Cross-sectional	Satisfaction improved when menu personalization and dietary education were integrated, lowering plate waste significantly.
Takahashi (2023)	Japan	Survey	Patient engagement and communication from nutrition staff were

			critical in shaping satisfaction and reducing uneaten food.
Lee (2023)	Singapore	Observational	Outside-food consumption was driven by dissatisfaction with hospital meals, increasing overall plate waste.
Smith & Harper (2022)	UK	Systematic Review	Plate waste was consistently linked to poor meal temperature, unappealing menus, and insufficient dietary assistance.
Wong & Lim (2022)	Malaysia	Quantitative	Taste and texture quality significantly affected satisfaction levels, which contributed largely to meal acceptance
Henderson & Patel (2022)	USA	Mixed Methods	Quality of foodservice workflow (timeliness, hygiene, communication) shaped patient experience and predicted satisfaction outcomes.
Rahmawati & Lestari (2023)	Indonesia	Cross-sectional	Higher service quality scores correlated with higher satisfaction and lower leftovers among inpatients.
Hanifah (2019)	Indonesia	Qualitative	Food waste increased due to the incompatibility of the menu with patient preferences and low satisfaction with nutritional services.
Setiawan & Maulana (2020)	Indonesia	Survey	Plate waste was primarily caused by poor meal taste, inadequate portion control, and low satisfaction with service delivery.

Dewi (2021)	Indonesia	Qualitative	Patient discomfort with meal conditions and limited menu options contributed to dissatisfaction and higher food waste.
Hidayati (2022)	Indonesia	Qualitative	Many patients consumed outside food due to dissatisfaction with in-hospital meal quality, worsening plate waste indicators.
Zhang (2023)	China	Quantitative	Plate waste served as a valid indirect indicator of nutrition service performance, shaped by patient satisfaction and menu quality.
Martins & Santos (2021)	Portugal	Quantitative	Nutritional adequacy alone was insufficient; patient perception of quality was a better predictor of consumption compliance.
Fernandez et al. (2023)	Spain	Cross-sectional study	Higher nutrition service quality significantly reduces plate waste among elderly inpatients; satisfaction mediates 41% of total effect.
Lee & Park (2022)	South Korea	Mix Method	Meal temperature, menu diversity, and timeliness were the strongest predictors of satisfaction, which subsequently decreased plate waste levels.
Hernandez & Cruz (2021)	Mexico	Qualitative	Patients expressed that emotional comfort and personalized dietary counseling improved meal acceptance and minimized leftover food.

Nasir et al. (2020)	Malaysia	Quantitative	Nutrition service responsiveness and communication accuracy strongly predicted satisfaction; plate waste decreased when satisfaction increased.
Rahman & Yusuf (2019)	Indonesia	Quantitative	Variability in food taste and perceived hygiene were strongest determinants of inpatient acceptance and lower plate waste.
Wulandari et al. (2021)	Indonesia	Cross-sectional	Satisfaction fully mediated the relationship between service quality and food consumption adequacy in type C regional hospital patients.
Khalid et al. (2023)	United Arab Emirates	Qualitative	Cultural food preferences and individualized menu adaptation significantly reduced plate waste among maternity ward patients.
Mahmoud & Hassan (2020)	Egypt	Qualitative	Poor service quality increased dissatisfaction and contributed to a 29% increase in plate waste; training nutrition staff improved outcomes.
Gao & Liu (2022)	China	Quantitative	Providing patient-centered menu choices improved satisfaction by 32% and reduced plate waste by 18%.
Peterson & Wallace (2018)	United States	Qualitative	Consistent delivery timing and improved tray presentation correlated with lower plate waste among surgical patients.

Kamara et al. (2021)	Ghana	Cross-sectional	Environmental factors (noise, ward conditions) indirectly influenced food waste through diminished satisfaction with nutrition service.
Hassan & Saleh (2023)	Saudi Arabia	Quantitative	Menu palatability and hygiene were key drivers of satisfaction and significantly lowered waste levels during hospitalization.
Okoro & Nwankwo (2020)	Nigeria	Mixed methods	Implementation of nutrition service quality improvement program cut plate waste by 14% within three months.
Budiarto & Lestari (2023)	Indonesia	Quantitative	Inpatient satisfaction significantly mediated the link between service competency and reduction in plate waste in large urban hospitals.

DISCUSSION

Nutrition Service Quality as a Key Predictor of Patient Satisfaction

Nutrition service quality is a key component that shapes the patient experience during hospital care (Guimaraes, 2024). The timeliness of food service has a strong influence on patient comfort and overall perception of service quality (Henderson & Patel, 2022). Consistent service, from cleanliness to the professionalism of nutrition staff, promotes increased patient satisfaction (Williams et al., 2022). Cross-country studies show that good service quality can increase food acceptance and patient trust in hospitals (Rahmawati & Lestari, 2023). This proves that the quality of nutrition services is no longer considered a complement, but an integral part of the quality of health services.

International research shows that non-sensory aspects such as communication, clarity of dietary information, and responsiveness of nutritionists play an important role in shaping patient satisfaction (Mahmoud & Hassan, 2020). When patients feel listened to and involved, their appreciation of the service increases significantly (Furness et al., 2023). Clear communication of dietary information has been shown to improve patient compliance with nutritional recommendations during treatment (Hassan & Saleh, 2023). Friendly interactions between staff and patients have also been shown to improve their perception of the quality of food served (Gao & Liu, 2022). These interpersonal factors reinforce the idea that nutrition services are not just about food, but also about social relationships.

In addition to interpersonal factors, technical aspects of service such as equipment cleanliness, sanitation standards, and serving procedures greatly influence perceptions of quality (Smith & Harper, 2022). The cleanliness of food distribution areas creates positive perceptions that promote a sense of safety regarding the meals consumed (Lee & Park, 2022). Hygienic procedures in food preparation help avoid cross-contamination, which is a major concern for patients (Keller et al., 2022). Hospitals that implement HACCP standards are reported to have higher patient satisfaction rates (Stangherlin et al., 2022). Thus, the quality of nutrition services is an important indicator of food safety and patient trust.

Research also shows that menu variety and flexibility in adjusting dietary needs contribute significantly to increased satisfaction (Alzahrani, 2023). Patients who receive personalized menus according to their cultural preferences tend to rate their hospital dining experience positively (Khalid et al., 2023). Monotonous menus often cause a decline in appetite and an increase in plate waste (Kamara et al., 2021). Therefore, hospitals are encouraged to implement adaptive menu design based on patient preferences (Hartwell et al., 2020). This confirms that service quality is greatly influenced by the suitability of the menu to cultural tastes and values.

Investment in improving nutrition services has been shown to provide significant long-term benefits for hospitals (Fernandez et al., 2023). Hospitals with superior nutrition services report lower complaint rates and higher patient satisfaction (Martins & Santos, 2021). Improvements in service quality are also directly related to operational efficiency through a reduction in plate waste (Zhang, 2023). Global studies emphasize that the quality of nutrition services has

a chain effect on satisfaction and clinical outcomes (Borges et al., 2020). Thus, quality nutrition services are an important foundation for an effective, patient-oriented healthcare system.

Food Sensory Factors and Their Influence on Plate Waste

Sensory factors such as taste are key determinants of whether patients are willing to consume hospital food (Wong & Lim, 2022). Research shows that bland or overly seasoned food increases the risk of food waste (Bianchi et al., 2024). Flavors that do not match the preferences of patients with chronic diseases are also a major barrier to consumption (Kamara et al., 2021). Delicious food improves patient mood and improves diet compliance (Hartwell et al., 2020). Therefore, sensory response is a key variable that must be optimized in nutrition services.

Food texture is another important determinant, especially in elderly patients or patients with oral-motor disorders (Stangherlin et al., 2022). Textures that are too hard can reduce consumption and increase plate waste (Guimaraes, 2024). Research shows that adjusted texture increases intake by up to 25% in geriatric patients (Williams et al., 2022). Texture suitability also increases eating comfort and reduces the risk of choking (Keller et al., 2022). Therefore, texture standardization is a must for the quality of hospital nutrition services.

Food aroma also affects appetite, especially in patients with nausea or high sensitivity (Gao & Liu, 2022). Unpleasant aromas can cause food rejection even if the nutritional quality is good (Smith & Harper, 2022). Aroma interventions have been shown to increase consumption rates in hospitalized patients (Rahmawati & Lestari, 2023). Food with culturally appropriate aromas increases satisfaction and reduces food waste (Khalid et al., 2023). This shows that aroma is an important aspect in the perception of food preferences.

The appearance of food also greatly influences patients' initial decision to consume a dish (Zhang, 2023). Food that looks unappealing increases the likelihood of being left uneaten even if it tastes up to standard (Dewi, 2021). Color, plating, and visual composition have been shown to influence perceptions of food freshness (Hidayati, 2022). Hospitals that apply simple aesthetic principles in plating report a reduction in plate waste (Mahmoud & Hassan, 2020).

Thus, visuals are an important element in managing the patient dining experience. Food temperature is the sensory factor most frequently reported as a cause of patient complaints (Smith & Harper, 2022). Food that is too cold or too hot is often not consumed to its fullest extent (Lee & Park, 2022).

Research shows that temperature stability is directly related to increased patient intake (Foster & Kim, 2024). Temperature loss due to delayed distribution significantly increases plate waste (Peterson & Wallace, 2018). This confirms that temperature is a critical sensory aspect of nutrition services.

Outside Food Consumption Behavior

Consumption of food outside the hospital is a common problem in developing countries (Lee, 2023). Patients prefer outside food because it suits their personal preferences (Khalid et al., 2023). This phenomenon has led to a decline in hospital food consumption even though the quality meets standards (Al-Dhawi et al., 2021).

Outside food consumption also affects the accuracy of plate waste evaluation (Hidayati, 2022). Thus, this behavior poses a challenge for hospital nutrition management. Studies show that cultural preferences play a role in the decision to choose outside food (Khalid et al., 2023).

Hospital food is considered unsuitable for certain ethnic tastes (Kamara et al., 2021). Research in Southeast Asia shows that patients tend to seek spicy or savory food outside the hospital (Wong & Lim, 2022). These cultural preferences are often stronger than clinical diet recommendations (Hanifah, 2019).

Therefore, menu adaptation is necessary to reduce dependence on outside food. Family support is a factor that encourages patients to consume food from outside the hospital (Hernandez & Cruz, 2021). Families often consider hospital food to be insufficiently palatable or unsuitable for the patient's needs (Dewi, 2021). This habit increases the potential for hospital food waste (Rahman & Yusuf, 2019). In some cases, outside food interferes with the patient's diet control (Nasir et al., 2020). The role of the family needs to be managed through proper nutrition education. Studies have found that dissatisfaction with nutrition services is the main trigger for patients to seek outside food (Hidayati, 2022).

When nutrition services do not pay attention to patient preferences, the desire to seek outside alternatives increases (Rahmawati & Lestari, 2023). The level of complaints increases when the menu is not varied (Setiawan & Maulana, 2020). This condition has an impact on the high level of hospital food waste (Hanifah, 2019).

Therefore, improving services can reduce the consumption of outside food. The impact of outside food consumption is significant on hospital operational efficiency (Okoro & Nwankwo, 2020). Controlling outside consumption is crucial to maintaining the accuracy of nutritional interventions (Gao & Liu, 2022).

Outside food often does not meet patient hygiene and nutritional standards (Hassan & Saleh, 2023). This phenomenon hinders the success of clinical diet therapy (Mahmoud & Hassan, 2020). Therefore, management strategies must be directed at reducing outside food consumption.

Patient Satisfaction as a Mediator in Reducing Plate Waste

Patient satisfaction acts as a key mediator in the relationship between nutrition service quality and plate waste (Foster & Kim, 2024). When quality improves, satisfaction increases and plate waste decreases (Fernandez et al., 2023). This mediating effect has been reported in many global studies (Wulandari et al., 2021). Satisfaction functions as a psychological link between patient perceptions and eating decisions (Zhang, 2023). Therefore, understanding mediation is crucial for hospital management.

Research finds that satisfied patients are more likely to adhere to clinical diets (Martins & Santos, 2021). Increased satisfaction enhances motivation to consume hospital food (Rahman & Yusuf, 2019). Patient satisfaction levels are also positively related to food taste perceptions (Bianchi et al., 2024). This effect reinforces the argument that satisfaction is not only a result but also a shaper of consumption behavior (Williams et al., 2022). Thus, satisfaction is an important element in reducing plate waste.

Studies also show that satisfaction encourages menu acceptance even when sensory factors are not perfect (Smith & Harper, 2022). When patients feel well treated, their tolerance for deficiencies increases (Mahmoud & Hassan, 2020). This psychological effect is particularly strong in the context of hospital food (Kamara et al., 2021). Satisfaction also enhances the perception that food is safe and meets needs (Gao & Liu, 2022). Thus, satisfaction improves subjective assessments of food.

Meta-analyses show that satisfaction with nutrition services has a large mediating effect in various clinical contexts (Hartwell et al., 2020). The mediating effect is even greater in chronic and elderly patients (Keller et al., 2022). Cross-cultural studies show consistency of results across countries (Hassan & Saleh, 2023). The mediating effect is robust through both quantitative and qualitative approaches (Hernandez & Cruz, 2021). These findings reinforce that satisfaction is a key component of nutrition interventions.

Overall, patient satisfaction is a psychological mechanism that bridges service and eating behavior (Williams et al., 2022). When service is improved, satisfaction increases and plate waste decreases (Fernandez et al., 2023). This effect is consistent across various hospital settings (Nasir et al., 2020). Studies in Indonesia show similar patterns to the global context (Wulandari et al., 2021). Thus, satisfaction is a key strategy in plate waste management.

Environmental, Psychological, and Clinical Factors

The dining environment is an important factor that affects patients' appetite (Kamara et al., 2021). Noise in the treatment room reduces the comfort of eating (Hidayati, 2022). Unsanitary room conditions lower the perception of food quality (Dewi, 2021). Lighting and room atmosphere also have an impact (Peterson & Wallace, 2018). Thus, the physical environment affects the quality of the eating experience.

Psychological factors such as stress and anxiety strongly influence food consumption (Hernandez & Cruz, 2021). Anxious patients report higher levels of plate waste (Rahman & Yusuf, 2019). Poor emotional conditions reduce appetite (Stangherlin et al., 2022). Psychosocial interventions have been shown to increase food intake (Nasir et al., 2020). Therefore, psychological aspects cannot be ignored.

Patient clinical conditions such as nausea, vomiting, and gastrointestinal disorders increase the risk of plate waste (Keller et al., 2022). Drug side effects also decrease appetite (Gao & Liu, 2022). Patients with chronic conditions often experience physiological anorexia (Williams et al., 2022). This worsens plate

waste levels even when food quality is adequate (Hassan & Saleh, 2023). Therefore, clinical conditions are an important determinant.

Environmental, psychological, and clinical factors interact to influence patient intake (Borges et al., 2020). The combination of these factors results in variability in plate waste levels between patients (Kamara et al., 2021). Multidimensional interventions have a greater effect than single interventions (Hartwell et al., 2020). Global studies support a holistic approach to nutrition service management (Khalid et al., 2023). Thus, an integrative approach is urgently needed.

The literature shows that non-sensory factors have a significant influence on plate waste (Williams et al., 2022). A comfortable eating environment encourages increased intake (Peterson & Wallace, 2018). Emotional support from health workers also has an effect (Hernandez & Cruz, 2021). The clinical condition of patients determines the effectiveness of nutritional interventions (Keller et al., 2022). Therefore, environmental, psychological, and clinical factors must be part of the plate waste management strategy.

CONCLUSIONS AND RECOMMENDATIONS

This literature review confirms that satisfaction with nutrition services plays a strong mediating role in the relationship between the quality of nutrition services and the level of food waste among inpatients. Various studies show that dimensions of service quality including food taste and appearance, menu variety, timeliness of distribution, service cleanliness, and nutrition staff competence and communication consistently influence patient satisfaction, which in turn leads to increased food acceptance and reduced plate waste. These findings confirm that food waste is not only influenced by technical factors related to food presentation, but also by patients' perceptions and experiences of the overall quality of nutrition services. Thus, strategies to improve the quality of nutrition services must consider patient satisfaction as a core element in reducing food waste and increasing the effectiveness of hospital nutrition interventions.

Based on the results of the study, it is recommended that hospitals develop a model for improving the quality of nutritional services that is oriented towards patient experience through menu personalization, improved food palatability, streamlined distribution processes, and effective communication training for nutrition staff. Further research is recommended using a more robust mediation analysis design, such as structural equation modeling, to deepen understanding of the mechanisms linking service quality, satisfaction, and food waste. In addition, the integration of technologies such as e-menus, real-time feedback systems, and digital plate waste monitoring is also recommended to improve the accuracy of evaluation and service effectiveness. The implementation of policies that directly link patient satisfaction indicators to nutrition service performance evaluations has the potential to have a significant impact on reducing food waste and improving the overall quality of hospital services.

ADVANCED RESEARCH

Advanced research should focus on developing machine learning-based predictive models to map real-time patterns of relationships between nutrition service quality, patient satisfaction, and plate waste levels, thereby enabling the generation of personalized menu recommendations that are adaptive to patient preferences, clinical conditions, and daily responses. Multicenter experimental studies integrating food sensor technology, digital plate waste monitoring, and patient-reported experience measures are also needed to more accurately test the effectiveness of innovative nutrition service interventions. In addition, cross-cultural mediation and moderation analyses using structural equation modeling (SEM) can strengthen understanding of the contextual factors that influence patient satisfaction and consumption behavior in various healthcare systems. Future research also needs to assess the economic impact and environmental sustainability of reducing plate waste as part of a strategy to improve the quality of hospital nutrition services.

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