Analysis of The Effect of Patient Eating Satisfaction On Food Waste: A Medical Informatics Perspective at Caruban Regional Hospital, Madiun Regency

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Article Info

Abstract

Background: Patient meal satisfaction is an important aspect of health services that can influence the patient's health and well-being. In the hospital context, this satisfaction is not only related to the quality of the food served but also to the management of food waste. High levels of food waste can have a negative impact on the environment and hospital operational costs. This research aims to explore the influence of patient eating satisfaction on the amount of food waste from the perspective of medical informatics produced at Caruban Hospital, Madiun Regency.

Methods: This research method uses a cross-sectional study design with a population of patients treated at Caruban District Hospital. The data collection technique was carried out through a questionnaire adopted from ACHFPSQ and Schiavone to measure eating satisfaction. Data analysis was carried out using descriptive and inferential statistical methods.

Results: These findings indicate that there is a significant relationship between the level of patient eating satisfaction and the amount of food waste produced. Patients who are satisfied with the food served tend to produce less food waste compared to those who are dissatisfied..The overall level of patient satisfaction with the quality of food and hospital services is quite good, with a score of 3.94 ± 0.77. However, there are still complaints about the taste of 35% and the portion of the food served. Patients consume around 70.25% of the food provided, while the remaining 27.25% becomes waste.

Conclusions: Patient satisfaction with the food served is an essential aspect of health services that can influence the patient's health and well-being. Improving food taste and portions is necessary to reduce food waste and increase hospital operational efficiency.

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INTRODUCTION

In assessing the satisfaction of inpatients, there are eight main influencing factors, namely medical services, food, laboratories, wards, reception, infrastructure, medicines and nursing, with food services occupying second place after medical services (Singh & Aggarwal, 2021). In Saudi Arabia, the overall satisfaction level with hospital services reached 80.9%, where food service received the highest satisfaction level at 91.15%. Furthermore, satisfaction with doctor services was 81.0%, the acceptance and registration process was 80%, and nursing services were 78.15% (Elias et al., 2022). In addition, effective communication, quick response, empathy, and clear explanations have been proven to have a significant impact on increasing patient satisfaction and trust (Karaferis & Niakas, 2024).

Food waste in hospitals is an important issue, both from an environmental and resource efficiency perspective. Hospitals that have high levels of food waste not only indicate waste but also reflect patient dissatisfaction with the food served. Patient meal satisfaction in hospitals is an important indicator in assessing the quality of health services. Previous research shows that Providing good food services reduces the increase in food waste (Cook et al., 2023). This includes adjusting the amount of food to patient needs, ensuring quality and quantity are in line with patient expectations, and establishing efficient communication between actors in the food supply chain, which can reduce waste food (Strotmann et al., 2017). In Sri Lanka, allowing patients to choose their meals through a diet ordering system has been shown to successfully reduce food waste in hospitals to less than 4% overall (Rathnayake & Dalpatadu, 2020).

Research conducted at Jasa Kartini (JK) Hospital, Tasikmalaya, in August-October 2017 showed that there was a significant relationship between food waste and food taste. The taste and appearance of food significantly influence food waste in patients on a low-salt diet (Saragih, 2020). In addition, standardizing food portion sizes has been shown to increase food waste in inpatient units and can be a first step for healthcare providers in designing advanced strategies to reduce food waste (Jonathan, 2023). In Italy, interventions toward energy efficiency and patient satisfaction are also carried out to minimize food waste, which is a concern for policymakers, health professionals, catering companies and patients (Bux et al., 2023).

The impact of patient satisfaction with food, food service, expectations regarding food quality, and the amount of food wasted greatly influences the problem of food being wasted (Adhiyati, 2018),(Schiavone et al., 2020). Food personalization and efficient room service can increase nutritional intake while reducing food waste (Rinninella et al., 2023). The determining factors for wasting patient plates involve the patient's clinical condition, the taste of the food, and the condition of the hospital food service environment (Diana et al., 2022).

In the context of Caruban District Hospital, it is important to identify whether there is a relationship between the level of patient eating satisfaction and the amount of food waste produced. Are satisfied patients more likely to finish the food served, or vice versa? This study aims to measure the level of patient eating satisfaction and analyze this relationship with the amount of food waste produced at Caruban Regional Hospital. Thus, this research can provide deeper insight into food management in hospitals.

This research has theoretical and practical benefits. The research results can add to the body of knowledge regarding patient eating satisfaction and food waste management. Practically, this research can provide recommendations for the management of RSUD Caruban to improve the quality of food services and reduce food waste.

METHODS

Setting and study design

This research uses a quantitative design with a cross-sectional approach, which allows data collection simultaneously from the population studied. This design was chosen to get a clearer picture of the level of patient satisfaction with food waste generated at Caruban Hospital, Madiun Regency, East Java, Indonesia.

Population and sampling

The study population consisted of 122 inpatients at Caruban Hospital, Madiun Regency. The sample was taken using

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convenience sampling, with the sample size calculated using the Raosoft, Inc. sample size calculator, with a margin of error of 5% and a confidence level of 95%. Inclusion criteria for participants were adult patients aged 18-65 years who had been hospitalized for more than 48 hours with a normal diet. Exclusion criteria for participants were post-operative patients, patients with Ryle tube feeding, parenteral feeding, or Nil by Mouth (NBM); patients with mental disorders, critical patients; and Patients on a texture modification diet.

Measurements

The tool used in this research is a questionnaire adopted from the Acut Hospital food service Patient Satisfaction Questionnaire (ACHFPSQ), which consists of five dimensions, namely: Food quality, Food service quality, Staff/service issues, Physical environment, Statements analyzed separately and Schiavone (Capra et al., 2005),(Schiavone et al., 2019). Meanwhile, several questionnaire questions from Schiavone are based on the ACHFPSQ, an instrument used to measure patient satisfaction with hospital food services. Participants were asked to provide additional information: (a) Sociodemographic data: age, gender, nationality, education, marital status and work; (b) Characteristics of the food served: quality, variety, presentation, quantity, confidence in food safety, appropriate temperature, importance of food; (c) Food service characteristics: food service satisfaction, food distribution time, politeness of staff preparing food; d) Food waste level (main outcome): to evaluate the amount of food thrown away, we used the following question: "What percentage of food do you consume?". Answered using a 5-point Likert scale: none/ almost none, about 1/4, about half, about 3/4, all/almost all). 'Almost none' means the patient only tastes the food and then refuses it. We also asked patients why they threw away food and whether they brought food from home or other external catering services. The questionnaire contains items rated on a 5-point Likert scale from "always" to "never" and an overall rating from "very good" to "very bad" and from "none" to "very much" (Schiavone et al., 2019). So, the combination of the ACHFPSQ and Schiavone produces a complete questionnaire, including the dependent variable used, namely the amount of food eaten, which can also be interpreted as the opposite, "food waste" left over from the food eaten. Moreover, the results of the Validity and Reliability tests are similar. Here is the link https://shorturl.at/SCVdu for the ACHFPSQ and Schiavone questionnaire format.

ACHFPSQ (Acute Care Hospital Foodservice Patient Satisfaction Questionnaire) and Schiavone instruments were used to measure patient satisfaction with hospital food services (Schiavone et al., 2020). ACHFPSQ is a questionnaire designed to provide patient satisfaction with hospital food and food services (Dall'Oglio et al., 2015). Meanwhile, Schiavone Instruments more precisely measures patient eating satisfaction and food consumption behavior (Schiavone et al., 2019). In more detail, the ACHFPSQ and Schiavone combination instrument statement consists of: 1) The taste of the food served is by my preferences (Scale: Very Dissatisfied [1] - Very Satisfied [5]). 2) The food I receive is always warm. (Scale: Very Dissatisfied [1] - Very Satisfied [5]). 3) The food portion is sufficient for my needs. (Options: Yes/No). 4) The amount of food I consume from what is served is (Options: <50%, 50–75%, >75%).

Data collection

The research was carried out in the Inpatient Hospital of Caruban Hospital, Madiun Regency, from March to June 2024. A research team trained to ensure the accuracy and consistency of data for patients who met the criteria, obtain their perspectives on satisfaction, and record food waste generated distributed patient satisfaction questionnaires to inpatients.

Data analysis

The collected data was analyzed using descriptive statistics to describe the characteristics of respondents and inferential analysis to examine the relationship between patient eating satisfaction and the amount of food waste. The Pearson correlation test was used to determine the strength and direction of the relationship between the two variables. Data on comments and suggestions is analyzed by grouping opinions and suggestions based on the same or similar substance and then

calculating the proportions using Excel.

RESULTS AND DISCUSSIONS

Patient eating satisfaction is directly related to the level of food waste in health facilities such as hospitals. Excessive food waste can be a serious economic, environmental, and service quality problem. Patient meal satisfaction plays an important role in reducing food waste in healthcare facilities. Increasing meal satisfaction through improving taste quality, menu variety, and appropriate portions can provide many benefits, including Reducing waste of resources and operational costs. Improving patient health and recovery through providing good nutrition. Support environmental sustainability by reducing food waste. Therefore, hospitals need to prioritize patient dining satisfaction as an indicator of the success of food service and a strategic step in reducing food waste. This research conducted an in-depth study using a questionnaire to determine the importance of the influence of patient eating satisfaction on food waste. More details can be seen in the socio-demographic results in Table 1 below, which the Author has presented.

Table 1. Socio-demographics

Parameter	Total n = 122 (persentage %)
Sosio demography	
Gender	
Man	59 (48%)
Woman	63 (52%)
Age	
18 to 25 years old	38 (31%)
26 to 35 years old	24 (20%)
36 to 45 years old	19 (16%)
46 to 55 years old	20 (16%)
56 to 65 years old	21 (17%)
Ethnicity	
Java	121 (99%)
Other	1 (1%)
Education	
No school	7 (6%)
Elementary school	28 (23%)
Junior high school	20 (16%)
Senior high school	60 (49%)
College	7 (6%)
Religion	
Islam	122 (100%)
Marital status	
Not married	23 (19%)
marry	99 (81%)
Work	
Does not work	13 (11%)
Civil servants	3 (2%)
Not Civil servants	99 (82%)
Student	7 (5%)
Income	
Below Minimum Wage (Rp.2.274.277)	99 (81%)
Above the Minimum Wage	23 (19%)

Table 1 depicts the socio-demographic characteristics of the 122 patients who participated in this study. Of the total sample, 48% were men and 52% women. The age range of 67% of patients is under 50 years old, with characteristics of 99% being Javanese, 100% being Muslim, and 81% being married. In terms of education, the majority of patients (49%) have a high school educational background, and 82% of patients' work is non-PNS, with an income 81% below Madiun Regency's minimum wage, namely under IDR 2,274,277. Next, data processing was carried out to find the results of patient eating satisfaction using the t-test and F-test in this study. More details can be seen in graphic Figure 1 below.
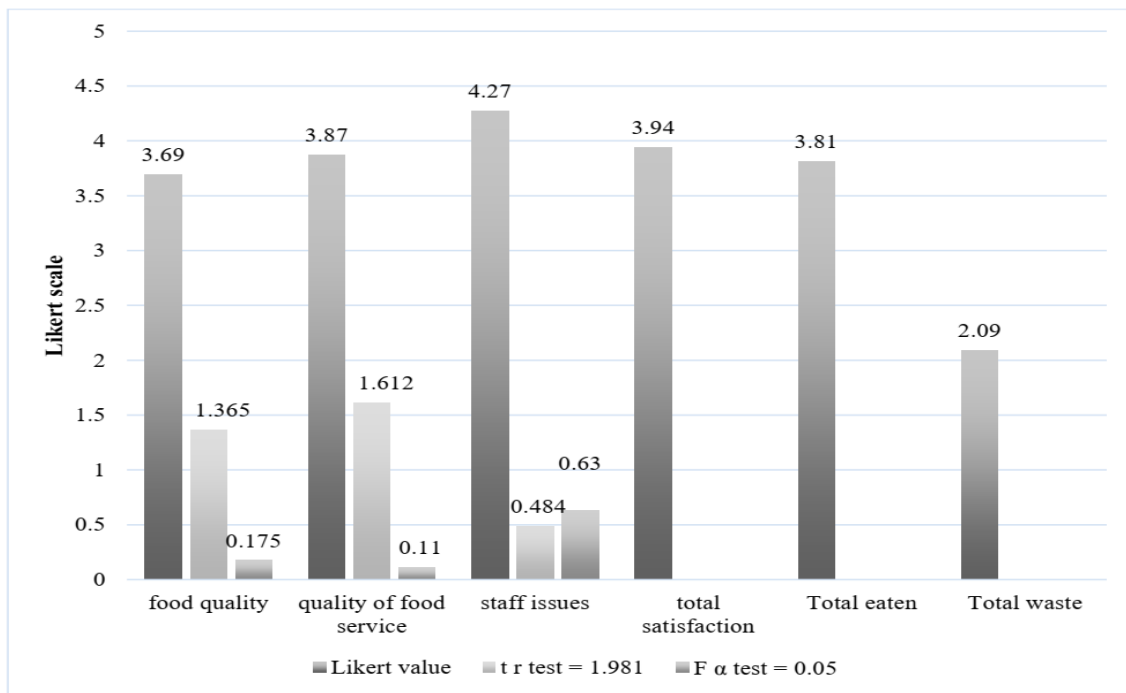

Figure 1. Patient satisfaction results, t-test and F-test

From Figure 1, we get the idea that after eliminating invalid and unreliable variables, it is found that the dimensions of food quality, food service quality, and staff/service issues have a total satisfaction of 3.94 ± 0.77, which is close to the good category. This shows that these three dimensions are still able to provide a level of satisfaction that almost reaches a good level even though there are irrelevant variables. The amount of food consumed is based on the questionnaire; the average food consumed per day per patient is 3.81 ± 1.02 or around 50-75% of the total portion of food. With the conversion of 0.1 servings to 2.5%, 3.81 servings are equivalent to 70.25% of food consumed per day. Meanwhile, the amount of food waste from the questionnaire, which is a conversion based on the amount of food eaten, shows that the amount of food waste/patient/day is 2.09 ± 1.02 or the equivalent of 25 – 50% of the portion of food/patient/day. If an increase

of 0.1 is 2.5%, then 2.09 is equivalent to 27.25%. When converted to grams, 27.25% x 1044.5 = 284.63 gr/patient/day.

It was concluded that patient satisfaction was 3.94 on the Likert scale, with the amount of food eaten being 3.81 on the Likert scale, meaning that it was close to good satisfaction with the amount of food eaten and inversely proportional to the smaller food waste, namely 2.09 on the scale Likert. While the t-test states that all dimensions of satisfaction are below the r table, the Sig value is known for the F test. for the influence of X1, satisfaction, while Y is the amount of food eaten.

The Relationship between Eating Satisfaction and Food Waste from the F test statistical analysis shows that there is a significant positive relationship between eating satisfaction and the amount of food eaten ($p < 0.05$). Conversely, this means that the higher the patient's level of eating satisfaction is, the

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less food waste is generated. These findings are consistent with previous research, which shows that meal satisfaction influences patient consumption behavior. This is also confirmed in the findings of the influence of external factors, as presented in Figure 2 below.
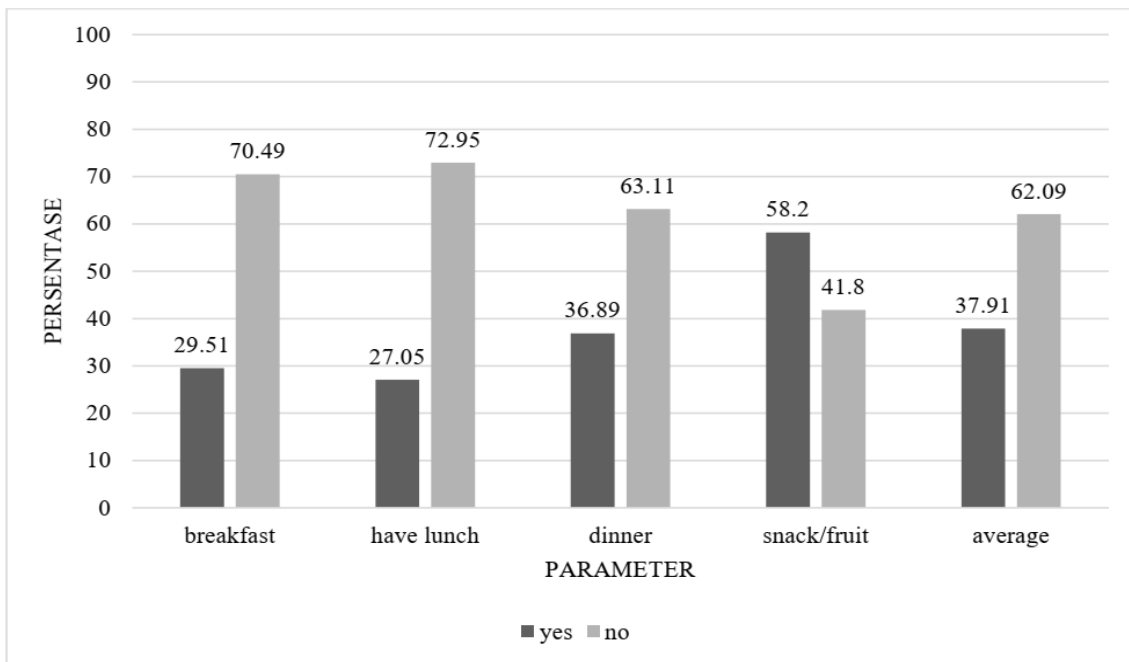

Figure 2. Proportion of bringing food from outside the hospital

Figure 4.2 shows that, on average, 37.91% of patients who are inpatients bring food from outside the hospital; the majority of inpatients, 62.09%, do not bring food from outside the hospital, meaning that there are more and more patients. If you do not bring food from outside, more food from the hospital will be eaten, so there will be less food waste. Moreover, the picture of patient food waste based on meal times when compared with the results of the questionnaire, the daily amount is almost the same, but it can be seen that breakfast waste is more, namely 37.5% of the total daily/patient/day 27.25%. Comments regarding service delivery can be seen in Figure 3 below.
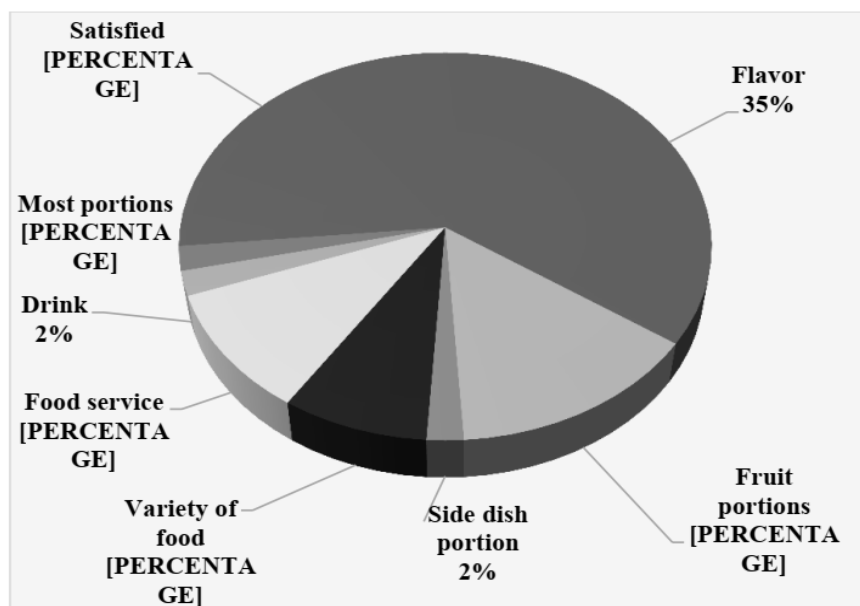

Figure 3. Comments on service delivery

Figure 4.3 shows that 35% of the 40% who commented commented on taste issues. Customers pay the greatest attention to the taste aspect of food. This shows that taste quality is the main factor in assessing service. Improving or increasing the taste of food will have a significant positive impact. Then, 27% were satisfied. Most customers expressed satisfaction with the overall service. This high level of satisfaction indicates that service delivery is running quite well. Regarding the fruit portion of 14%. There are also quite a lot of comments regarding fruit portions, showing customers' attention to the presence and quantity of fruit provided. This indicates that fruit plays an important role in perceived customer satisfaction. Meanwhile, service problems are 10%. This shows that the food service aspect is also quite highlighted, indicating the need to maintain or improve the quality of staff service or serving systems. More important is food variety (8%), which provides comments regarding menu variations, showing the importance of food diversification so that customers feel more satisfied and not bored.

Aspects in the low category are drinks (2%), large portions (2%), and side dish portions (2%). This condition shows that comments regarding portions of side dishes, drinks and portions that are too large appear in small numbers. However, this aspect is still important to pay attention to because even if the number of comments is small, it can have an impact on the perception of some customers. Based on a socio-demographic analysis carried out on 122 patients in this study, several significant findings emerged regarding the relationship between patient characteristics and their level of satisfaction with food quality, consumption and food waste produced.

Socio-Demographic Characteristics

Several socio-demographic aspects influence patients' perceptions and levels of satisfaction with food and their consumption behavior. Gender, with a nearly equal distribution of men (48%) and women (52%), allows for a fair comparison of food consumption patterns, showing no significant differences in satisfaction or food consumption based on gender. Age plays a significant role, as 67% of patients are under 50 years old, indicating that most patients are of productive age, typically more concerned about nutrition and with more apparent food preferences. This group generally has higher expectations for food quality, particularly in taste and nutritional value. Cultural and religious factors, such as ethnicity and religion, also heavily influence perceptions, with 99% of patients being Javanese and 100% being Muslim. This underscores the importance of halal food and considering cultural and religious preferences in hospital menu planning to ensure patient satisfaction. Marital status, with 81% of patients being married, suggests that familial habits may lead to higher expectations for food quality, including taste, portion sizes, and nutritional balance. Education levels further impact food assessment, as 49% of patients have a high school education. Those with higher education levels are generally more knowledgeable about nutrition and critical of food quality. Employment and income also play a role, with 82% of patients not being civil servants and 81% earning below the Madiun Regency Regional Minimum Wage (UMR). These economic conditions may lead to greater appreciation of hospital food among lower-income patients, contrasting with higher-income patients who often have better access to high-quality food outside the hospital.

Satisfaction with Food Quality, Service and Staff Issues

Patient satisfaction is evaluated based on three main dimensions: food quality, food service, and staff issues. Environmental factors are not evaluated because they are not reliable. The analysis reveals that the average patient satisfaction score is 3.94 ± 0.77, approaching the "good" category, indicating that the hospital generally provides adequate services. In terms of food quality, while most patients expressed satisfaction with the taste, variety, and presentation, there remains room for improvement, particularly in addressing individual cultural and dietary preferences. Notably, 35% of patients (from the 40% who provided feedback) expressed dissatisfaction with the taste of the food, highlighting the need for enhancements in this area. Foodservice aspects such as punctuality, cleanliness, and staff friendliness received positive feedback, reflecting overall patient satisfaction. However,

there is still potential for improvement in the communication and interaction between food service staff and patients, which could further enhance the dining experience. Similarly, while interactions between food staff and patients were rated satisfactory, opportunities remain to improve communication and staff responsiveness to better meet patient needs and expectations. The classification of four dimensions in the questionnaire provides a detailed description of the level of satisfaction as well as the relationship and influence of these dimensions on satisfaction with food services in hospitals (Boughoula et al., 2020). These findings indicate that patient-focused food service models are successful in increasing nutritional intake and patient satisfaction, as well as reducing plate waste and meal costs compared to conventional food service models (McCray, Maunder, Krikowa, et al., 2018). In addition, patient-based service models can also improve clinical outcomes cost-effectively (McCray, Maunder, Barsha, et al., 2018). This suggests that by improving food quality, understanding patient preferences, and providing better menu options, hospitals can increase patient satisfaction. Apart from that, the level of satisfaction with food services in hospitals still needs to improve, as it is influenced by food quality and environmental factors. Significant improvements are needed to improve the quality of these services (Teka et al., 2022).

Food Consumption and Waste

Data showed that patients consumed approximately 3.81 ± 1.02 portions of food per day, which was equivalent to 70.25% of the total portions served. Most patients accept and consume the food the hospital provides, although certain factors impact consumption levels and lead to food waste. Despite relatively high food consumption rates, about 27.25% remains uneaten. This may be attributed to mismatches in taste preferences or the common practice of patients bringing food outside the hospital, especially at night. For instance, 37.91% of patients reported bringing snacks or fruit, often due to the hospital's 17:00 meal schedule being earlier than their usual eating habits. On average, food waste per patient daily amounts to 2.09 ± 1.02 servings, equivalent to

27.25% of the total food served, or 284.63 grams in weight. This significant waste highlights a discrepancy between the portions provided and actual consumption. Breakfast, in particular, accounts for 37.5% of total food waste, possibly because patients' breakfast habits differ from hospital routines. Moreover, 82% of patients are not office workers, so their eating patterns tend to favor later meals, further contributing to the mismatch.

Various factors that influence the relationship between meal satisfaction and food waste involve the type of food served, the way it is served, and hospital policies in menu management. Patient satisfaction with food services in hospitals is influenced by aspects of food quality, such as taste, texture, appearance, variety and cleanliness, as well as the quality of food services, including service systems, eating equipment, and staff attitudes and performance. Considering how important the quality of food and service is in determining the level of patient satisfaction, regular evaluation and assessment are very important (Nafi'a, 2021). Implementation of an 'On-Demand' snack service in an inpatient setting has been shown to reduce food waste, indicating that menu variety and attractive presentation can increase patient satisfaction (Ellick et al., 2024).

The Relationship Between Satisfaction, Consumption, and Food Waste

This research found a positive correlation between the level of patient satisfaction with food and the amount of food consumed. More satisfied patients tend to consume more, which contributes to reduced food waste. With a satisfaction score of 3.94, average food consumption reached 3.81 portions per day. Conversely, lower satisfaction is associated with increased waste generated. The findings of this research have important implications for hospital management, especially in efforts to reduce food waste. By increasing patient dining satisfaction, hospitals can improve the patient experience while reducing the food waste generated. Hospital managers need to take steps to increase the awareness of nutritional service personnel regarding the importance of health and food quality, ensure their involvement with patients, provide patients with freedom of choice, and exercise adequate supervision to

increase the variety of dishes (Vafaeenasab et al., 2021). Additionally, implementation of the new role of Food Service Dietitian has shown positive results with cost savings and increased adherence to nutritional care plans (Yona et al., 2020). These steps can contribute to cost savings as well as provide a better environmental impact.

One of the goals of hospital food services is to play a role in the patient's healing process during hospitalization, namely by providing food that suits the patient's needs. Nutrition services in hospitals aim to provide food that is hygienic, safe to consume, and nutritionally balanced which will help the patient's healing process (Arifiyanti, 2017). Nutritionists have the responsibility to provide food services that have been adapted to the patient's needs and type of treatment. This aims to reduce the risk of infection in patients. The success of food services is indicated by less food waste or the patient finishing the food so that there are no leftovers (Antasouras et al., 2023).

Factors that influence the occurrence of food waste generally consist of 2, namely internal factors and external factors (Moehyi, 2019). Internal factors are age, illness, gender, length of stay in hospital, appetite, eating habits, psychological status, physical activity, and disorders of the digestive organs. Meanwhile, external factors are color, appearance, texture, portion and taste, level of doneness and temperature of food, and other factors such as temperature in the inpatient room, menu change cycle, quality of food served, and food outside the hospital. These factors will be able to increase patient satisfaction (do Rosario & Walton, 2020).

In the Campania region of Italy, a cross-sectional study was conducted with a sample of 762 inpatients in three hospitals evaluating the amount of food waste. Found the total food wasted amounting to 41.6%. Main dishes, first (pasta or rice), second dishes (meat or fish), generate the same amount of waste (38.5% and 39.7% respectively). Side dishes (vegetables or potatoes), however, generated the largest amount of waste (55.0%); 40.7% of patients completely threw away this part of the food. The types of food waste among the three hospitals reflected similar patient behavior,

with the amount of food wasted never falling below 30%. Women tended to waste more food than men (59.1% vs. 38.2%; p = 0.000). Other variables were correlated with less food waste, such as having a favorable opinion of food quality (RR = 1.91; 95% CI = 1.68–2.17) and satisfaction with food service in general (RR = 1.86; 95% CI = 1.64–2.10). Poor quality, different eating habits, and feeling full are the main reasons why patients throw away food (Schiavone et al., 2019).

Meanwhile, several states in the Eastern Mediterranean Region (EMR), including Iran, Saudi Arabia and Qatar, have assessed patient satisfaction with food waste, experiencing food waste in hospitals (25.4%) of the total served. affects patient's nutritional status and predispose to malnutrition. Therefore, it is important to study the influence of patient eating satisfaction on food waste to be highlighted and completed by hospitals, especially services to inpatients, in order to improve food quality to a good standard (Hoteit et al., 2024).

CONCLUSION

This research shows that there is a significant relationship between patient eating satisfaction and the amount of food waste at Caruban Regional Hospital. The overall level of patient satisfaction with the quality of food and hospital services is quite good, with a score of 3.94 ± 0.77. However, there are still complaints about the taste of 35% and the portion of the food served. Patients consume around 70.25% of the food provided, while the remaining 27.25% becomes waste. Socio-demographic factors such as age and cultural preferences also influence satisfaction, and the habit of bringing food from outside the hospital also contributes to increased waste.

It is recommended that the management of RSUD Caruban take steps to improve the quality of food services by focusing on several key areas. Enhancing the taste and variety of food to better align with patients' preferences is crucial. Additionally, food portions should be adjusted to meet patients' needs more accurately. Reducing food waste should include improving communication about patient dietary requirements and preferences. Furthermore, managing the impact of external

food patients can help minimize food waste and ensure that hospital meals are effectively utilized. Future research should examine more deeply the factors that influence meal satisfaction and food waste, as well as conduct studies in other hospitals to compare the results. More comprehensive research will provide a better understanding of this topic and help with food waste management in healthcare facilities. This study has several limitations, including a relatively small sample size and limitations in the generalizability of the results. In addition, this study was only conducted in one hospital, so the results may not be widely applicable. For further research, it is recommended to conduct a larger study involving several hospitals to get a more comprehensive picture of the relationship between patient eating satisfaction and food waste. Additionally, longitudinal studies could be conducted to look at changes in meal satisfaction and food waste over time.

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