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Factors That Influence Food Waste Behavior Among Hospitalized Patients in Hospital Raja Perempuan Zainab II

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Abstract: Food waste in hospitals is a significant issue with implications for both environmental sustainability and healthcare efficiency. This study investigates the factors of food attributes influencing food waste behaviour among hospitalized patients in Hospital Raja Perempuan Zainab II (HRPZ II). Specifically, it seeks to examine how food quality, food presentation and food portion affect consumer behaviour towards food waste problems among hospitalized patients. A mixed-methods approach was used, collecting data via surveys from hospitalized patients. The questionnaire, divided into six sections employed a Likert scale for nuanced responses. This descriptive, cross-sectional study utilized purposive sampling to ensure relevant perspectives, targeting 417 respondents to boost validity and reliability. Statistical Package for the Social Sciences (SPSS) Version 27 was used for data analysis from the questionnaire. The data analysis methods used include reliability analysis, descriptive analysis, Pearson correlation, and multiple regression analysis. The findings revealed that food attribute variables—food quality, food presentation and food portion—positively influence consumer behaviour towards food waste problems among hospitalized patients, with food presentation emerging as the most significant predictor. These findings highlight the critical need to minimize the environmental impact throughout the entire food cycle, from production to the disposal of leftover waste, to reduce food waste disposal problems in hospitals. Academically, this study serves as a foundation for future research, encouraging scholars and practitioners to further investigate the long-term effects of educational initiatives and cultural factors on food waste behaviors in advancing environmental sustainability.

Keywords: *Food Quality, Food Presentation, Food Portion, Food Waste, Public Hospital.*

1. Introduction

Food is any substance, liquid or solid, that provides the body with necessary nutrients. The main ingredients of food include proteins, carbohydrates, fats, and other nutrients that the body needs for growth, development, and other essential processes. Food is necessary for survival and plays a significant role in the economy (Britannica, 2019). However, food waste has become a growing issue, especially in institutional settings like hospitals. In hospitals, food supplies for patients must meet specific standards or guidelines through menu planning, assessment of the nutritional needs of the hospital population, and providing useful suggestions for food selections suited to various dietary needs, including special and therapeutic diets. Despite these efforts, food waste remains a problem, as a significant amount of food prepared for patients is discarded due to preferences, dietary restrictions, or poor presentation. Additionally, hospitals are required to serve meals that comply with menu specifications and dietary needs, including low-fat, gluten-free, vegan, and other types of diets (National Catering and Nutrition Specification for Food and Fluid Provision Hospitals in Scotland, 2016). Addressing food waste in hospitals is crucial to ensure that food resources are used efficiently and sustainably.

Food waste can be defined as using food meant for human consumption for non-human purposes, repurposing food for animal feed, or throwing away edible food (Rusyda, 2024). Nonetheless, preliminary data on food waste from the perspective of facility management has shown how serious the issue is. According to Wafi and Tumiran (2022), the Department of National Food Waste discovered that approximately 45 percent of the 29,000 tons of waste solids generated daily in Malaysia were derived from food waste. Therefore, food waste has an impact on the environment by releasing dirty gases that contribute to climate change. Referring to Chauhan et al. (2021), food service institutions such as hotels, restaurants, and institutional food outlets such as hospitals caused 8% of food waste problems. Food waste has become a major problem nowadays, particularly in hospitals where it is claimed that many patients refuse to eat because the food does not suit their

tastes. Wang et al. (2022) have reported 15% of food trays that are delivered to the ward for patient consumption are brought back untouched to the dishwashing area for disposal. As a result, hospitals are one of the establishments that become contributors to the creation of waste in Malaysia (Osman et al., 2021).

A hospital is a facility that has been set up, manned, and furnished to diagnose illnesses, treat patients medically and surgically, provide lodging during the process, and treat injured patients. According to Chemah et al. (2018), a hospital is one of the eateries that provides on-site patient food service. The preparation, distribution, and serving of safe food is the aim of any food service organization. Any hospital food service must have competent management in place to maximize patient food and nutrient intake while successfully reducing waste. Chemah et al., (2018) claim that some researchers found that food presentation and variety are the primary factors that influence patients' satisfaction towards meal services in hospitals. Patients' satisfaction with the food served to them is claimed to lead to zero plate waste. This is related to food attributes and quality, which include taste, diversity of food, flavor, food temperature and texture that influence consumer satisfaction towards products offered by food service establishments. Other than that, food quality, food preparation and food portions also influence food waste behavior among hospitalized patients in HRPZ II. Thus, this study aims to answer the following research objective:

RO1: To identify the relationship between factors of food quality and food waste behaviors among patients in public hospitals.
RO2: To examine the relationship between factors of food presentation and food waste behaviors among patients in public hospitals.
R03: To examine the relationship between factors of food portions and food waste behaviors among patients in public hospitals.

2. Literature Review

Food Waste

Food waste has a profound negative impact on the environment, economy, and society, making it a pressing global concern (Coşkun & Yetkin Özbük, 2020). The Food and Agriculture Organization has estimated that one-third of all food produced globally is either lost or wasted (Ishangulyyev et al., 2019). According to Dhir et al. (2020), food waste can be categorized into three main types: (a) avoidable waste, which refers to food that was once edible but becomes inedible by the time it is discarded; (b) unavoidable waste, which includes inherently inedible items like eggshells; and (c) potentially avoidable waste, such as certain food parts like potato skins, which are sometimes consumed but often discarded.

The level of food waste in hospitals is notably higher than in other food supply settings. This issue has far-reaching negative effects on health, society, the economy, and the environment, making food waste a contentious topic within hospital food service departments. Antasouras et al., (2022) stated that part of the difficulty is leftover food, in which food is served but not eaten by the patient. Despite the adequate availability of food in hospitals, many patients do not consume enough, leading to malnutrition and increased food waste. Brennan & Browne (2021) identify various factors contributing to food waste in hospitals, including clinical issues related to Nutrition Impact Symptoms (NIS), reduced appetite due to illness or medication, changes in taste or smell, swallowing difficulties, pain, textured modified diets, and other challenges associated with prolonged hospital stays.

Hospitals generate significant amounts of waste, including food waste, much of which ends up in landfills. This contributes to environmental degradation by increasing greenhouse gas emissions and pollution. Food waste exacerbates problems such as habitat destruction, nutrient depletion, air and water contamination, and climate change (Siddiqui et al., 2022). Moreover, Seberini (2020) notes that food procurement, preparation, and disposal are costly processes for hospitals. The presence of food waste inflates these costs, impacting hospital budgets and potentially diverting resources from essential patient care services. Thus, food waste creates significant economic challenges and reduces hospital revenues.

Food Quality

According to Future Learn (2022), food quality refers to the combination of features and attributes in a food item that makes it acceptable to consumers. These characteristics include appearance, texture, flavor, and more. Food quality plays a vital role in ensuring patient satisfaction, particularly regarding their meals. For patients to heal and recover, they need nutritious meals. Given the medications administered, hospital food services must ensure that the food provided is of the highest quality. Serving high-quality meals can stimulate patients' appetites (Osman et al., 2021).

Hospital food service plays a key role in meeting patients' needs and ensuring their satisfaction with the meals provided. According to the Ministry of Health Malaysia (2021), hospital food services must cater to individual patient needs and preferences while offering a balanced menu that meets their dietary requirements. Therefore, hospital food services should strive to provide the highest level of care to their patients. David et al. (2023) highlight that patients are becoming increasingly aware of food quality, which has made the healthcare sector more competitive.

Consequently, the healthcare industry now views patients as clients. Several factors influence food quality, including nutritional value, taste, appearance, freshness, odor, color, contaminants, and adulterants. Akbara et al. (2021) emphasize that assessing food quality involves evaluating the overall attributes of food, such as its flavor, freshness, and visual appeal. Maintaining high food quality in hospital food services helps prevent foodborne illnesses and ensures patient satisfaction.

Food Presentation

Food presentation refers to the arrangement and visual appeal of food on a plate or serving dish (Gluchowski et al., 2024). It involves using various artistic and culinary techniques to enhance the dish's appearance and make it more visually appealing to diners. The primary goal of food presentation is to create a pleasurable and memorable dining experience by engaging the senses, particularly sight. According to Chemah et al. (2018), research shows that food presentation and variety are among the main factors influencing hospitalized patients' satisfaction with meal services. When patients are satisfied with the food provided, plate waste is minimized. Previous studies have revealed that several factors related to food quality—such as taste, variety, flavor, temperature, and the texture of meat and vegetables—have the greatest influence on patient satisfaction with hospital food services.

Osman et al. (2021) identify two types of food-serving systems used in hospitals under the Health Ministry: centralized systems and bulk systems. The study found that bulk systems resulted in a lower percentage of food waste compared to centralized systems. In bulk systems, freshly prepared dishes are transported to ward pantries on trolleys instead of being delivered in bulk to patients' bedsides. This approach helps maintain food at the correct temperature, ensuring that meals remain warm and appetizing, which can enhance patients' appetites. However, the study also noted that using a bulk system led to an overall increase in food waste.

Food Portion

Food portion refers to the amount of food served or consumed in a single sitting, typically measured in weight, volume, or similar units (Osman et al., 2021). Portion sizes vary based on cultural norms, dietary guidelines, and personal preferences. Hospital food and nutrition services must ensure patients receive adequate diets that meet their nutritional needs during hospitalization (Wierda et al., 2024). According to Norshariza et al. (2019), dieticians play a crucial role in tailoring meals to meet individual patient requirements. For instance, patients with swallowing difficulties may be prescribed soft diets, liquid diets, or pureed food. Such adjustments help increase food intake and significantly reduce food waste. Ofei et al. (2020) found that interventions like meal replacements and reducing meal portions based on patients' clinical conditions can effectively minimize plate waste. Customizing portion sizes according to patients' preferences further contributes to waste reduction.

Additionally, implementing on-demand food services, where meals are ordered and delivered promptly, or room service models, can enhance nutritional intake while reducing waste and costs (Mackenzie-Shalders et al., 2020). Patients, such as those on diabetic diets, may limit food intake to maintain proper blood glucose control. Therefore, routine monitoring of patients' food choices, consumption, and waste should be part of a

comprehensive approach to optimizing portion sizes, ensuring they contribute effectively to daily energy and protein intake (Osman et al., 2021).

Patients also prefer meals that align with their tastes and dietary habits. Common reasons for not finishing meals include differences in food preferences, lack of appetite, and inconvenient meal times. Aminuddin et al. (2018) note that older patients often have reduced taste sensitivity and distinct taste preferences compared to younger individuals, while culturally appropriate meals can enhance their comfort and satisfaction. Furthermore, patients with higher education levels tend to have higher expectations and are less easily satisfied with hospital food services. The type of catering system, whether in-house or outsourced, also impacts patient satisfaction. Addressing these diverse needs and preferences is essential to reducing food waste and improving the effectiveness of hospital food service operations.

3. Methodology

The purpose of this study is to identify the relationship between factors of food quality, food presentation and food portion towards food waste behaviors among hospitalized patients in HRPZ II. The research study involves quantitative methods, with self-administered questionnaires given to hospitalized patients. Quantitative research involves systematic data analysis, using statistical, mathematical, and computer approaches. This will be a descriptive and cross-sectional study. The research will occur in an informal setting and aim to gain a full understanding of how food quality, presentation, and portion affect food waste behaviors among hospitalized patients at Hospital Raja Perempuan Zainab II (HRPZ II) in Kota Bharu, Kelantan. The research used a purposive sampling technique, which is also known as selective sampling, that allows researchers to pick specific individuals or certain aspects of a population for research. Purposive sampling selects individuals with specific characteristics or expertise related to the research objectives. Hence, the researcher used purposive sampling, as according to Etikan et al., (2016) it is an easy and cost-effective way for conducting large-scale surveys as the method of choice for participant selection.

The questionnaires were distributed specifically to our target sample, which is hospitalized patients in HRPZ II. The questionnaire is designed to progress only for respondents who were hospitalized at Hospital Raja Perempuan Zainab II. Google Forms includes a mechanism where respondents must identify themselves as hospitalized patients to proceed to the next survey section. This careful approach is implemented to guarantee that only individuals involved as hospitalized patients contribute to the survey. This ensures the study's data is both relevant and accurate. Questions were created as comprehensibly as possible with simple language in Bahasa Malaysia and English to reduce any probable uncertainty.

According to the Unit Record of Statistics from Hospital Raja Perempuan Zainab II (2023), there were 67,019 hospitalized patients in 2023. Referring to Krejcie and Morgan's (1970) sample size table, a minimum of 381 respondents was deemed necessary for research involving this population. The survey, which spanned over a month, aimed to gather at least 381 samples to ensure accurate data analysis. Ultimately, the study included 417 respondents, surpassing the minimum requirement and providing a more robust foundation for comprehensive and reliable exploratory research. The sample consisted of hospitalized patients from Hospital Raja Perempuan Zainab II, representing various dietary categories such as normal diet, gluten-free diet, low-carb diet, and others. Screening questions were incorporated into the survey to confirm participant suitability.

The research instrument chosen for this study is a questionnaire that is carefully made containing 34 questions. Accuracy in designing the questionnaire is important to ensure that the questions are aligned with the objectives of the study. The questionnaire was structured into six sections for exploration. The first section addresses screening, followed by questions about demographic characteristics in the second section. The third, fourth and fifth sections investigate the independent variables, focusing on food quality, food presentation and food portion. Moving forward, the sixth section covers questions related to the dependent variable specifically, food waste behaviors among hospitalized patients in HRPZ II. To measure the perspective of the respondents, a Likert scale was used in these four sections. The scale ranges from 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree) to 5 (Strongly Agree), providing a nuanced understanding of opinions and perspectives, ranging from negative to positive. This thoughtful approach ensures a comprehensive and in-depth examination of aspects of the study. To conduct data collection activities, the Research Ethics Committee (REC)

letter of approval is required before collecting data to share the questionnaire. To conduct this study, ethics approval was obtained with reference no: 600-UiTMCTKD (PJI/RMU 5/2) JPN.

For the data analysis, data gathered were processed and analyzed using Statistical Package for Social Science (SPSS) version 27. Researchers have tested the reliability of the data by using Cronbach's Alpha on collected data from the pilot test. The pilot test was conducted with 30 respondents who agreed to answer the questions. As for Table 1, the result of the reliability test has been received as reliable variables. Besides, descriptive analysis, Pearson correlation analysis and multiple regression analysis will be used to test the relationship.

Table 1: Reliability Test

Variables	Cronbach's Alpha	Number Of Items	Number of Respondents
Food Quality	0.606	4	30
Food Presentation	0.724	4	30
Food Portion	0.650	4	30
Food Waste	0.899	12	30

4. Findings and Results

Data collection and sample characteristics

Statistical Package for the Social Sciences (SPSS) Version 27 was used for data analysis from the questionnaire. To reach a total of 417 people, we used an online platform that provided a Google Forms link for the respondents. There are a total of six parts to the survey, and before going on to the next part, we check if the responder is qualified to answer the screening question. The sections that follow provide a list of the independent and dependent variables that were utilized in this inquiry. The demographic summary of the respondents is presented in the table below.

Table 2: Demographic Characteristics

Variables	Categories	Frequency	Percentage (%)
Gender	Male	193	46.3
	Female	224	53.7
Age	18-28 Years Old	81	19.4
	29-39 Years Old	178	42.7
	40-50 Years Old	145	34.8
	51 Years and Above	13	3.1
Race	Malay	253	60.7
	Chinese	87	20.9
	Indian	77	18.5
Marital status	Single	144	34.5
	Married	257	61.6
	Divorced	8	1.9
	Widow	8	1.9
Level of Education	Primary	40	9.6
	Secondary	65	15.6
	Diploma	169	40.5
	Degree and above	143	34.3
Income	Below RM500	18	4.3
	RM500 - RM1000	18	4.3
	RM1001 - RM1500	75	18.0
	RM1501 - RM2000	141	33.8
	RM2001 - RM2500	91	21.8
	RM2501 and above	74	17.7

The researcher has utilized four weeks for the whole data collection process. A total of 417 responses have been received for the present study. Of the number of responses, 193 of them are male and the rest are 224 females. The frequency age group of the respondents was 18-28 years old, with 81%. 178 respondents were 29-39 years old, 34.8% of respondents were aged between 40-50 years old and the rest were 51 years old and above with 13 respondents. Among the respondents, 34% are single and the other 61.6% are married. 33.8% of respondents had an income range from RM1501 to RM2000, 21.8% were between RM2001 to RM2500, 17.7% of respondents had an income of RM2501 and above and the income level for the rest of the respondents was less than RM1500.

Descriptive Analysis

The descriptive analysis has been conducted to look at the means and standard deviations of each item in each category of food quality, presentation, portion, and waste, using a five-point Likert scale. If the mean score is less than 2.99, then respondents strongly disagree with the statement related to the variables. On the other hand, if the mean score is between 3.00 and 3.99, then respondents are partially or fully in agreement with the statement. In conclusion, statements regarding the three factors in the questionnaire are strongly agreed upon by respondents when the mean score is 4.00 to 5. Notice: On a Likert scale, 1 indicates Strongly Disagree, 2 indicates Disagree, 3 indicates Neutral, 4 indicates Agree, and 5 indicates Strongly Agree.

Descriptive Analysis of Independent Variable 1 (Food quality)

Table 3 presents the results of the descriptive analysis that was performed on the first independent variable. The first independent variable in this study is food quality. According to the table below, the mean score distribution for the items under the food quality ranges from 2.69 to 3.79, indicating that the respondents are more inclined to agree or strongly agree with the statements presented in the food quality section of the questionnaire. As a result, the findings on the food quality are reported in Table 3 in this section.

Table 3: Mean Score for Independent Variable 1 (Food quality).

No	Survey Item	N	Mean	Std. Dev
1.	I am sure the hospital has provided healthy food options for hospitalized patients.	417	3.53	0.846
2	The meals that have been served are delicious with various flavours.	417	2.69	1.608
3.	The temperature of the food served is appropriate and consistent.	417	3.03	1.439
4.	I think the frequency of menu rotations keeps the dining experience interesting.	417	3.79	1.070

Note: Likert Scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree)

Referring to Table 3, the survey results underscore a high level of awareness and consensus among participants regarding various aspects of food quality. The highest mean score observed for the statement is number 4 (M=3.79, SD=1.070) indicating that respondents agreed that they think the frequency of menu rotations keeps the dining experience interesting. The second-highest mean score was associated with the statement that the hospital has provided healthy food options for hospitalized patients, which is number 1 (Mean = 3.53, Std. Deviation = 0.846). This suggests a strong agreement among participants with a relatively low level of variability in responses. Conversely, the lowest mean score pertained to meals that have been served and are delicious with various flavours, which is number 2 (Mean = 2.69, Std. Deviation = 1.608). The second-lowest score observed for the statement is number 3 (Mean = 3.03, Std. Deviation = 1.439) indicating that respondents agreed that the temperature of the food served is appropriate and consistent.

Descriptive Analysis of Independent Variable 2 (Food presentation)

Table 4 presents the findings of the descriptive analysis conducted on the second independent variable. Food presentation serves as the second independent variable for the study. Based on the table provided, the average scores for the questions related to respondents' attitudes range from 3.25 to 3.79. This indicates that, on average, respondents' opinions about food presentation vary from strongly disapprove to highly agree. The items in this range exhibit varying food presentations, indicating a variance among respondents in terms of the features addressed by the food presentation variable in the research instrument.

Table 4: Mean Score for Independent Variable 2 (Food presentation)

No	Survey Item	N	Mean	Std. Dev
1.	I feel that the appearance of the food is appealing and appetizing.	417	3.25	1.231
2	The cleanliness of the serving area positively impacts the food presentation.	417	3.79	1.071
3.	The presentation of the food makes me feel confident about its freshness.	417	3.43	0.993
4.	I am satisfied with the visual presentation of the prepared food.	417	3.71	1.207

Note: Likert Scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree)

Based on Table 4, the analysis of food presentation of food waste reveals different patterns. The participants strongly agreed that the cleanliness of the serving area positively impacts the food presentation, which was number 2 with a high mean score of 3.79 and a standard deviation of 1.071, indicating strong agreement on this aspect of cleanliness. The second-highest mean score was associated with satisfaction towards the visual presentation of the prepared food, which is number 4 (Mean = 3.71, Std. Deviation = 1.207). The lowest mean score for this category was that the participants felt that the appearance of the food was appealing and appetizing (M3.25, SD=1.231). The second-lowest score observed for the statement is number 3 (Mean = 3.43, Std. Deviation = 0.993) indicating that respondents agreed that the presentation of the food makes them feel confident about its freshness. These findings highlight areas where targeted educational interventions can address specific food presentation to reduce overall food waste in public hospitals.

Descriptive Analysis of Independent Variable 3 (Food Portion)

Table 5 shows the average score distribution runs from 2.75 to 3.76, showing that the respondents' food portion varies across the full Likert scale, from strongly disagree to strongly agree.

Table 5: Mean Score for Independent Variable 3 (Food Portion)

No	Survey Item	N	Mean	Std. Dev
1.	I find that the portion sizes of main meals in public hospitals are appropriate.	417	3.72	0.939
2	I find that the portion sizes of meals in public hospitals are sufficient for individuals with specific dietary requirements (e.g., diabetic, gluten-free).	417	3.52	0.976
3.	I think the portion sizes of meals in public hospitals are comparable to those served in other healthcare facilities.	417	2.75	1.770
4.	I am sure food portion sizes in public hospitals promote overall health and well-being.	417	3.76	1.134

Note: Likert Scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree)

In the evaluation of participants' food portions related to food waste (Table 5), several prominent trends emerged, highlighting commendable adherence to crucial food portions. The highest mean score was associated with the statement "I am sure food portion sizes in public hospitals promote overall health and well-being," which is number 4 (M=3.76, SD=1.134). This robust consensus among participants indicates a strong commitment to meticulous food portions to reduce food waste. The second-highest mean score linked to the statement is number 1: “I find that the portion sizes of main meals in public hospitals are appropriate"(M=3.72, SD=0.939). This reflects that HRPZ II generally follows established nutritional guidelines to ensure balanced meals and meet the nutritional needs of patients. Conversely, the lowest mean score was number 3 which is associated with the statement ", I think the portion sizes of meals in public hospitals are comparable to those served in other healthcare facilities" (M=2.75, SD=1.770) and the second lowest mean score was number 2 with the statement “I find that the portion sizes of meals in public hospitals are sufficient for individuals with specific dietary requirements (e.g., diabetic, gluten-free)”(M=3.52, SD=0.976). These findings offer valuable insight into aspects of the food portion. Targeted interventions can leverage this information to improve understanding and contribute to overall improvements in reducing food waste in HRPZ II.

Descriptive Analysis of Dependent Variable (Food waste)

The dependent variable of this study is food waste in HRPZ II. As we can see from Table 6, the mean score ranges from 3.62 to 4.32, this shows that almost all the respondents agree with the food waste in the public hospital Raja Perempuan Zainab II.

Table 6: Mean Score for Independent Variable 3 (Food waste)

No	Survey Item	N	Mean	Std. Dev
1.	The problem of food waste occurs in public hospitals because there is no menu option offered to patients	417	4.21	1.173
2	I found the food served in public hospitals lacked seasoning and this was a factor in food wastage.	417	3.96	1.254
3.	The temperature of the food served in public hospitals is not suitable and can cause food waste problems among patients.	417	4.24	1.158
4.	I found that the menu provided by the public hospital is the same and waste occurs due to the lack of variety in the menu.	417	4.06	1.179
5.	I am not interested in eating food served in public hospitals because the food served is less appealing in terms of food appearance.	417	4.29	1.223
6.	A less clean serving area can make me not feel like eating and it can cause waste.	417	4.32	1.235
7.	Unappealing food presentation can affect my confidence to eat, leading to waste.	417	4.17	1.160
8.	A good visual presentation of food can attract my attention and waste problems can be reduced.	417	4.20	1.226
9.	The appropriate size of food is important to serve patients in public hospitals to ensure that food waste does not occur.	417	4.18	1.166
10.	The right size of food servings should be provided to patients who need a certain diet to ensure that the patient gets enough food without having to waste it.	417	4.29	1.286
11.	The size of food servings in public hospitals is not satisfactory compared to other healthcare centers, which will lead to wastage.	417	3.62	1.017
12.	I support the size of the food portions in the hospital, so that it guarantees the health and well-being of the patients and so that hospital food does not o to waste.	417	3.79	1.092

Note: Likert Scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree)

In the assessment of food waste (Table 6), there is a consistent pattern of high mean scores, indicating strong compliance with food waste. The highest mean score observed for the statement is number 6, which is "Unclean serving areas can make me not want to eat and can cause waste," with an impressive mean score of 4.32 and the second highest standard deviation of 1.235. Dirty or unkempt eating areas can be unattractive and unappetizing, causing patients to lose the desire to eat. Similarly, the second highest mean score observed for the statement is number 10 which is “The right size of food servings should be provided to patients who need a certain diet to ensure that the patient gets enough food without having to waste it." (M=4.29, SD=1.286). This shows a strong agreement, and consistency has proven the cause of food waste disposal in public hospitals. On the other hand, the lowest mean score is associated with the statement "The size of food servings in public hospitals is not satisfactory compared to other health care centers which will cause waste." which is the number 11 (Mean = 3.62, SD=1.017), reflecting that the food in the public hospital is satisfactory.

Pearson Correlation

The strength and direction of the linear relationship between two variables are analyzed through Pearson Correlation. Table 7 shows the relationship between food quality, food presentation, food portion and food waste behaviours among patients in public hospitals. There are hypotheses to be analysed by using the Pearson

Correlation test as below:
H_1: There is a significant relationship between food quality and food waste behaviours among patients in public hospitals.
H_2: There is a significant relationship between food preparation and food waste behaviour among patients in public hospitals.
H_3: There is a significant relationship between food portions and food waste behaviour among patients in public hospitals.

The features of a dataset can be characterized by descriptive statistics like Pearson's correlation coefficient. It details the strength and direction of a linear relationship between two numerical variables. The following Pearson Correlation table shows that food quality and food waste are strongly correlated (r = 0.535). Furthermore, there is a robust positive association between food presentation and food waste, with a correlation coefficient of (r = 0.660). Finally, food portions and food waste in HRPZ II are strongly correlated (r = 0.602). A positive correlation is displayed for all potential associations. In this case, the presentation of the food had the strongest association.

Table 7: Pearson Correlation Test

		Food quality	Food presentation	Food portion	Food waste
Food quality	Pearson Correlation	1	0.784**	0.798**	0.535**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	417	417	417	417
Food presentation	Pearson Correlation	0.784**	1	0.830**	0.660**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	417	417	417	417
Food portion	Pearson Correlation	0.798**	0.830**	1	0.602**
	Sig. (2-tailed)	<.001	<.001		<0.001
	N	417	417	417	417
Food waste	Pearson Correlation	0.535**	0.660**	0.602**	1
	Sig. (2-tailed)	<.001	<0.001	<0.001	
	N	417	417	417	417

**Correlation is significant at the 0.01 level (2-tailed)

Multiple Regression Analysis
In this study, the researchers employed multiple regression analysis to assess the hypothesis of a correlation between independent variables (food waste, food presentation, and food portion) and a dependent variable (food waste in public hospitals). The sample size of 417 for this study is adequate for doing multiple linear regression analysis. The results of the multiple regression are summarized in the table below.

Table 8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	. 667[a]	.445	.441	.73624

a. Predictors: (Constant), food quality, food presentation and food portion
b. Dependent Variable: Food waste

According to the data in Table 8, the value of R is 0.667, indicating a significant correlation between the dependent variable and independent factors. Furthermore, as indicated, the coefficient of determination (R2) is 0.445, indicating that our independent factors account for 44.5% of the variance in our dependent variable, food waste in public hospitals. In addition, researchers can determine the significance of the data by analysing the ANOVA (Table 9). The ANOVA test yielded a value of F (3,413) = 110.243, with a p-value of <.001. This indicates that there are statistically significant variations in the means of quality, presentation, and portion among the different groups. The p-value of less than .001 strongly rejects the null hypothesis. At a generally used significance level of 0.05, the results indicate that the null hypothesis can be rejected, providing evidence for the existence of substantial variations in quality, presentation, and portion sizes among the groups. These findings emphasize the significance of quality, presentation, and portion size in differentiating across the groups. Additional post-hoc tests can be performed to detect certain disparities across groups and investigate the consequences of these discoveries.

Table 9: ANOVA

Model		Sum of Squares	df	F	Sig.
1	Regression	179.272	3	110.243	<.001[b]
	Residual	223.868	413		
	Total	403.149	416		

a. Dependent Variable: Food waste
b. Predictors: (Constant), food quality, food presentation and food portion

Table 10: The Effect of Factors That Influence Food Waste Behavior Among Hospitalized Patients in Hospital Raja Perempuan Zainab II

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.365	.157		8.706	<.001
	Food Quality Factor	-.027	.072	-.025	-.377	.706
	Food Presentation Factor	.594	.080	.524	7.422	<.001
	Food Portion Factor	.211	0.82	.187	2.568	.001

a. Dependent Variable: Food waste

This study used multivariate linear regression analysis to find out which characteristics could be the best predictors of the dependent variable. Table 10 shows that of the independent variables with the most significant unique contributions to this study, the presentation variable has the highest beta value at .524, followed by the portion variable at .187. With a beta value of -.025, quality, on the other hand, showed a lesser association.

Additionally, all factors contributed significantly to predicting the dependent variable, as their significance levels (sig.) were lower than typical standards. Specifically, food presentation and food portions have a positive impact, while food quality has a limited and negative one. Food waste in public hospitals is the dependent variable, and there are statistically significant relationships between independent components (food portion, food presentation, and food quality). Quality, Presentation, and Portion explain 44.5% of the variability in the dependent variable, according to the modified R^2 value of. .445. To comprehend and predict food waste in HRPZ II, a strong model highlights the relevance of these factors.

Discussion

Pearson Correlation analysis revealed a significant relationship between quality, presentation, portion and behaviour of food waste among patients in HRPZ II. There is a strong positive correlation ($r = 0.535$, $p < 0.001$) between food quality and food waste that supports the acceptance of H_1. Hospitals should source fresh, high-quality ingredients to prepare meals. This not only enhances the taste but also ensures the meals are visually

appealing. Fresh ingredients retain the color, texture, and flavor of food better than processed or canned foods, making them more appetizing. Based on the mean score for each survey item in Table 3, it seems that HRPZ II generally have a good level of knowledge in food quality that is relevant to ensure patient satisfaction, as shown by the high mean score but attention may be needed in all areas, especially the palatability of food with various flavour. Food quality includes the total quality of food such as taste, freshness, and visual appeal (Akbara et al., 2021). This shows that when the quality of food increases, the food waste issue will decrease in public hospitals.

Next, a strong positive correlation ($r = 0.660$, $p < 0.001$) was identified between the presentation of real food and food waste confirming the reception of H_2. Food should be colourful and orderly, with attention to detail in the plating. Simple techniques such as adding decorations, arranging food neatly and using festive ingredients can make a meal more interesting. Overall, the mean score in Table 4 shows that the food presentation remains consistent, such as the appearance of the food, the clarity of the dish, the freshness of the food and the visual satisfaction of the presentation. According to Karan et al. (2023), there are two categories of food-serving systems,: centralized systems and bulk systems. Bulk systems have a lower percentage of food waste than centralized systems because they can keep freshly made food at the right temperature and keep the food warm, which will increase the patient's appetite. This finding underlines the importance of food presentation to overcome or reduce food waste in public hospitals, which is especially important to avoid environmental pollution.

Ultimately, a second high strong positive correlation ($r = 0.602$, $p < 0.001$) was identified between the portion of real food and food waste confirming the acceptance of H_3. The portion of food served in HRPZ II should meet the nutritional needs of hospitalized patients. Each patient has unique nutritional needs based on their medical condition, age, weight and recovery goals. Dietitians and nutritionists play an important role in designing meal plans that meet all the needs. Ensuring that food portions are adequate and balanced in terms of macronutrients (proteins, carbohydrates, and fats) and micronutrients (vitamins and minerals) is important for patient recovery. Overall, the mean score in Table 5 suggests that the food portion shows a good performance, but attention may be needed to ensure portion sizes are comparable to those in private healthcare facilities. According to Norshariza et al. (2019), patients may choose their menu options, but nutritionists are responsible for tailoring recommendations to meet individual needs. For example, patients with difficulty swallowing may require soft, liquid, or blended diets. These findings emphasize the importance of food portioning and presentation in minimizing food waste in public hospitals, as excessive waste contributes to significant financial losses. Properly designed meal plans and visually appealing presentations can help address this issue effectively.

This study utilized multiple regression analysis to examine the relationships between independent variables (food quality, food presentation, and food portion) and the dependent variable (food waste behaviour) among hospitalized patients at Hospital Raja Perempuan Zainab II. Hypotheses were formulated to determine the significance of these relationships, and the analysis yielded noteworthy results. With an R-value of 0.667, the findings indicate a strong relationship between the independent variables and the dependent variable. The R^2 value of 0.445 suggests that food quality, food presentation, and food portion collectively explain 44.5% of the variability in food waste behaviour among HRPZ II hospitalized patients. Additionally, a p-value of less than 0.001 in the ANOVA test confirms statistically significant differences between group means for quality, presentation, and portion, further validating the importance of these factors.

The coefficients in Table 10 provide further insights into the individual contributions of each independent variable. Notably, food presentation and food portion exhibit positive and significant effects, with beta values of 0.524 and 0.187, respectively, indicating that improvements in food presentation and adherence to portion sizes positively influence food waste behaviour among hospitalized patients. In contrast, food quality showed a weaker and negative correlation (beta = -0.025), suggesting a less significant role in predicting food waste behaviour in this context.

The overall model underscores the critical role of food presentation and portioning in predicting and reducing food waste behaviour among HRPZ II hospitalized patients. These findings have significant implications for developing targeted interventions and training programs, including leveraging social media to raise awareness among patients and the broader community about minimizing food waste.

5. Conclusion and Recommendations

In conclusion, food quality, presentation, and portion sizes are crucial factors that hospitals can address to enhance sustainability by minimizing the environmental impact associated with food production and the disposal of uneaten waste. Although food presentation has generally improved, there remains a gap in certain aspects, such as ensuring clear serving spaces and appealing visual presentation. Providing high-quality, visually appealing, and appropriately portioned meals can significantly reduce food waste, optimize resource use, and enhance patient satisfaction. Hospitals should continuously evaluate and refine their food service practices by incorporating patient feedback and adopting best practices in food preparation and presentation. The findings underscore the importance of implementing targeted training programs to standardize food quality and portioning. However, the study faced several limitations. First, the sample size: limited resources can make it challenging to collect a sufficiently large and representative sample of hospitalized patients. Collaborating with multiple hospitals could help gather a more diverse and robust sample. Second, reliance on self-reporting: patients may not always accurately report their food waste behaviours. Observational methods, where researchers or trained staff monitor and record food waste, could address this issue. This study is critical in ensuring patient satisfaction while tackling the pervasive issue of food waste disposal. It also opens avenues for further exploration of the long-term impact of educational initiatives and cultural influences on food preparation practices. Overall, the findings provide valuable insights for reducing food waste at Hospital Raja Perempuan Zainab II and promoting sustainable food service practices.

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