Evaluation of Food Waste in the Nutrition Installation at PKU Muhammadiyah Gamping Yogyakarta Hospital

by Maria Ulfa

Submission date: 13-Jun-2025 12:58PM (UTC+0700)
Submission ID: 2698155994
File name: 71214-242292-5-ED.docx (95.47K)
Word count: 5217
Character count: 33554

Evaluation of Food Waste in the Nutrition Installation at PKU Muhammadiyah Gamping Yogyakarta Hospital

A'ida Hana Yumna[1], Maria Ulfa[1,2*], Nurul Huda Razalli[3], Roslee Rajikan[3], Nesrin Akca[4], Meltem Saygili[4]

[1] School of Medicine, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Jl. Brawijaya, Kasihan, Bantul, Yogyakarta, 55183, Indonesia
[2] Master of Hospital Administration, Postgraduate Program, Universitas Muhammadiyah Yogyakarta, Jl. Brawijaya, Kasihan, Bantul, Yogyakarta, 55183, Indonesia
[3] Dietetic Program, Center for Healthy Ageing and Wellbeing, Faculty of Health Sciences, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia
[4] Department of Health Management, Faculty of Health Sciences, Kirikkale University, Yenişehir, Ankara Cd. 7. Km, 71450, Yahşihan/Kırıkkale, Türkiye
*Corresponding author: mariaulfa@umy.ac.id

ABSTRAK

Judul: Evaluasi Limbah Makanan di Instalasi Gizi di RS PKU Muhammadiyah Gamping Yogyakarta, Indonesia

Latar Belakang: Limbah makanan rumah sakit berdampak signifikan pada biaya operasional, keberlanjutan lingkungan, dan kualitas perawatan pasien. Limbah makanan berkontribusi terhadap jejak ekologi global dan muncul dari berbagai faktor seperti kepuasan pasien terhadap makanan, keragaman menu, dan kontrol porsi. Penelitian ini mengevaluasi limbah makanan yang dihasilkan oleh pasien rawat inap di Rumah Sakit PKU Muhammadiyah Gamping Yogyakarta dan bertujuan untuk mengidentifikasi faktor-faktor yang memengaruhi limbah makanan untuk mengembangkan strategi pengurangan yang efektif.

Metode: Dengan menggunakan metodologi penelitian kuantitatif, penelitian ini difokuskan pada 50% sampel dari kapasitas tempat tidur rumah sakit, yang melibatkan 127 pasien. Data tentang limbah makanan pasien dikumpulkan melalui pengukuran langsung pada tiga interval: jumlah makanan yang disajikan, limbah yang dihasilkan di dapur, dan sisa makanan di piring pasien. Berat badan dicatat dengan cermat untuk pasien yang memenuhi syarat selama penelitian. Data yang dikumpulkan dianalisis menggunakan *Statistical Package for the Social Sciences* (SPSS) untuk menentukan pola konsumsi dan mengukur total limbah makanan per makanan.

Hasil: Temuan penelitian mengungkapkan bahwa sebagian besar limbah makanan terjadi selama makan malam (30.643 kg), melebihi limbah selama makan siang dan sarapan. Rata-rata, 84,23 kg makanan dibuang setiap hari, dengan 75% (n=227) pasien memilih untuk tidak mengonsumsi makanan mereka. Faktor-faktor yang berkontribusi meliputi ukuran porsi yang tidak tepat, pilihan menu yang tidak menarik, dan gangguan dalam aktivitas pasien yang memengaruhi waktu makan.

Kesimpulan: Penelitian ini menyoroti volume sampah makanan yang signifikan di antara pasien rawat inap rumah sakit, yang terutama disebabkan oleh selera makan, variasi menu, dan kualitas makanan. Temuan tersebut menekankan perlunya ukuran porsi yang dioptimalkan, penawaran menu yang beragam, dan strategi distribusi makanan yang lebih baik dalam layanan gizi rumah sakit. Peningkatan di area ini diantisipasi akan menghasilkan pengurangan sampah makanan, biaya operasional yang lebih rendah, dan mendukung inisiatif keberlanjutan lingkungan.

Kata kunci: Sampah Makanan; Kepuasan Pasien; Variasi Menu; Rumah Sakit; Manajemen Makanan

ABSTRACT

Title: Evaluation of Food Waste in the Nutrition Installation at PKU Muhammadiyah Gamping Yogyakarta Hospital

Background*: Hospital food waste significantly impacts operational costs, environmental sustainability, and patient care quality. It contributes to the global ecological footprint and arises from multifaceted factors such as patient meal satisfaction, menu diversity, and portion control. This study evaluates food waste generated by inpatients at PKU Muhammadiyah Gamping Yogyakarta Hospital and aims to identify factors influencing food waste to develop effective reduction strategies.*

Methods*: Employing a quantitative research methodology, the study focused on a sample representing 50% of the hospital's bed capacity, involving 127 patients. Data on patient meal waste were collected through direct measurements across three intervals: the quantity of food served, waste generated in the kitchen, and food*

remaining on patient plates. Weights were meticulously recorded for eligible patients throughout the study. The collected data were analysed using the Statistical Package for the Social Sciences (SPSS) to determine consumption patterns and quantify total food waste per meal.
***Results**: Findings reveal that most of the food waste occurred during dinner (30.643 kg), surpassing waste during lunch and breakfast. On average, 84.23 kg of food was discarded daily, with 75% (n=227) of patients opting not to consume their meals. Contributing factors included inappropriate portion sizes, unappealing menu selections, and interruptions in patient activities affecting mealtime.*
***Conclusion**: This research highlights a significant volume of food waste among hospital inpatients, primarily driven by appetite, menu variety, and food quality. The findings emphasise the necessity for optimised portion sizes, diversified menu offerings, and improved meal distribution strategies within hospital nutritional services. Enhancements in these areas are anticipated to yield reductions in food waste, lower operational costs, and bolster environmental sustainability initiatives.*

Keywords**: **Food Waste; Patient Satisfaction; Menu Variety; Hospital; Food Management

INTRODUCTION

In recent years, the issue of food waste has gained significant attention. Food waste is the most significant contributor to the global environmental footprint, accounting for 10% of emissions.[1] The three dimensions of sustainability, environmental, economic, and social, are closely linked to food waste.[2] Reducing food waste will alleviate the financial strain on the already limited healthcare sector. If patient satisfaction and food intake are improved, addressing malnutrition will also contribute to social sustainability.[3,4] Malnutrition is a common problem in hospitals worldwide and has been associated with increased morbidity and mortality, costs, and extended hospital stays.[5] Therefore, reducing food waste in hospitals has many benefits from a sustainability perspective. The end-of-consumer food supply chain, encompassing households, the food service industry, and the retail sector, is responsible for 22% of the approximately 1.3 billion tonnes of food waste generated globally annually.[6] Governments, environmental groups and global leaders have committed to reduce food waste and diverting waste from landfills to address this issue.[7]

Hospitals are places where food waste often occurs, so it is essential to develop strategies to manage it. Food waste in some healthcare facilities accounts for up to 50% of total waste. This includes edible food (e.g., leftovers) and inedible organic materials (e.g., bones, and vegetable peels).[8] Food waste in hospitals occurs for a variety of reasons.[9] Patient-related factors include health status, length of stay, appetite, expectations, and food quality and quantity satisfaction. The appearance, portion size, taste, and variety of menu choices are also important. However, several challenges exist within the food service model.[10] These include difficulty accommodating therapeutic diets, ingredient variability due to seasons, and difficulty predicting food quantities. Additionally, limitations in food service design can lead to delays between ordering and consumption and frequent provision of excess or incorrect items. These issues can significantly impact patient satisfaction and the overall dining experience. In addition, food waste is also influenced by the hospital environment itself due to the disruption of services and the patient environment, which has an impact on food intake.[11]

Food waste can occur at any stage of the food service system, including storage, preparation, cooking, and serving. Nevertheless, the most significant losses typically happen at the final stage: the point of consumption. Measuring food waste—defined as food that is served but not consumed—provides valuable feedback on meal acceptability. This information can guide menu adjustments and monitor dietary adequacy. Plate waste is consistently higher in hospitals than in other food service sectors. While restaurants, cafes, schools, and workplace canteens generally maintain plate waste levels of less than 15%, hospitals often experience plate waste that is two to three times greater.[12] Based on the explanation above, information and research results regarding evaluating patient food waste have not been widely found in Indonesia. Therefore, this study aims to assess food waste produced by hospital inpatients, especially teaching hospitals in Yogyakarta, Indonesia.

METODE

Study Design

This research utilises a quantitative research design, concentrating on the meticulous process of weighing and evaluating patients' meal trays before and after their distribution. The study adheres strictly to the procedures outlined by the European Commission Standard (2019), ensuring a comprehensive and systematic approach. Conducted at RS PKU Muhammadiyah Gamping in Yogyakarta, the research spanned a period from February to June 2024, aiming to assess the nutritional adequacy and compliance of meal provisions within the healthcare setting.

Participants

The study included 50% of the total bed capacity at the PKU Muhammadiyah Hospital in Gamping, Yogyakarta, which has 225 beds. The meal tray weighing focused on Class III patients who met the inclusion criteria. The inclusion criteria were: aged 18 years or older, hospitalised for at least two days, undergoing a regular or therapeutic diet, and able to eat independently while fully conscious. The exclusion criteria included patients receiving nutrition via a Ryle's tube, parenteral nutrition, or those with a "nil by mouth" (NBM) status; patients with mental disorders or in critical condition; and patients on modified texture diets.

Data Source Measures

In this study, we implemented a visual estimation method using a percentage scale to evaluate the amount of food waste generated after the distribution of soup trays. Each working day, we meticulously assessed the food waste produced. To accurately measure this waste, we employed an electronic kitchen scale (Jata 722P, Portugal), which has a maximum capacity of 5 kg and offers precise measurements up to 0.1 grams. This approach allowed us to quantify the food waste in grams, providing a detailed insight into the effectiveness of our food distribution methods.

Ethical Consideration

This study has received ethical approval from the Ethics Committee of the Universitas 'Aisyiyah Yogyakarta (No. 3410/KEP-UNISA/I/2024) and the RS PKU Muhammadiyah Gamping Yogyakarta Ethics Committee (No. 030/KEP-PKU/I/2024), along with research permission from RS PKU Muhammadiyah Gamping Yogyakarta (No. 0289/PI.24.2/II/2024).

RESULT AND DISCUSSION

RS PKU Muhammadiyah Gamping Yogyakarta is a private hospital in the Special Region of Yogyakarta and operates under the Muhammadiyah organisation. As an Islamic-based healthcare facility, RS PKU Muhammadiyah Gamping is dedicated to delivering high-quality medical services while adhering to Islamic values. The hospital also functions as a teaching institution, collaborating with the University of Muhammadiyah Yogyakarta (UMY) to provide resources for skill and knowledge development for medical students and healthcare professionals. With approximately 225 beds available across various wards, the hospital participated in a study involving 127 patients, all meeting the established inclusion and exclusion criteria. This research was conducted between January and July 2024.

Table 1. The Average Food Portions Served to Inpatients at PKU Muhammadiyah Gamping Hospital

DAY	BREAKFAST/LUNCH/DINNER		
	Breakfast (Gr/Portion)	Lunch (Gr/Portion)	Dinner (Gr/Portion)
I	414	321	380
II	379	357	459
III	360	396	394
IV	368	405	398
V	396	346	365
VI	385	352	383
VII	370	335	404
VIII	405	335	332
IX	410	403	377
X	354	318	354
X	354	318	354
Average	**378**	**354**	**385**

In Table 1, the average food portions served to inpatients at PKU Muhammadiyah Gamping Hospital are detailed as follows: 378 grams for breakfast, 354 grams for lunch, and 385 grams for dinner. This study measured food waste at three distinct points during data collection. Initially, we weighed the food plates to determine the weight of each prepared menu item, which is presented in Table 1 as the total food produced. After the food was served to the patients, we weighed the remaining food in the kitchen pan before disposal, categorising this as residual waste. Lastly, the dirty plates from the patients were returned to the kitchen or washing area, where any uneaten food was collected and weighed; this is referred to as plate waste. Total food waste was calculated by summing the amounts of leftovers and plate waste. All food measurements were recorded in grams.

Table 2. The Average Food Production, Serving, Consumption, and Waste by Meal Period

	Food Produced (gr)	Served Food (gr)	Leftover Waste (gr)	Plate Waste (gr)	Food Consumed (gr)	Total Waste (gr)

	mean	mean	mean	mean	mean	mean
Breakfast	**378**	**378**	**24945**	**247**	**131**	**25192**
Lunch	**354**	**354**	**27983**	**240**	**114**	**28223**
Dinner	**385**	**385**	**30384**	**259**	**126**	**30643**

Table 2 displays the results of calculations related to average food production, food served, food waste, waste on plates, food consumed, and total waste for each meal period: breakfast, lunch, and dinner. This data provides valuable insights into consumption patterns and the waste generated during mealtime, which is essential for formulating more efficient and effective food management strategies.

According to Table 2, as many as 141,859 kg of food was produced for patients in a single day. The meal portions per patient were 378 grams for breakfast, 354 grams for lunch, and 285 grams for dinner. Conversely, the amount of unserved food totalled 83,312 kg per day, distributed as follows: approximately 66 patients consumed 24,945 kg for breakfast, around 80 patients consumed 27,983 kilograms of lunch, and about 79 patients consumed 30,384 kilograms for dinner. The highest unserved food waste and patient leftovers were observed during dinner. Specifically, patients consumed only 126 grams of food each during dinner, underscoring a significant gap between the food served and consumed.

The portion sizes of meals served to hospital patients are critically important in meeting their nutritional requirements, supporting the healing process and enhancing the overall quality of care provided. At PKU Muhammadiyah Gamping Hospital, a comprehensive analysis of meal services revealed that average portion sizes varied significantly by mealtime: breakfast averaged 378 grams, lunch averaged 354 grams, and dinner averaged 385 grams. These variations in portion sizes warrant a thorough examination of established hospital nutrition standards. It is crucial to consider individual patient energy needs, which can differ widely based on age, sex, activity level, and specific medical conditions. For instance, patients recovering from surgery may require a different caloric intake than those with chronic illnesses or rehabilitation.[13] Additionally, medical conditions such as diabetes, heart disease, or dietary restrictions may necessitate further portion sizes and nutritional content adjustments.[13,14] Understanding these factors is essential to ensure that all patients receive meals that meet their energy requirements and effectively support their unique health needs throughout their hospital stay.

Nutritional Needs and Portion Adjustments

Hospitalised patients require adequate nutrition to facilitate their recovery, encompassing essential macronutrients such as energy, proteins, fats, carbohydrates, and vitamins and minerals.[13] The adequacy of these nutrients is closely tied to the patient's nutritional status and the therapeutic objectives set by healthcare providers. Therefore, effective portion control is crucial, especially for individuals facing specific conditions such as malnutrition or obesity, as these factors can significantly influence recovery outcomes. For instance, patients with chronic illnesses, including diabetes or cardiovascular disease, may need adjusted portion sizes to accommodate their altered metabolic requirements and associated medical treatments.[9] Consequently, the nutritional composition of hospital meals should be customised to reflect the patient's medical condition and dietary preferences.

In hospital settings, it is a common practice to serve lighter meals in the morning, which may reflect established protocols or the generally reduced appetite of patients during the early hours.[12] Conversely, more significant portions are typically provided for lunch and dinner to address the increased energy demands later in the day. However, this general approach necessitates more nuanced adjustments based on individual patient health status, daily energy expenditure, and specific nutritional needs.[15,16] This methodology aligns with national dietary guidelines, such as those from the Ministry of Health of the Republic of Indonesia, which recommend proportionate calorie distribution among the day's three main meals tailored to each patient's energy requirements.

Food Waste and the Mismatch Between Portion Sizes and Patient Needs

The issue of food waste within the healthcare sector, particularly in hospitals, is a paramount concern that necessitates critical attention from healthcare providers and management. The study in three hospitals at Victoria, Australia report an alarming rate of food waste in hospital settings, indicating that as much as 45% can be attributed to patients leaving food uneaten on their plates.[8] This statistic underscores a significant disjunction between the portion sizes of food served and the actual consumption behaviours of patients. Hospitals frequently depend on standardised meal portions that fail to accommodate individual patients' diverse dietary needs and preferences, contributing to considerable food waste.[17–19] This disconnection can also be linked to the inadequacy of personalised meal planning. Many hospital meal programs do not sufficiently account for specific dietary requirements, medical conditions, or individual taste preferences—all crucial factors significantly influencing appetite and food choices. For instance, patients recovering from surgical procedures may possess distinct

nutritional needs and appetite levels compared to those receiving treatment for chronic illnesses. Neglecting these complexities can result in well-meaning meal programs that inadvertently exacerbate food waste.

To tackle this issue effectively, integrating information technology and data analytics into hospital meal planning emerges as a promising strategic solution. Advanced systems capable of tracking and analysing patients' food consumption patterns can yield valuable insights into individual preferences and nutritional requirements.[20,21] By leveraging this data, hospitals can dynamically adjust portion sizes and meal offerings to align more closely with consumption trends. The data-driven methodologies can significantly mitigate food waste while enhancing patient satisfaction.[1] Moreover, adopting these technological innovations may yield substantial operational cost savings. By reducing the overproduction of food—ensuring that meal provisions are neither excessive nor insufficient—hospitals can optimise their food service operations.[17,22] This approach conserves valuable resources and fosters a more sustainable model of hospital food management. In summary, addressing the challenge of food waste through personalised meal planning and integrating advanced technology can enhance the quality of patient care and facilitate the efficient utilisation of hospital resources.

Patient Satisfaction and its Correlation with Food Consumption and Waste

Extensive research has established a significant link between patient satisfaction with food quality, overall food consumption, and waste reduction in healthcare settings. A pivotal study in New Zealand revealed a noteworthy positive correlation between patients' satisfaction with the quality of the food provided and the level of food waste generated.[14] Within hospitals, prioritising and enhancing patient satisfaction with meals emerges as an essential strategy for improving the patient experience and minimising leftover food.[23,24] When patients enjoy their meals and find them satisfying, they are far more likely to consume what is served. This increased consumption reduces food waste and ensures patients receive the vital nutrients necessary for their recovery and well-being.

Hospitals are encouraged to implement systematic feedback mechanisms, such as satisfaction surveys, to cater to patients' dietary preferences and enhance meal satisfaction. These surveys can offer valuable insights into patient tastes and preferences. A recent study highlighted the importance of customising menu options to reflect diverse cultural preferences and dietary restrictions, significantly enhancing patient food intake.[10] Furthermore, by tailoring food choices to address specific medical conditions—such as offering soft-textured diets for individuals with swallowing difficulties—hospitals can achieve dual benefits: improved food consumption rates and positive outcomes for patient health.[25,26] This comprehensive approach addresses the practical aspects of meal service and fosters a nurturing environment conducive to patient healing and satisfaction.

Technological Innovations and Waste Reduction Strategies

Hospitals stand to gain significantly from technological innovations to reduce food waste, a pressing issue within the healthcare sector. One practical approach involves using predictive algorithms and advanced food distribution systems, which enable hospitals to accurately forecast the specific quantities of food needed for each meal service.[27,28] By analysing a range of factors—including historical consumption data, patient demographics, dietary restrictions, and clinical conditions—hospitals can optimise their food inventories to align with actual demand rather than relying on approximations that often lead to excess waste. In addition, sophisticated technologies like innovative waste tracking systems allow for real-time monitoring of food waste levels in hospital kitchens and dining areas.[29] These systems provide valuable insights into food waste patterns, pinpointing areas where waste occurs most frequently and under what circumstances. With this information, hospital administrators and nutrition services can implement targeted corrective actions, such as adjusting meal preparations or refining food storage and handling practices, to minimise waste effectively.

Moreover, embracing a comprehensive, data-driven approach to food waste management can significantly enhance the sustainability of hospital food systems. This improves operational efficiency and aligns with broader environmental sustainability goals, which have become increasingly relevant today. Reducing food waste in healthcare settings is crucial for promoting environmental sustainability.[2] Since hospitals are among the most significant food consumers, their waste contributes notably to greenhouse gas emissions and landfill overflow. Therefore, developing and implementing proactive waste reduction strategies is essential for lowering the carbon footprint of healthcare institutions.[30–32] These initiatives benefit the environment and enable hospitals to operate more responsibly and efficiently, ultimately enhancing their service to patients and the community.

Staff Training and Stakeholder Involvement

To effectively implement waste reduction and portion management strategies in hospitals, it is essential to provide comprehensive training for all staff engaged in food service. This training should target nutritionists, chefs, and food service personnel, ensuring they thoroughly understand efficient food management practices. These practices encompass a range of techniques, such as accurately adjusting portion sizes according to individual patient needs, closely monitoring food intake, and employing effective portion control measures to minimise waste. Additionally, training programs should stress the importance of recognising and accommodating

the diverse dietary requirements of patients. This includes medical needs, such as allergies, specific dietary restrictions, personal preferences, and cultural considerations.[33,34] By aligning food options with patients' tastes and nutritional needs, hospitals can enhance overall patient satisfaction while simultaneously working to reduce food waste.

Key stakeholders, including food service providers, manufacturers, and suppliers, are crucial to a hospital's effective food procurement strategies. Close collaboration between these partners and hospital staff is essential to ensure that food supplies are tailored to meet the specific demands of the hospital's patient population.[35–37] This proactive approach helps mitigate the risks of overstocking and minimise instances of food waste. Moreover, fostering strong collaborative relationships between hospitals and food suppliers can improve food sourcing and more effective inventory management. By sharing data on patient consumption patterns and food preferences, hospitals can make informed decisions regarding their food purchasing strategies.[38] This significantly contributes to waste reduction efforts and ensures patients receive fresh, appealing meals that meet their nutritional needs. A comprehensive strategy that includes training, collaboration, and data-driven decision-making is vital for reducing waste in hospital food services.

Regulatory Framework and Future Directions

Regulators, including health authorities and local governments, should comprehensively revise national guidelines to ensure they are adaptable and responsive to the diverse needs of patients across various demographics and medical conditions. This revision process should include thorough consultations with healthcare professionals, patients, and community organisations to identify specific areas for improvement. Regular inspections and detailed monitoring of hospital food management practices are essential to ensure compliance with these guidelines.[39] These evaluations should assess adherence and offer actionable feedback to help hospitals enhance their food management systems. This includes examining food sourcing, preparation methods, and waste disposal practices to identify opportunities for improvement. Furthermore, establishing a robust system of incentives for hospitals that significantly reduce food waste can promote a culture of sustainability within healthcare facilities.[19,22] Incentives may include financial subsidies for implementing advanced technology to reduce waste and support obtaining sustainability certifications, which recognise hospitals' efforts in environmental stewardship.

Additionally, launching public awareness campaigns specifically focused on reducing food waste in the healthcare sector is crucial. These campaigns should aim to educate the community about the environmental consequences of food waste while providing practical strategies for patients, staff, and hospital administrators to adopt more sustainable practices.[40–42] Educational workshops, informative materials, and interactive programs can engage the community and foster collaborative efforts toward waste reduction in healthcare settings. By implementing these interconnected initiatives, we can create a more sustainable healthcare system that addresses patients' health needs, prioritises environmental responsibility, and encourages community involvement.

CONCLUSION

The effective management of food portions in hospitals is essential not only to fulfil the nutritional needs of patients but also to minimise food waste and enhance operational efficiency. By harnessing patient consumption data, embracing technological innovations, and collaborating with stakeholders, hospital managers can improve their food distribution systems, reduce waste, and elevate the overall quality of healthcare services. These strategies align with broader sustainability objectives, ensuring hospitals deliver high-quality care while lowering environmental impact. As such, they must continue to innovate and implement best practices in managing food portions and waste, ultimately leading to better patient outcomes and decreased operational costs.

REFERENCES

1. Eriksson M, Malefors C, Bergström P, Eriksson E, Osowski CP. Quantities and quantification methodologies of food waste in Swedish hospitals. Sustainability (Switzerland). 2020;12(8):1–12; https://doi.org/10.3390/su12083116.

2. Lipinski B. What's Food Loss and Waste Got to Do with Sustainable Development? A Lot, Actually. 2015 Sep 23 [cited 2024 Dec 4]; Available from: https://www.wri.org/insights/whats-food-loss-and-waste-got-do-sustainable-development-lot-actually

3. Ulfa M, Aktas N, Rajikan R, Quoc Anh N, Reza Sobhani S. Food Security Challenges for Hospital Sustainability. Journal of Nutrition and Food Security. 2024 Nov 10;9(4):761–72; https://doi.org/10.18502/jnfs.v9i4.16905.

4. Fanzo J, Rudie C, Sigman I, Grinspoon S, Benton TG, Brown ME, et al. Sustainable food systems and nutrition in the 21st century: a report from the 22nd annual Harvard Nutrition Obesity Symposium. Am J Clin Nutr. 2021 Nov 9;115(1):18–33; https://doi.org/10.1093/ajcn/nqab315.

5. Cass AR, Charlton KE. Prevalence of hospital-acquired malnutrition and modifiable determinants of nutritional deterioration during inpatient admissions: A systematic review of the evidence. J Hum Nutr Diet. 2022 Dec;35(6):1043–58; https://doi.org/10.1111/jhn.13009.

6. Ishangulyyev R, Kim S, Lee SH. Understanding Food Loss and Waste—Why Are We Losing and Wasting Food? Foods. 2019 Jul 29;8(8):297; https://doi.org/10.3390/foods8080297.

7. Mu'awanah H, Ulfa M, Rajikan R, Saygili M, Akca N. Hospital Food Waste Trends: A Bibliometric Analysis. Journal of Health Science and Medical Research. 2024;20241069; http://dx.doi.org/10.31584/jhsmr.20241069.

8. Collins J, Porter J. Quantifying waste and its costs in hospital foodservices. Nutrition and Dietetics. 2023;80(2):192–200; https://doi.org/10.1111/1747-0080.12796.

9. Razalli NH, Cheah CF, Mohammad NMA, Manaf ZA. Plate waste study among hospitalised patients receiving texture-modified diet. Nutr Res Pract. 2021;15(5):655–71; https://doi.org/10.4162/nrp.2021.15.5.655.

10. McAdams B, Robinson E, Gordon R. Investigating food waste generation at long-term care facilities in Ontario. British Food Journal. 2023;125(8):2902–17; https://doi.org/10.1108/BFJ-06-2022-0561.

11. Pibriyanti K, Mufidah I, Luthfiya L, Fadholah A, Sulistiyani EF, Fathsidni BM, et al. Comparative analysis of food service satisfaction and nutritional adequacy between private hospitals and academic hospitals in patients with non-communicable diseases. AcTion: Aceh Nutrition Journal. 2024;9(2):360; http://dx.doi.org/10.30867/action.v9i2.1711.

12. Schiavone S, Pelullo CP, Attena F. Patient evaluation of food waste in three hospitals in southern Italy. International Journal of Environmental Research and Public Health. 2019;16(22); https://doi.org/10.3390/ijerph16224330.

13. Kesari A, Noel JY. Nutritional Assessment. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023.

14. Reynolds A, Mitri J. Dietary Advice For Individuals with Diabetes. In: Feingold KR, Anawalt B, Blackman MR, Boyce A, Chrousos G, Corpas E, et al.,. Endotext. South Dartmouth (MA): MDText.com, Inc.; 2024.

15. Dashti HS, Scheer FAJL, Saxena R, Garaulet M. Timing of Food Intake: Identifying Contributing Factors to Design Effective Interventions. Adv Nutr. 2019 Jul;10(4):606–20; https://doi.org/10.1093/advances/nmy131.

16. Weekes CE. Manual of Dietetic Practice 6th Edition. John Wiley & Sons Ltd; 2019.

17. Chatzipavlou M, Karayiannis D, Chaloulakou S, Georgakopoulou E, Poulia KA. Implementation of sustainable food service systems in hospitals to achieve current sustainability goals: A scoping review. Clinical Nutrition ESPEN. 2024 Jun 1;61:237–52; https://doi.org/10.1016/j.clnesp.2024.03.030.

18. Manimaran S, Razalli NH, Abdul Manaf Z, Mat Ludin AF, Shahar S. Strategies to Reduce the Rate of Plate Waste in Hospitalized Patients: A Scoping Review. Nutrients. 2023 Jan 6;15(2):301; https://doi.org/10.3390/nu15020301.

19. Yona O, Goldsmith R, Endevelt R. Improved meals service and reduced food waste and costs in medical institutions resulting from employment of a food service dietitian – a case study. Isr J Health Policy Res. 2020 Feb 3;9:5; https://doi.org/10.1186/s13584-020-0362-0.

20. Papastratis I, Konstantinidis D, Daras P, Dimitropoulos K. AI nutrition recommendation using a deep generative model and ChatGPT. Sci Rep. 2024 Jun 25;14(1):14620; https://doi.org/10.1038/s41598-024-65438-x.

21. Rantala E, Balatsas-Lekkas A, Sozer N, Pennanen K. Overview of objective measurement technologies for nutrition research, food-related consumer and marketing research. Trends in Food Science & Technology. 2022 Jul 1;125:100–13; https://doi.org/10.1016/j.tifs.2022.05.006.

22. Strotmann C, Friedrich S, Kreyenschmidt J, Teitscheid P, Ritter G. Comparing Food Provided and Wasted before and after Implementing Measures against Food Waste in Three Healthcare Food Service Facilities. Sustainability. 2017 Aug;9(8):1409; https://doi.org/10.3390/su9081409.

23. Lai H, Gemming L. Approaches to patient satisfaction measurement of the healthcare food services: A systematic review. Clinical Nutrition ESPEN. 2021 Apr 1;42:61–72; https://doi.org/10.1016/j.clnesp.2020.12.019.

24. Osman NS, Md Nor N, Md Sharif MS, Hamid SBA, Rahamat S. Hospital Food Service Strategies to Improve Food Intakes among Inpatients: A Systematic Review. Nutrients. 2021 Oct 18;13(10):3649; https://doi.org/10.3390/nu13103649.

25. Liu T, Zheng J, Du J, He G. Food Processing and Nutrition Strategies for Improving the Health of Elderly People with Dysphagia: A Review of Recent Developments. Foods. 2024 Jan 10;13(2):215; https://doi.org/10.3390/foods13020215.

26. Wilandh E, Skinnars Josefsson M, Persson Osowski C, Mattsson Sydner Y. Better hospital foodservice – aspects highlighted in research published 2000–2023: A scoping review. Clinical Nutrition Open Science. 2024 Apr 1;54:1–40; https://doi.org/10.1016/j.nutos.2024.01.001.

27. Kuppusamy S, Meivelu M, Praburaman L, Mujahid Alam M, Al-Sehemi AG, K A. Integrating AI in food contaminant analysis: Enhancing quality and environmental protection. Journal of Hazardous Materials Advances. 2024 Nov 1;16:100509; https://doi.org/10.1016/j.hazadv.2024.100509.

28. Posch K, Truden C, Hungerländer P, Pilz J. A Bayesian approach for predicting food and beverage sales in staff canteens and restaurants. International Journal of Forecasting. 2022 Jan 1;38(1):321–38; https://doi.org/10.1016/j.ijforecast.2021.06.001.

29. Onyeaka H, Tamasiga P, Nwauzoma UM, Miri T, Juliet UC, Nwaiwu O, et al. Using Artificial Intelligence to Tackle Food Waste and Enhance the Circular Economy: Maximising Resource Efficiency and Minimising Environmental Impact: A Review. Sustainability. 2023 Jan;15(13):10482; https://doi.org/10.3390/su151310482.

30. Piubello Orsini L, Landi S, Leardini C, Veronesi G. Towards greener hospitals: The effect of green organisational practices on climate change mitigation performance. Journal of Cleaner Production. 2024 Jul 10;462:142720; https://doi.org/10.1016/j.jclepro.2024.142720.

31. Tomson C. Reducing the carbon footprint of hospital-based care. Future Hosp J. 2015 Feb;2(1):57–62; https://doi.org/10.7861/futurehosp.15.016.

32. Walsh SJ, O'Leary A, Bergin C, Lee S, Varley Á, Lynch M. Primary healthcare's carbon footprint and sustainable strategies to mitigate its contribution: a scoping review. BMC Health Services Research. 2024 Dec 20;24(1):1630; https://doi.org/10.1186/s12913-024-12068-8.

33. Martín-Rodríguez A, Belinchón-deMiguel P, Rubio-Zarapuz A, Tornero-Aguilera JF, Martínez-Guardado I, Villanueva-Tobaldo CV, et al. Advances in Understanding the Interplay between Dietary Practices, Body Composition, and Sports Performance in Athletes. Nutrients. 2024 Feb 19;16(4):571; https://doi.org/10.3390/nu16040571.

34. Soon-Sinclair JM. 'Food allergy? Ask before you eat': Current food allergy training and future training needs in food services. Food Control. 2024 Oct 22;112(1); https://doi.org/10.1016/j.foodcont.2020.107129.

35. Alderwick H, Hutchings A, Briggs A, Mays N. The impacts of collaboration between local health care and non-health care organizations and factors shaping how they work: a systematic review of reviews. BMC Public Health. 2021 Apr 19;21(1):753; https://doi.org/10.1186/s12889-021-10630-1.

36. Roberts S, Hopper Z, Chaboyer W, Gonzalez R, Banks M, Desbrow B, et al. Engaging hospitalised patients in their nutrition care using technology: development of the NUTRI-TEC intervention. BMC Health Serv Res. 2020 Feb 27;20:148; https://doi.org/10.1186/s12913-020-5017-x.

37. Yinusa G, Scammell J, Murphy J, Ford G, Baron S. Multidisciplinary Provision of Food and Nutritional Care to Hospitalized Adult In-Patients: A Scoping Review. J Multidiscip Healthc. 2021 Feb 22;14:459–91; https://doi.org/10.2147/JMDH.S255256.

38. Cranney L, Thomas M, Shepherd L, Cobcroft M, O'Connell T, Munn L, et al. Towards healthier food choices for hospital staff and visitors: impacts of a healthy food and drink policy implemented at scale in Australia. Public Health Nutr. 2021;24(17):5877–84; https://doi.org/10.1017/S1368980021003426.

39. Barnes J, Whiley H, Ross K, Smith J. Defining Food Safety Inspection. Int J Environ Res Public Health. 2022 Jan 11;19(2):789; https://doi.org/10.3390/ijerph19020789.

40. Pinto RS, Pinto RM dos S, Melo FFS, Campos SS, Cordovil CM dos S. A simple awareness campaign to promote food waste reduction in a University canteen. Waste Management. 2018 Jun 1;76:28–38; https://doi.org/10.1016/j.wasman.2018.02.044.

41. Saber D, Aziza R, Dreyer S, Sanford D, Nadeau H. Hospital Food Waste: Reducing Waste and Cost to our Health Care System and Environment. Online J Issues Nurs. 2022 Feb 25;27(2); https://www.doi.org/10.3912/OJIN.Vol27No02PPT33.

42. Verbruggen SCAT, Otter SC den, Bakker J, Briassoulis G, Ilia S, Latten L, et al. Call for sustainable food systems including (medical) nutrition for hospitalised children and their families. Frontline Gastroenterology. 2024 Jun 1;15(e1):e73–87; https://doi.org/10.1136/flgastro-2023-102478.

Evaluation of Food Waste in the Nutrition Installation at PKU Muhammadiyah Gamping Yogyakarta Hospital

ORIGINALITY REPORT

12%	9%	8%	4%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Diponegoro Student Paper	2%
2	Bruce McAdams, Emily Robinson, Rebecca Gordon. "Investigating food waste generation at long-term care facilities in Ontario", British Food Journal, 2023 Publication	1%
3	Submitted to University of Queensland Student Paper	1%
4	patr.otago.ac.nz Internet Source	1%
5	Eaton, Brienna R.. "Plate Waste of Southern California Hospitals: A Comparative Study", California State University, Long Beach, 2023 Publication	1%
6	www.mdpi.com Internet Source	1%
7	Submitted to Curtin University of Technology Student Paper	1%
8	ejournal.undip.ac.id Internet Source	1%
9	Christian Reynolds, Tammara Soma, Charlotte Spring, Jordon Lazell. "Routledge Handbook of Food Waste", Earthscan, 2020 Publication	<1%

10	www.coursehero.com Internet Source	<1 %
11	fg.bmj.com Internet Source	<1 %
12	garuda.kemdikbud.go.id Internet Source	<1 %
13	www.medrxiv.org Internet Source	<1 %
14	www.njmonline.nl Internet Source	<1 %
15	bmcpregnancychildbirth.biomedcentral.com Internet Source	<1 %
16	perpustakaan.poltekkes-malang.ac.id Internet Source	<1 %
17	pmc.ncbi.nlm.nih.gov Internet Source	<1 %
18	repository.umy.ac.id Internet Source	<1 %
19	jnfh.mums.ac.ir Internet Source	<1 %
20	bmchealthservres.biomedcentral.com Internet Source	<1 %
21	discovery.researcher.life Internet Source	<1 %
22	iieta.org Internet Source	<1 %
23	mental.jmir.org Internet Source	<1 %
24	pdfs.semanticscholar.org Internet Source	<1 %

25	www.jhsmr.org Internet Source	<1%
26	Maha Hoteit, Esraa Antar, Dana Malli, Ferial Fattouh et al. "A review on hospital food waste quantification, management and assessment strategies in the eastern Mediterranean region", Journal of Agriculture and Food Research, 2024 Publication	<1%
27	Nathan Cook, Denise Goodwin, Judi Porter, Jorja Collins. "Food and food-related waste management strategies in hospital food services: A systematic review", Nutrition & Dietetics, 2022 Publication	<1%
28	eprints.nottingham.ac.uk Internet Source	<1%
29	Kamiar Mahmoudifar, Ahmad Raeesi, Behzad Kiani, Mitra Rezaie. "Food waste in hospitals: implications and strategies for reduction: a systematic review", Management of Environmental Quality: An International Journal, 2024 Publication	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

Evaluation of Food Waste in the Nutrition Installation at PKU Muhammadiyah Gamping Yogyakarta Hospital

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9