Original Article

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Food Security and Food Safety for Healthcare Sustainability in Indonesia

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Abstract:

Objective: This research sought to describe the strategies employed to address food security and safety within Indonesian healthcare environments, with a particular emphasis on the principles of sustainable healthcare. In light of the multifaceted challenges presented by climate change, it is imperative for hospitals and other healthcare facilities to not only guarantee the nutritional adequacy of their food services but also to implement rigorous measures to prevent foodborne illnesses.

Material and Methods: This qualitative study comprised semi-structured interviews with 11 participants, including healthcare facility managers and nutritionists from seven hospitals and four community healthcare centres (PUSKESMAS). The interviews aimed to gather participants' insights regarding the role of food security and safety in achieving sustainable healthcare. The data were analysed using NVivo 12 software.

Results: Healthcare sustainability depends heavily on ensuring adequate nutrition and preventing food insecurity. However, recent statistics show that only 22.11% of sustainable health facilities meet food security standards, whereas food safety standards are met by 62.1%.

Conclusion: The findings suggest that food security plays a crucial role in supporting sustainable healthcare practices. Institutions striving for long-term sustainability appear to prioritise achieving food security as a fundamental objective.

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These insights underscore the need to incorporate food-related considerations into comprehensive sustainability strategies within the healthcare sector.

Keywords: food safety, food security, healthcare, hospital, sustainability

Introduction

Nutritious food is essential for the well-being and recovery of patients in healthcare facilities. Therefore, nutrient-rich foods are integral to patient care[1]. The health facility's food service is the primary food source for most patients while they are inpatients, which is crucial for effective health service management[2]. As leaders in the healthcare field, healthcare facilities must set the standard for other industries by prioritising the consumption of fresh, locally sourced, and sustainable products. Additionally, their nutrition systems should offer nutritious meal options tailored to the unique needs and medical conditions of both inpatients and outpatients. By doing so, individuals can gain a better understanding of the significance of their diet, ultimately promoting healthier nutritional habits[3].Healthcare facilities must implement the Hazard Analysis Critical Control Point (HACCP) system to ensure the production of safe and nutritious food[4].

Food is essential for survival, growth, development, and productivity. It also plays a crucial role in supporting public health[5]. Food is a vital necessity in healthcare facilities, so ensuring food safety and security is crucial. Food security refers to uninterrupted access to sufficient, safe, and nutritious food that fulfils the nutritional needs of patients in health facilities. By ensuring food security, hospitals can provide menus that cater to patients' dietary requirements, thereby fulfilling their daily nutritional needs[6]. Ensuring food safety in hospitals is essential for maintaining patient trust. It significantly impacts the patient's overall well-being, nutrition, and the risk of microbiological contamination in healthcare facilities[7]. Since the COVID-19 pandemic, food security and safety have become major concerns worldwide. COVID-19 impacted the world's socio-economic and food security more than other infectious diseases. The COVID-19 pandemic led food factories to reduce or slow their production, and the lockdown significantly disrupted the food supply chain. Apart from that, coupled with structural weaknesses in the global food system, including production, distribution, accessibility, and stability of the food chain, many people have been affected by the worldwide food crisis[8]. Food security refers to the ability to access safe and nutritious food that meets dietary needs and preferences, both physically and financially. Persistent food insecurity inevitably results in malnutrition[9]. Thus, early interventions are crucial for prevention[10]. Access to nutritious food that meets cultural preferences and fulfils the nutrients required for proper growth and development is an indispensable human right. It must always be guaranteed to every individual[11]. Food security is a multifaceted concept that encompasses several vital elements, including stability, availability, accessibility, consumption, and biological assimilation. It is crucial to ensure physical and financial accessibility to food through domestic food production, imports, exports, food support, proper storage, and adequate transit capabilities[12]. Access to healthy food and sufficient income is paramount to achieving food security. However, this depends on consumer demand and supply, as well as strict compliance with national food regulations[13]. The food available at home depends on the distance between production centres, distribution, and the infrastructure required to conduct internal agri-food trade[14].

Recent literature increasingly emphasises the critical importance of nutrition and food security in promoting the sustainability of healthcare systems. Malnutrition, foodborne

illnesses, and diet-related non-communicable diseases (NCDs), such as diabetes and cardiovascular disorders, are significant contributors to the heightened burden faced by healthcare infrastructures[15]. Ensuring access to safe and nutritious food has been shown to mitigate hospital admissions, expedite patient recovery, and reduce overall healthcare expenditures[16]. Furthermore, within hospital settings, the safety and quality of food have a direct impact on patient outcomes, particularly among vulnerable populations, including children, pregnant women, and the elderly. A bibliometric analysis conducted by Ulfa et al. in 2024 highlights a growing trend toward integrating food safety and sustainability within hospital management, thereby reaffirming their crucial relevance in healthcare planning[15].

Healthcare must adopt sustainability to improve social and health conditions, expanding its responsibilities to encompass both current and future patients[17]. Healthcare sustainability involves social equity, environmental stewardship, economic viability, and accessibility[18]. It involves not only continuous clinical services but also the integration of environmentally responsible practices, efficient resource utilisation, and preventive health strategies that enhance public health and minimise ecological impact. Health facilities have a significant social impact, as they ensure food safety and security for their patients through various activities, including food procurement, energy utilisation, and waste disposal. To ensure sustainability, health facilities must comply with the implemented standards that intersect with risk management and food safety. Food safety is critical to patient well-being and recovery. It is necessary for the sustainable operation of health facilities[19]. The food services provided by health facilities have a considerable impact on the environment and food security, as they leave a significant mark at each stage of the food supply chain, including production, distribution, preparation, consumption, and waste disposal.20 This study aimed to investigate the intricate interrelationship between food security, food safety, and healthcare sustainability in Indonesia.

Material and Methods

Study design and setting

This study utilized a qualitative methodological approach, integrating a comprehensive literature review with semi-structured interviews to investigate themes pertinent to food security, food safety, and sustainable practices within hospital settings. Conducted between February and April 2023, the research took place in Rembang, Central Java, Indonesia, encompassing one public hospital and two primary healthcare facilities within the region. Rembang is a coastal city and regency situated in the northeastern region of Central Java, Indonesia, along the Java Sea. It has a population of around 650,000 residents, with its economy predominantly fueled by agriculture, fisheries, small-scale industries, and trade. Socioeconomically, Rembang is classified as a developing area with moderate income levels, where rural livelihoods and traditional markets are central to food availability and distribution.

Study participants

Participants were selected using purposive sampling based on their relevance to the research focus. The study included a total of eleven respondents, comprising healthcare facility managers—such as the principal director, head of medical support, and head of the nutrition department—as well as nutritionists from the selected hospitals and healthcare centres. The inclusion criteria required participants to be either a nutritionist or a healthcare facility manager at one of the study sites and to be willing to engage in the research. Exclusion criteria included individuals who declined to participate or were unavailable due to illness or departure from their position during the study period. All participants provided written informed consent before the interviews.

Study instrument

The researchers developed a semi-structured interview guide as the primary data collection instrument for this study. Informed by a preliminary literature review, the guide aligned with the study's thematic areas: food security, food safety, and sustainable hospital practices. Its design aimed to elicit qualitative insights from healthcare facility managers and nutritionists, facilitating the exploration of both information and personal perspectives. Comprising 47 open-ended questions—10 on food security, 30 on food safety, and seven on sustainability—the guide addressed critical issues such as food availability, hygiene practices, and mitigation of environmental impact. Each question was carefully crafted to encourage detailed responses rather than simple yes-or-no answers.

Study variables

This study examined three key thematic variables—food security, food safety, and sustainable hospital practices—selected for their relevance to contemporary healthcare challenges in service delivery, public health nutrition, and environmental sustainability. The investigation of these variables was conducted through a structured interview guide, which highlighted their interconnections, including the impact of food safety on food security and how sustainability goals influence both dimensions.

Data collection

Data collection was conducted through face-to-face semi-structured interviews, which were executed by the researchers. Each interview lasted approximately 30 minutes. With the participants' consent, all interviews were audio-recorded and subsequently transcribed verbatim to ensure the accuracy and comprehensiveness of the data.

Data management

The transcribed data were systematically managed using NVivo 12 software, which provided a comprehensive framework for coding and organising qualitative data. The transcripts were diligently coded in alignment with the study's thematic variables, enabling a structured analysis. NVivo's advanced features facilitated the categorization of responses, thereby enhancing the identification of recurring themes and patterns.

Data analysis

Thematic content analysis was employed as the primary methodological approach for analysing the qualitative data. The analysis process entailed the careful identification of key themes and sub-themes present within the interview transcripts, facilitated using NVivo 12 software. The sophisticated analytical tool enabled researchers to systematically code, categorise, and interpret emerging data trends, significantly enhancing the reliability and depth of the analysis and providing a comprehensive understanding of the nuances within the qualitative data.

Ethical considerations

This study was approved by the Health Research Ethics Commission of Universitas Aisyiyah Yogyakarta on March 18, 2023, with an ethical number 2657/KEP-UNISA/III/2023.

Results

From Table 1, most informants were 25-30 years old, with four respondents (36.3%). Meanwhile, the fewest respondents were those aged 41-45, with one respondent (9.0%). The majority of respondents in this study were female, comprising eight respondents (72.7%). From the table above, it can also be seen that the respondents with

Table 1 General description of informant demographics

Informants code	Age	Gender	Working place (healthcare level)	Education background	Employment status	Position	Length of work
1	40	Male	Primary Healthcare	Nutritionist Diploma	Civil servant	Nutritionist	12 years
3	28	Female	Primary Healthcare	Nutritionist Diploma	Civil servant	Nutritionist	2 years
4	25	Female	Primary Healthcare	Bachelor of Nutritionist	Civil servant	Nutritionist	2 years
5	27	Female	Primary Healthcare	Bachelor of Nutritionist	Civil servant	Nutritionist	3 years
2	27	Male	Public Hospital	Bachelor of Nutritionist	Civil servant	Nutritionist	2 years
6	52	Female	Public Hospital	Bachelor of Nutritionist	Civil servant	Head of the nutrition installation	20 years
7	50	Male	Public Hospital	Master of Public Health	Civil servant	Head of Medical Support	15 years
8	47	Female	Public Hospital	Bachelor of Nursing	Civil servant	Head of Medical Support	13 years
9	38	Female	Public Hospital	Bachelor of Nutritionist	Civil servant	Nutritionist	11 years
10	39	Female	Public Hospital	Bachelor of Nutritionist	Civil servant	Nutritionist	13 years
11	42	Female	Public Hospital	Bachelor of Nutritionist	Civil servant	Nutritionist	14 years

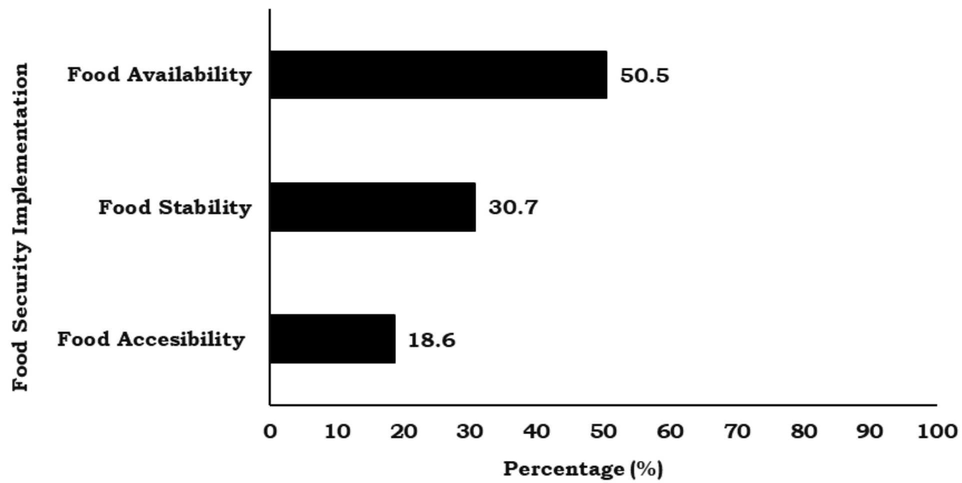
the most years of work were six respondents (54.5%). Only 9.0% of respondents had worked 10–20 years. All respondents are employed as civil servants, and most have a bachelor's degree in nutrition.

This research identified three indicators of food security: food accessibility, food stability, and food availability (Figure 1). Healthcare facilities had the highest implementation of food security in terms of food availability, at 50.5%, and the lowest in terms of food accessibility, at 20.6%. The implementation of food stability in healthcare facilities was 30.7%.

According to Figure 2, the interviews conducted with respondents at the hospitals and two healthcare centres demonstrated that four food safety indicators had been implemented in these facilities. The food management process was the highest implemented indicator, with a percentage of 69.2%, followed by personal hygiene at 20.4%. Preventing food contamination was implemented at a rate of 6.6%, making it the third most implemented indicator, while the temperature gauge and food handling time were the least implemented at 5.5%.

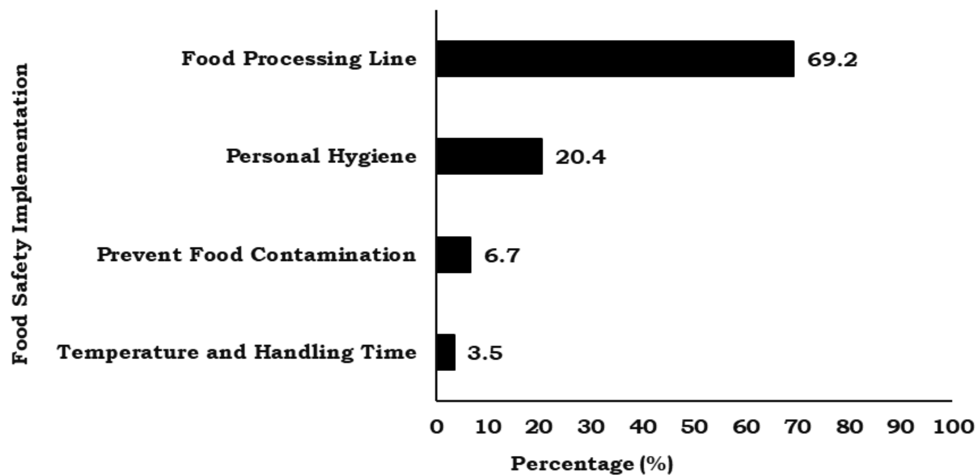
The food ingredient management process involved four crucial stages: selecting ingredients, storing foodstuffs, processing foodstuffs, and serving foodstuffs. Figure 3 depicts that healthcare facilities were the primary implementers of food ingredient storage, with a staggering 30.5% share. In contrast, the stage of serving food ingredients exhibited an alarming 22.3% implementation rate, the lowest among all the stages. The food ingredient selection stage accounted for a 25.4% share, while the food processing application represented 23.7%. These findings highlight the need for greater focus and attention on the serving stage to ensure that the food ingredient management process is executed effectively.

Figure 4 elucidates the percentage of sustainable implementation in healthcare facility nutrition installations. It



The data represent the proportion of 11 surveyed health facilities that implement food security indicators

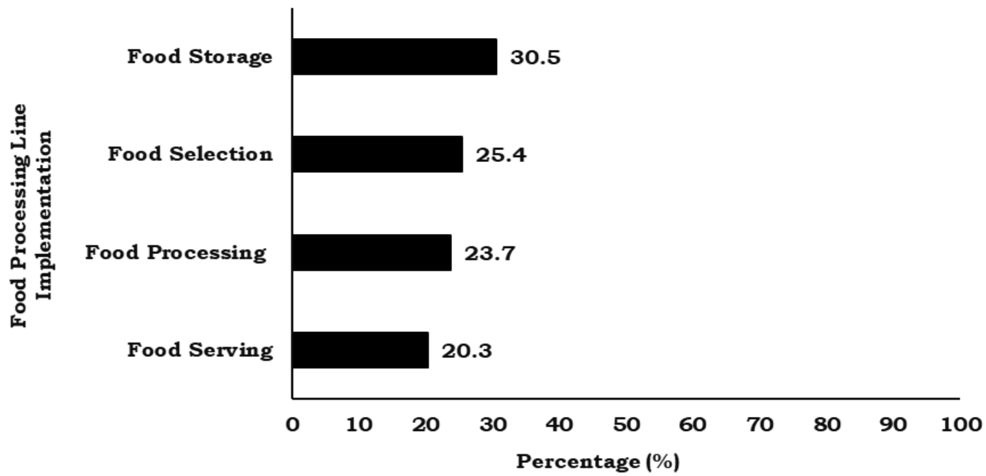
Figure 1 Percentage of food security implementation in health facilities (N=11)



Based on the assessment of food safety procedures in 11 health facilities

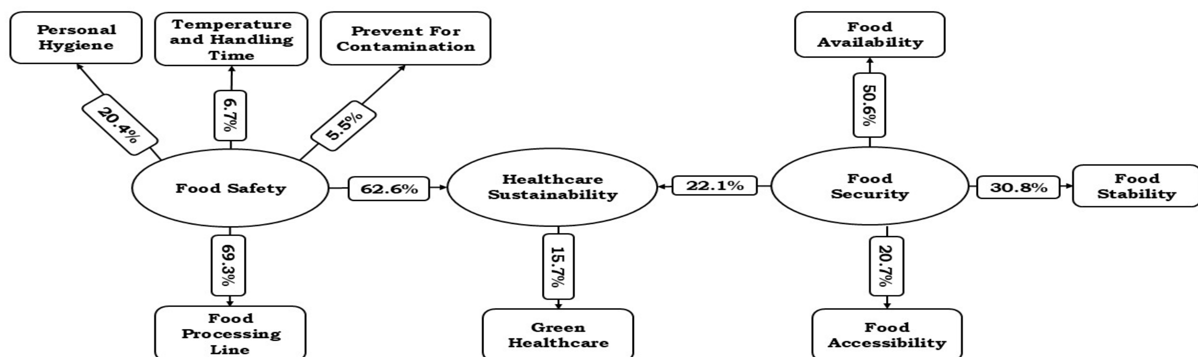
Figure 2 Percentage of food safety procedures in healthcare facilities (N=11)

is evident from Figure 4 that a significant proportion, 87.5%, of healthcare facility nutrition installations had incorporated sustainable health service practices. In contrast, only 15.7% had adopted green health services. Figure 4 indicates a pressing need to promote the implementation of sustainable and green health services in healthcare facility nutrition installations. The data processing was obtained from the NVivo 12 application, utilising qualitative coding and thematic analysis.



Percentages indicate the number of facilities meeting each implementation standard

Figure 3 percentage of food processing line implementation in healthcare facilities



Each indicator reflects the implementation status reported by 11 health facilities

Figure 4 Chart of implementation of food security, food safety, and green health services for sustainable healthcare facilities

Discussion

ThisThis study assessed the effectiveness of hospital nutrition units in implementing integrated protocols that address food safety, food security, and environmental sustainability. Findings indicate that 69.2% of facilities met basic food safety standards, while 87.5% adhered to food security benchmarks concerning availability, stability, and accessibility of nutritious options. However, only 12.5% implemented green hospital practices, highlighting a significant gap in environmentally sustainable operations. These results have important implications for stakeholders, including hospital leadership, infection control teams,

dietitians, environmental health officers, and policymakers. Their roles are crucial in aligning healthcare practices with planetary health and the United Nations' Sustainable Development Goals (SDGs). The literature emphasises that food safety, food security, and effective waste management are essential to hospital sustainability frameworks, underscoring the value of this integrated assessment for stakeholders across clinical and administrative domains in promoting sustainable healthcare systems.

This study indicates a 69.2% rate of food safety implementation; however, this statistic is primarily based on self-reported data from nutrition installation units, raising concerns about potential reporting and social desirability bias. Nutritionists in healthcare facilities are responsible for properly storing the food ingredients using freezers, refrigerators, and dry food storage. Key practices—such as the First In First Out (FIFO) inventory system, adherence to the cold chain, and hygiene protocols—were not independently verified through audits, environmental swabs, or microbial sampling[21]. As a result, the actual performance may differ from what has been reported. Similar concerns have been raised in prior studies, underscoring the need for observational triangulation and microbial quality testing to substantiate food safety data within healthcare settings[22–24]. Furthermore, although the discussion of food security covered aspects such as availability, stability, and accessibility, these elements were assessed narratively rather than through concrete, measurable indicators. Indicators such as daily calorie intake, nutrient density, food cost ratios, and procurement cycle times are crucial for generating actionable, policy-relevant findings. These metrics have been extensively employed in recent hospital-based food security assessments[25–27].

The study's findings indicate that only 12.5% of healthcare facilities have implemented green health services. However, this figure may underrepresent the actual performance levels due to the absence of standardised metrics for assessing environmental sustainability. The term "green hospital" has not been defined or evaluated using internationally recognised frameworks, such as the World Health Organization's Health Care Without Harm indicators, the LEED for Healthcare standards, or the Planetary Health Report Card. This lack of operational clarity poses significant challenges when attempting to compare healthcare facilities across different regions, particularly in Europe and the United States, where comprehensive metrics related to energy consumption, waste management, and carbon emissions are routinely employed[28–30].

The research findings assert the presence of three key indicators of food security in healthcare facilities: food availability, food stability, and food accessibility. Food availability is crucial to ensure an adequate food supply, encompassing both food production and the availability of food stock, thereby preventing food insecurity and meeting patients' dietary needs in healthcare facilities[12]. Healthcare facilities must ensure food stability by providing sufficient nutrition to meet patients' needs, even during economic crises or extreme climate changes[31]. It is crucial to consider patients' dietary needs when providing food in healthcare facilities. Thus, the food available must have proper nutritional content. Healthcare facilities must follow a 10+1 menu cycle[3]. Food accessibility is vital in ensuring that healthcare facilities can acquire high-quality and nutritious food for their patients without compromise[31]. To enhance food accessibility, it is crucial to emphasise two critical economic and physical indicators. The former is related to healthcare facility income, while the latter is related to facilities and infrastructure.

A key strength of this investigation lies in its holistic approach, which evaluates food safety processes, security constructs, and environmental sustainability within a unified framework. It critically examines the prevailing challenges and institutional responses related to food safety and nutrition within healthcare settings while also

evaluating the implications of food-related issues for the resilience and sustainability of the Indonesian healthcare system. Furthermore, this study proposes strategic recommendations to effectively integrate food security and safety into national policies that aim to enhance healthcare sustainability. This perspective provides valuable insights that are often lacking in hospital settings within low- and middle-income countries (LMICs). Additionally, the use of operational indicators—such as cold storage protocols, menu cycles, and waste disposal practices—benchmarks and guides future initiatives focused on quality improvement and sustainability. Nonetheless, there are limitations to consider. The sample size is modest, and the reliance on self-reported data without independent validation hampers the generalizability of the findings. Moreover, the absence of patient-centred outcomes—such as infection rates or food acceptability—restricts the interpretation of the operational improvements. Finally, the operationalisation of food security did not include metrics for affordability or procurement efficiency. Future research should aim to incorporate larger, randomised samples, utilise mixed-methods designs, conduct quantitative food waste audits, assess dietary adequacy scores, and align with recognised sustainability frameworks, such as the WHO Climate Action Guidelines and LEED-HC models.

Conclusion

This study aimed to explore the interrelationship between food safety, food security, and sustainable healthcare practices in Indonesia. The findings reveal that while food safety measures—such as proper storage, handling times, and temperature control—are crucial, the adoption of green health services in healthcare facilities remains limited. To ensure long-term sustainability in healthcare institutions, it is vital to prioritize food security, particularly regarding food availability and stability. A notable limitation of this study is that it involved only 11 respondents and did not differentiate between hospitals and healthcare centres. Future research should examine the differences between these facility types to better inform targeted interventions.

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Conflicts of interest

The authors declare no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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