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Analysis Of Plate Waste And Food Cost Losses Among Inpatients At Madiun City Hospital

Analisis Sisa Makanan Dan Kerugian Biaya Makanan Pada Pasien Rawat Inap Di Rumah Sakit Kota Madiun

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ABSTRACT

Background: Plate waste is an important indicator of hospital food service quality because it reflects patient acceptance of meals and contributes to financial losses due to food waste. Plate waste exceeding 20% indicates inefficiencies in food service management and may adversely affect patients' nutritional intake. **Objective:** This study aimed to analyze plate waste in regular and soft diets and estimate food cost losses among inpatients at Madiun City Hospital. **Methods:** This was a prospective descriptive observational study. Plate waste was assessed using a six-point Comstock visual estimation method. Food cost losses were calculated based on standard recipes and actual food prices provided by the hospital's outsourced food supplier. The data were analyzed using descriptive statistics. **Results:** The average plate waste in soft diets (22.4%) was higher than that in regular diets (14.2%). The highest proportion of plate waste was observed in plant-based side dishes, accounting for 26.9% in regular diets and 41.1% in soft diets. Increased plate waste contributed to substantial food cost losses, with total losses amounting to Rp 2,860,109.72 for regular diets and Rp 1,750,065.40 for soft diets during a menu cycle. **Conclusion:** Soft diets generated a higher proportion of plate waste than regular diets. Plant-based side dishes contributed the largest proportion of plate waste in both diet groups. Regular evaluation of patient meal acceptance and menu modifications is necessary to improve food service quality and reduce financial losses associated with plate waste.

INTRODUCTION

Hospital Nutrition Services play an important role in supporting patient recovery by providing meals that meet individual nutritional requirements and medical conditions. Adequate nutritional intake helps maintain nutritional status, accelerate recovery, prevent complications, and improve the overall quality of health care services. As an integral component of patient care, hospital nutrition services encompass meal provision, nutrition counseling, and monitoring of patients' food intake to support the effectiveness of medical treatments. The level

of plate waste is one indicator of the effectiveness of hospital food service management. High levels of plate waste reflect poor patient acceptance of hospital meals and may lead to inadequate nutritional intake and inefficiencies in food service management. According to the Indonesian Ministry of Health, the acceptable standard for plate waste in hospitals is less than 20% (Kemenkes, 2013).

Various internal and external factors influence patients' food intake. Internal factors include appetite and clinical condition, whereas external factors include food quality characteristics such as appearance, taste,



texture, temperature, and food service factors, including staff service and meal delivery practices (Razalli et al., 2021). A mismatch between the meals provided and patients' preferences may increase plate waste. Therefore, plate waste is not only an indicator of patient satisfaction with hospital meals but also a reflection of the quality and effectiveness of hospital food service.

Plate waste is a significant concern in hospital food service management because of its nutritional and economic implications. Approximately 20–40% of hospital operational expenditures are allocated to food service activities, making plate waste a substantial source of financial loss (Kemenkes, 2013). Recent international evidence from hospital foodservice studies in Australia reported that a substantial proportion of food served to hospitalized patients is not consumed, with nearly half of total foodservice waste consisting of plate waste, indicating significant inefficiencies in hospital meal provision systems (Collins & Porter, 2023). In Indonesia, a study on soft diet patients at Ibnu Sina Padang Hospital found that food cost losses attributable to plate waste among patients receiving soft diets reached Rp108,250 during a single menu cycle (Ningsih, 2022). Similarly, a study at Dr. Cipto Mangunkusumo reported food cost losses of Rp286,550.32 per menu cycle among patients receiving soft diets, with vegetables and staple foods contributing the largest proportion of waste (Dewi & Djokosujono, 2022).

Madiun City Hospital is a type C public hospital that provides inpatient healthcare services to residents of Madiun City and surrounding areas. Preliminary observations conducted on November 13, 2024, among 10 inpatients revealed an average plate waste of 29.6%, exceeding the Ministry of Health's standard of $\leq 20\%$. Despite the potential nutritional and economic consequences of plate waste, no study has specifically examined food cost losses associated with plate waste at Madiun City Hospital. Therefore, this study aimed to analyze plate waste and estimate food cost losses among inpatients at Madiun City Hospital as a basis for evaluating and

improving the quality and efficiency of hospital nutrition service.

METHODS

This study employed a prospective descriptive observational design. Data were collected prospectively over one complete hospital menu cycle for 10 consecutive days, from June 2 to June 11, 2025. This study was conducted at the Madiun City Hospital, in Madiun City, East Java, Indonesia. This study was designed to describe plate waste and food cost losses among inpatients without any intervention on the study variables.

The study population consisted of all inpatients admitted to class I, II, III, and VIP wards at Madiun City Hospital, with an average daily census of approximately 80. Participants were selected using purposive sampling based on predetermined inclusion and exclusion criteria, resulting in an average of 46 eligible patients daily. The inclusion criteria were male and female patients aged 18–59 years who received regular, soft, or high-energy high-protein (HEHP) diets, and did not have chewing or swallowing difficulties. For analytical purposes, patients receiving HEHP diets with regular food texture were classified into the regular diet group, whereas those receiving HEHP diets with soft food texture were classified into the soft diet group. The exclusion criteria included unconscious patients, patients receiving therapeutic diets other than HEHP diets, patients on liquid diets, and patients who were fasting.

Plate waste was assessed using a six-point Comstock visual estimation method. The assessment categories were converted into percentage values as follows: score 0 = 0% food remaining (completely consumed), score 1 = 25% food remaining, score 2 = 50% food remaining, score 3 = 75% food remaining, score 4 = 95% food remaining, and score 5 = 100% food remaining (not consumed). Digital scales were used to determine standard portion weights, and standard recipes and food price data were obtained from the hospital nutrition department and outsourced food suppliers.

Primary data were collected through direct observation of the patients' plate waste



using the Comstock visual estimation method. Secondary data were obtained from hospital records, including patient characteristics, menu cycles, standard recipes, and food price information.

Food cost losses were calculated by identifying the ingredients used in each menu item based on standard recipes and determining their costs using actual food prices. The percentage of plate waste for each menu item was obtained from the Comstock assessment results. Food cost losses were estimated by multiplying the percentage of plate waste by the food cost of each menu item. An additional seasoning cost equivalent to 10% of the wasted food cost was included in the calculation. The resulting values were multiplied by the number of patients at each mealtime and summed across the menu cycle to obtain the total food cost loss.

Data were analyzed using descriptive univariate statistics and presented as frequencies, percentages, and mean values. The analysis was conducted to describe the proportion of plate waste and estimated food cost losses among inpatients at Madiun City Hospital.

RESULTS AND DISCUSSION

This study involved 460 inpatient meal observations at Madiun City Hospital, including 285 observations of patients receiving regular diets and 175 observations of patients receiving soft diets. Data were collected over a 10-day menu cycle. This study aimed to describe the proportion of plate waste and estimate the food cost losses associated with patient food waste.

Plate Waste in Regular and Soft Diets

Table 1. Average Plate Waste Over a Menu Cycle

Food Group	Regular Food (%)	Soft Food (%)
Staple Foods	21.4	24.7
Animal Side Dishes	8.5	22.8
Plant-based Side Dishes	26.9	41.1
Vegetables	19.5	29.1
Fruit	3.9	4.2
Total Average	14.2	22.4

The results presented in Table 1 indicate that the average plate waste in regular diets

was 14.2%, which was below the maximum acceptable standard of 20% established by the Indonesian Ministry of Health (Kemenkes RI, 2018). This finding suggests that patient acceptance of regular diets at Madiun City Hospital was generally satisfactory and that the hospital food service met the recommended standards for plate waste. In contrast, the average plate waste of soft diet was reached 22.4%, exceeding the recommended threshold. This finding indicates that patient acceptance of soft diets was less favorable and highlights the need for improvements in menu planning and food preparation practices for patients on soft diets.

Plate waste remains a common issue in hospital foodservice systems and is influenced by both patient-related and diet-related factors. Previous studies in Indonesian hospital foodservice settings have reported that patients receiving soft diets tend to generate higher plate waste, which is influenced by patients' clinical conditions and food-related factors such as taste, texture, and appearance (Handayani & Srimati, 2021). Patients prescribed soft diets often experience digestive disorders, postoperative conditions, swallowing difficulties, or reduced appetite, which may limit food consumption (Andhini, 2024). In addition, the texture-modified nature of soft diets may reduce their visual appeal and palatability, thereby decreasing patient acceptance (Putri, 2024). Compared with regular diets, soft diets generally offer less variation in texture and appearance, which may contribute to lower consumption.

Among all food groups, plant-based side dishes exhibited the highest percentage of plate waste, accounting for 26.9% in regular diets and 41.1% in soft diets. This finding indicates that plant-based side dishes had the lowest level of patient acceptance compared with other menu items. One possible explanation is the limited variety of ingredients commonly used in hospital food services, particularly tofu and tempeh, which are frequently served as sources of plant-based protein. The repeated use of similar ingredients throughout the menu cycle may lead to menu fatigue and reduced patient



interest in consuming these foods (Fadilla & Rachmah, 2020).

In addition to the limited variation in ingredients, food preparation methods may also influence patient acceptance. Plant-based side dishes are commonly prepared using similar cooking techniques, such as frying, sauteing, or boiling, which may result in repetitive flavors and textures. Consequently, patients may become less interested in consuming these foods. This issue may be more pronounced in soft diets, where texture modification is necessary to accommodate patients' medical conditions. The softening process can alter the original texture and flavor characteristics of foods, making them less appealing to patients (Mardianingsih et al., 2020). Furthermore, foods with more favorable taste characteristics tend to be better accepted by patients, whereas foods perceived as less palatable are more likely to be left uneaten (Saufani et al., 2024). Plant-based side dishes in soft diets are typically prepared using non-frying methods to ensure they are easy to chew, swallow, and digest (Rachmawati, 2020).

Staple foods also showed relatively high levels of plate waste, accounting for 21.4% in regular diets and 24.7% in soft diets. These values exceeded the overall average plate waste in both diet groups. Several factors may contribute to this finding, including large portion sizes and declines in food quality during distribution. Rice, which serves as the primary staple food, may experience changes in temperature and texture before consumption, affecting its palatability. Inappropriate food temperature has been reported to decrease food consumption among hospitalized patients (Paramita & Sulistya Kusuma, 2020). In addition, reduced appetite associated with illness may further limit patients' ability to consume the portions served (Kemenkes, 2013).

The vegetable group also demonstrated relatively high plate waste, reaching 19.5% in regular diets and 29.1% in soft diets. This finding may be associated with changes in the sensory characteristics of vegetables during cooking and serving. Prolonged cooking and texture modification may reduce the visual

appeal and acceptability of vegetables, while food appearance has been shown to significantly influence plate waste among hospitalized patients (Budianingsih et al., 2024). Similar findings were reported by Ningsih (2022), who observed relatively high vegetable waste among hospitalized patients.

Animal side dishes contributed 22.8% plate waste in soft diets. These foods are frequently prepared by boiling or steaming in texture-modified menus, which may reduce flavor intensity and overall palatability. Previous research by Lestari et al. (2023) also demonstrated that cooking methods significantly influence patient acceptance of animal side dishes, particularly soft diets that are often perceived as bland.

In contrast, fruit showed the lowest proportion of plate waste in both diet groups, accounting for 3.9% in regular diets and 4.2% in soft diet. This finding suggests that fruit is one of the most acceptable menu components among hospitalized patients. Fruits are generally served fresh and require minimal processing, allowing the preservation of their natural taste, texture, and appearance. Similar findings were reported by Dewi & Djokosujono (2022), who found that fruit generated lower levels of plate waste than other food groups because of its higher acceptability among patients.

Beyond food-related factors, the higher level of plate waste observed among patients receiving soft diets may also be influenced by clinical conditions. Patients prescribed soft diets often experience clinical conditions such as dysphagia, gastrointestinal disorders, postoperative recovery, nausea, fatigue, and poor appetite, which may reduce food intake and increase plate waste during hospitalization (Manimaran et al., 2023). In addition, certain medications administered during hospitalization may affect appetite and food preferences, further contributing to food waste.

From a clinical nutrition perspective, excessive plate waste may hinder the achievement of adequate nutritional intake in hospitalized patients. Sufficient energy and nutrient intakes are essential for supporting



recovery and maintaining nutritional status during hospitalization. When patients do not consume the meals provided, their nutritional requirements may not be met, potentially delaying recovery and increasing the risk of malnutrition. Therefore, plate waste should be considered not only an indicator of food service performance but also an important measure of the effectiveness of nutritional care provided to hospitalized patients.

Food Cost Losses

Table 2. Total Food Cost Losses During a Menu Cycle

Food Group	Regular Food (Rp)	Soft Food (Rp)
Staple Foods	602,070.00	133,728.00
Animal Side Dishes	874,915.58	835,770.76
Plant-based Side Dishes	651,593.93	415,442.28
Vegetables	621,930.21	331,724.36
Fruit	109,600.00	33,400.00
Total	2,860,109.72	1,750,065.40

In addition to affecting patients' nutritional intake, plate waste has important economic implications for hospital food service management. The findings of this study showed that the total estimated food cost losses during one menu cycle amounted to Rp. 2,860,109.72 for regular diets and Rp. 1,750,065.40 for soft diet. Although the percentage of plate waste was higher in soft diets, the total financial loss was greater in regular diets. This difference may be attributed to the higher cost of food ingredients used in regular diets and the larger number of patients receiving regular diets than soft diets.

Among all food groups, animal side dishes contributed the largest proportion of food cost losses in both diet groups. Animal-based food items such as meat, chicken, eggs, and fish generally have higher market prices than other food items. Consequently, even a relatively low percentage of plate waste can result in substantial financial losses. In regular diets, for example, animal side dishes accounted for only 8.5% plate waste but generated the highest food cost loss among all food groups. This finding demonstrates that financial losses associated with plate waste are influenced not only by the amount of food discarded but also by the economic value of the served food items. Similar observations have

been reported by Tagoe (2022), who emphasized that the economic impact of food waste is strongly affected by food prices and the portion sizes.

Vegetable and plant-based side dishes also contributed considerably to overall food cost losses. These findings indicate that a substantial proportion of menu items were not consumed by patients. Several factors may explain this situation, including unfavorable texture, taste preferences, limited menu variation, and patients' clinical conditions. Reduced appetite, nausea, digestive discomfort, and other illness-related factors may decrease patients' willingness to consume vegetables and plant-based side dishes (Miranda, 2022). Furthermore, the high financial losses associated with plant-based side dishes are consistent with plate waste findings, which identified this food group as having the highest percentage of leftovers. The limited variation in ingredients and preparation methods may contribute to patient boredom and reduced acceptance of these menu items.

Staple foods also generated considerable food cost losses because they were served at every meal. Leftover staple food may result from portion sizes that exceed patients' consumption capacity or from reductions in food quality during distribution and service. Changes in temperature and texture may decrease the palatability of staple foods, resulting in lower consumption and increased waste.

In contrast, fruits generated the lowest food cost loss among all food groups. This finding suggests that fruits are the most acceptable menu components for hospitalized patients. Fruits are generally characterized by their fresh taste, attractive appearance, and ease of consumption, making them more likely to be completely consumed. In addition, fruits require minimal processing, which helps maintain their sensory quality during serving (Nabila et al., 2025). Similar patterns have been observed in hospital foodservice in Indonesia, where fruits are among the most fully consumed food items due to their high acceptability and sensory characteristics (Rochmah et al., 2020).



From a hospital food service management perspective, food cost losses resulting from plate waste represent a form of avoidable resource inefficiency. If these losses are accumulated over a longer period, such as one year, the resulting financial burden may become substantial and affect the efficiency of hospital budget allocations. Therefore, reducing plate waste should be considered an important strategy for improving service quality and cost efficiency.

Collaboration among dietitians, food service personnel, and nursing staff is essential for monitoring patients' food consumption and identifying factors contributing to low meal acceptance. Routine monitoring of plate waste can serve as an important quality indicator for hospital nutritional services. Through regular evaluation of plate waste and continuous improvement of menu planning and food service practices, hospitals can enhance patient satisfaction, optimize nutritional intake, and minimize financial losses associated with food waste.

Overall, the findings of this study demonstrate that plate waste affects not only patients' nutritional adequacy but also the economic efficiency of hospital food service operations. Therefore, continuous monitoring of plate waste and periodic evaluation of hospital menus are necessary to improve the quality of nutrition services and reduce food cost losses.

CONCLUSIONS

The findings of this study indicate that plate waste among inpatients at Madiun City Hospital differed according to diet type. The average plate waste in regular diets was 14.2%, which was below the maximum acceptable standard of 20%, whereas plate waste in soft diets reached 22.4%, exceeding the recommended threshold. Plant-based side dishes contributed the highest proportion of plate waste in both dietary groups, indicating relatively low patient acceptance of these menu items.

Plate waste also results in substantial food cost losses. During one complete menu

cycle, the total food cost losses amounted to Rp 2,860,109.72 for regular diets and Rp 1,750,065.40 for soft diets. Animal side dishes contributed the largest proportion of food cost loss because of their relatively high economic value.

These findings highlight the importance of routinely monitoring plate waste as an indicator of both patient meal acceptance and the efficiency of hospital food services management. Improvements in menu planning, food preparation, and meal presentation, particularly for soft diets and plant-based side dishes, may help reduce plate waste, improve nutritional intake, and minimize food cost losses.

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