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Improving food safety knowledge, attitudes, and practices: a pre-post study across 34 Indonesian Provinces to inform the Free Nutritious Meals Program

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Abstract

Purpose: This study aims to analyze trends in Knowledge, Attitudes, and Practices (KAP) scores on food safety from Village Food Safety Movement (VFSM) program documentation and inform insights for implementing the Free Nutritious Meals Program. **Methods:** This study used a descriptive design with a retrospective longitudinal (pre-post) approach, using secondary data from survey reports conducted in 2024 across 232 villages in 34 Indonesian provinces that were intervened in by the VFSM Program, involving 10,909 respondents. **Results:** The results showed improvement in the proportion of food safety KAP scores across all respondent groups. However, the KAP scores remained below the good performance benchmark (80%). Knowledge and practice scores remain in the moderate performance range, while attitude scores remain poor. **Conclusion:** The community-level food safety KAP gap (a finding from VFSM) represents a challenge that may potentially increase the risk of foodborne diseases and food loss and waste. Future studies should explore whether these KAP scores are directly associated with foodborne diseases, food loss, and waste. Therefore, further studies are needed to assess the intervention's direct impact and its implications for the government's priority programs, such as VFSM and the Free Nutritious Meals Program.

Keywords: attitudes; food loss and waste; food safety; foodborne diseases; health knowledge

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INTRODUCTION

Food loss and waste are serious global concerns. According to UNEP's Food Waste Index Report 2024, 13.2% of food is lost in the supply chain after harvest and before retail. At the same time, 19% is wasted at the retail and consumption stages. Globally, households waste one billion meals per day or an average of 79 kg/capita/year [1]. The Ministry of National Development Planning of the Republic of Indonesia (Bappenas) reported that food loss and waste in Indonesia (200-2019) reached 115–184 kg/capita/year, equivalent to 23-48 million tons annually. Based on these data, consumption stages account for the largest proportion of food waste [2].

Reducing food loss and waste along the supply chain is essential to improving food security, as stated in the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development [3], particularly SDG 12 on responsible consumption and production [4]. In line with this global commitment, food security is a national priority in Indonesia's National Medium-Term Development Plan (RPJMN 2025–2029) [5]. These issues are relevant. High levels of food loss along the supply chain reduce access to food. In contrast, food waste at the consumption stage highlights inefficiencies that intensify economic strain

and nutritional gaps. Therefore, food security should be understood not only as physical food availability but also as food safety and nutritional quality. In this regard, one of the Indonesian Government's priority programs for 2025–2029 is the Free Nutritious Meals Program. This program aims to improve nutritional status. Implementing the program requires integration across the supply chain (production, distribution, consumption, and waste management). This integration is essential to prevent inefficiencies and also to minimize potential risks, such as foodborne disease.

Previous studies have identified multiple drivers of food loss and waste, including inadequate Good Handling Practices (GHP), improper storage, limited food safety knowledge, misinterpretation of labeling, and inefficient household consumption behaviors [2]. These drivers relate to food safety, underscoring the need for interventions that address these challenges on both the supply (producers) and demand (consumers) sides. The Indonesian Food and Drug Authority (Indonesian FDA) initiated the Village Food Safety Movement (VFSM), a community-based intervention designed to empower village communities on the supply side (food enterprises) and the demand side (the communities themselves) to maintain food safety [6].

The VFSM is one of the government's programs that shares similar objectives with the Free Nutritious Meals Program, particularly in promoting local economic development [7] and enhancing community health. This aligns with the concept that the Free Nutritious Meals Program adopts a circular economy approach [8], providing economic and social benefits such as increased resource efficiency, cost savings, and improved community health [9]. In terms of food safety, implementing adequate standards within the program can enhance nutrient absorption. To achieve the program's objectives, it is essential to monitor and evaluate its implementation, highlighting the importance of a comprehensive understanding of community characteristics. However, data on the initial state of these communities remain limited. In addition, empirical data in Indonesia on village communities' knowledge, attitudes, and practices (KAP) related to food safety, as well as measurable changes following program interventions, remain limited. This gap challenges the ability to design improvements and to align community-level interventions with national priority programs, including the Free Nutritious Meals Program. Therefore, an intervention evaluation is essential to assess village communities' knowledge, attitudes, and practices related to food safety. This study aims to analyze trends in village communities' knowledge, attitudes, and practices regarding food safety, informed by the VFSM program. These findings are expected to inform the development of priority programs that support food security, ensure adequate nutrition, and reduce food loss and waste in Indonesia, such as the Free Nutritious Meals Program.

METHODS

Study design, setting, and subjects

The study employed a descriptive design with a retrospective longitudinal (pre-post) approach, utilizing secondary data from the Village Food Safety Movement (VFSM) intervention conducted in 2024. The analysis assessed changes before and after the intervention among the same respondents.

Respondent groups were selected based on the VFSM program targets, in accordance with Indonesian Food and Drug Authority Regulation Number 4 of 2022 concerning the VFSM program [6]. This pre-post survey is part of the program stages. The respondents included in the post-intervention data collection were the same as those who participated in the pre-intervention data collection and had provided informed consent to participate (respondents who had relocated to another village, had died, or whose conditions did not permit participation in the post-intervention survey were excluded from the study). Respondents were drawn from 232 villages that received interventions under the VFSM program, implemented by 42 regional offices of the Indonesian FDA across 34 provinces in 2024. Regional governments and specific criteria determined the selected villages, including demonstrated commitment, potential for village economic development, availability of local food-sector resources, and the need for assistance to improve food safety related to foodborne diseases or other relevant cases. The survey included 10,909 respondents: 3,581 housewives, 1,224 members of school communities, 1,866 youth communities, 1,267 household food industries, 1,646 ready-to-eat food industries, and 1,325 retailers.

Data collection

Enumerators distributed the VFSM questionnaire surveys to participants from 42 Indonesian FDA regional offices in 2024. This questionnaire was identical to the one used in the VFSM program during 2021–2023. The KAP questionnaire comprised three sections: knowledge, attitudes, and practices. Each section included several aspects, organized into the following question blocks: ***Knowledge:*** general knowledge of food safety; knowledge of food purchasing; knowledge of food preparation, processing, and serving, or product display for retail; and Knowledge of hygiene in food processing. ***Attitudes:***

attitudes at the food purchasing stage; Attitudes related to food preparation, processing, and serving, or product display for retail; attitudes regarding hygiene in food processing; attitudes regarding food poisoning management. ***Practices:*** practices at the food purchasing stage; practices related to food preparation, processing, and serving, or product display for retail; hygienic practices in food processing

In the knowledge and practice aspects, correct responses were assigned a score of 1, whereas incorrect responses were assigned a score of 0. For the attitude aspect, we measured responses using a Likert scale ranging from strongly disagree to strongly agree, with scores from 1 to 5, respectively. We collected completed questionnaires at EpiData 3.1 and sent them to the Directorate of Community and Enterprises Empowerment of Processed Food of the Indonesian FDA for analysis.

Data analysis

We analyzed the collected data using univariate methods, including frequencies, distributions, and measures of central tendency. We compared scores from these assessments to identify trends in knowledge, attitudes, and practices using descriptive statistics, and conducted the analysis using the Data Analysis ToolPak in Microsoft Excel. We collected data as part of the VFSM program implementation. All participants were informed of the study's purpose, and we obtained written informed consent before data collection. We handled all personally identifiable information confidentially and did not include it in the analysis or publication. Because this study was conducted as part of routine program monitoring and evaluation activities, we did not obtain formal ethical clearance with a reference number. However, the study procedures followed standard ethical principles for research involving human participants.

RESULTS

Based on the pre- and post-intervention survey findings, knowledge, attitude, and practice scores increased from pre- to post-intervention (Table 1). The knowledge score increased from 60.9% to 76%, and the practice score increased from 65.9% to 74.8%. Meanwhile, the attitude aspect increased slightly from 50.4% to 52%. Retailers and the ready-to-eat food industry showed a large increase in knowledge, from 61.4% to 79.9% and from 62.7% to 79.5%, respectively. In terms of attitude, retailers achieved the highest post-intervention score, followed by housewives and household food industries. Although youth communities had the lowest pre-intervention attitude scores (49.2%), they showed the greatest improvement after intervention. In terms of practice, school communities showed the highest post-intervention scores (79.1%). However, retailers and youth communities showed the largest increases. Overall, the findings showed improved food safety knowledge, attitude, and practice across all community groups in the villages following the intervention program.

Table 1. Percentage of KAP scores regarding food safety (n = 10,909)

	n	Knowledge		Attitudes		Practices	
		Pre (%)	Post (%)	Pre (%)	Post (%)	Pre(%)	Post (%)
Housewive	3,581	63.6	77.7	51.3	53.0	63.1	72.8
School	1,224	66.5	79.4	50.1	51.4	71.8	79.1
Youth	1,866	52.1	65.4	49.2	51.2	56.6	66.9
Household food industry	1,267	58.9	74.4	50.3	51.9	68.7	75.0
Ready-to-eat food industry	1,646	62.7	79.5	49.8	51.3	69.8	78.8
Retail	1,325	61.4	79.9	51.8	53.1	65.5	76.0
Average		**60.9**	**76.0**	**50.4**	**52.0**	**65.9**	**74.8**

DISCUSSION

This study describes the results of VFSM interventions in 231 villages across 34 provinces, where post-intervention scores improved. In comparison, a study involving high school students in one district in West Java, Indonesia, reported that 60.78% of respondents had moderate knowledge, 85.29% demonstrated good attitudes, and 71.57% exhibited good practices regarding food safety [10]. Other studies have shown that food safety education interventions improve average knowledge and practice scores among housewives [11]. According to Kaugi et al. (2023), knowledge, attitude, and practices were associated with adherence to food safety and hygiene standards [12]. Another study found improved maternal practices after food safety education interventions [13].

Food safety knowledge, attitudes, and practices improved after the intervention. Nevertheless, knowledge, attitudes, and practices remained below the 80% benchmark. According to Bloom, the assessment of knowledge, attitude, and practice domains indicates that a score between 80 and 100% reflects good performance, while a score between 60 and 79%

denotes moderate performance. Scores below 60% suggest poor performance in the domain [14–16]. The outcomes indicate the need for strengthened training and continuous technical support for both the community and food businesses to ensure compliance with food safety and hygiene standards.

When knowledge, attitudes, and practices fall below the adequate category, they increase the potential for foodborne disease. Lower practice scores were correlated with the emergence of foodborne diseases [17]. Similarly, Msrahi and Turkistani (2025) found links between foodborne diseases, certain factors, and the level of food safety knowledge and practices [18]. Another study emphasizes that inadequate hygiene and sanitation, together with cross-contamination, represent two of the five major food-handling factors linked to foodborne disease [19]. According to WHO, strengthening consumer education on food safety represents a key intervention with the potential to lower the global burden of foodborne disease [20]. To further improve program outcomes, the VFSM program must evolve through adaptive intervention frameworks that prioritize education on the most impactful issues. Ensuring food safety, food security, and adequate nutrition requires strong, sustained commitment at all levels. Collaboration and synergy between priority programs are needed to achieve food safety, food security, and nutrition. Synergizing the VFSM program with the Free Nutritious Meal Program may be considered as part of broader efforts to strengthen food safety capacity. Both programs share target beneficiaries, particularly pregnant women and the school community on the demand side, as well as food enterprises on the supply side. Food safety plays a pivotal role in advancing health and addressing nutritional concerns. In line with the FAO and WHO, food contributes to nutrition only when it is safe, thereby supporting adult health and children's growth [21]. Hence, such collaboration may help mitigate food safety risks, including foodborne disease.

Septivani et al. (2025) examined the major risks of the Free Nutritious Meal Program through the ISO 31000:2018 risk management framework and a qualitative descriptive method. Their findings indicated that food quality and safety represent critical concerns. Furthermore, schools frequently receive complaints about spoiled or mishandled meals. In other cases, food was delivered in a deteriorated condition or with an inadequate nutritional balance [22]. These findings may threaten food safety and increase health risks. According to the WHO, food safety, nutrition, and food security are closely interconnected [23]. When food safety is inadequate, the risk of foodborne disease increases, contributing to higher rates of discarded or rejected food. The pre- and post-intervention survey results from the VFSM program can serve as a reference for strengthening food safety within the Free Nutritious Meals Program. Therefore, strengthening the food safety knowledge, attitudes, and practices of both food handlers and beneficiaries (including school communities and pregnant or breastfeeding mothers) is essential to support program implementation and prevent potential risks. Strengthening food safety management may support the delivery of nutritious meals to beneficiaries while helping to minimize potential waste.

Improving food safety knowledge, attitudes, and practices is expected to indirectly reduce food loss and waste. The VFSM program is expected to support optimized resource utilization and reduced waste by integrating with the Free Nutritious Meals Program, which faces the challenge of food waste. In 2029, this program is estimated to produce around 469 thousand tons of food waste from food handlers and 1.4 million tons from beneficiaries [24]. Another study has shown that consumer education and increased awareness of food safety and nutritional value may further support food acceptance and consumption [25].

Strengthening collaboration among stakeholders may help address implementation challenges in priority government programs. According to the National Food Agency's food waste management guidelines, one key measure to prevent large-scale food waste is ensuring that all employees have adequate knowledge of proper food storage methods tailored to each food type [26]. Therefore, strengthening food handling and food safety knowledge may be important for food handlers in the Free Nutritious Meals Program. Continuous capacity building and technical assistance for communities and food enterprises may be recommended as a policy priority, particularly on topics with high potential impact on food safety and hygiene compliance. Food safety is a key component of the Free Nutritious Meals Program. The program emphasizes adherence to nutritional standards, management of physical, biological, and chemical contaminants, allergen control, and personal hygiene protocols to ensure food safety. The guidance also covers receiving materials, storage, processing, portioning, distribution, and responsible waste management [8]. These efforts are expected to reduce food safety risks and minimize food loss and waste.

Feedback from beneficiaries is recommended to generate a database to improve adaptive programs based on real challenges. Improving food safety knowledge, attitudes, and practices is expected to support efforts to reduce food loss and waste and

maintain public health. However, this study has several limitations, including no control group, reliance on self-reported data, and no evidence of direct outcomes. Further studies with controlled designs, objective outcome measures, and direct measures of the intervention's impact on foodborne disease and environmental aspects are recommended to strengthen the evidence.

CONCLUSION

These findings show that the VFSM intervention can improve food safety knowledge, attitude, and practice, even though scores remained below the ideal benchmark. This gap may potentially increase the risk of foodborne diseases and environmental issues such as food loss and waste. However, this study does not directly assess the impact, so future research should directly measure the link between KAP scores and foodborne diseases, food loss, and waste. Further studies using more comprehensive designs, such as controlled approaches or multivariate methods, are needed to assess the intervention's impact and its implications for the government's priority programs, such as the Free Nutritious Meals Program.

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Authors' contributions
D.S.K: Conceptualization, investigation, data curation, methodology, resources, visualization, writing – original draft. C.L: Conceptualization, data curation, methodology, supervision, validation, writing – review & editing. A.L.R: Data curation, format analysis, methodology, software, writing – review & editing. R.F: Project administration, supervision, validation. A.Y.P: Funding acquisition, supervision. All authors approved the final manuscript.

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Data availability
The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics statement
Data were collected as part of the VFSM program implementation. All participants were informed of the study's purpose, and we obtained written informed consent before data collection. We handled all personally identifiable information confidentially and did not include it in the analysis or publication. Because this study was conducted as part of routine program monitoring and evaluation activities, we did not obtain formal ethical clearance with a reference number. However, the study procedures followed standard ethical principles for research involving human participants.

Conflicts of interest
The authors declare no conflict of interest regarding the publication of this article.

Use of artificial intelligence (AI)
Portions of this manuscript were edited using ChatGPT to improve grammar and clarity. The authors reviewed and validated all AI-assisted content and take full responsibility for the final content.

REFERENCES

1. United Nations Environment Programme. Food Waste Index Report 2024: Think Eat Save – Tracking Progress to Halve Global Food Waste. Nairobi: UNEP; 2024. Available from: [Website]
2. Ministry of National Development Planning/Bappenas. Food Loss and Waste in Indonesia: A Study Report. Jakarta: Ministry of National Development Planning/Bappenas; 2021. Available from: [Website]
3. Santeramo FG. Exploring the link among food loss, waste and food security: what the research should focus on. Agriculture & Food Security. 2021;10:26.
4. Global Goals. Goal 12: Responsible Consumption and Production. London: The Global Goals; 2023. Available from: [Website]
5. Republic of Indonesia. Peraturan Presiden Nomor 12 Tahun 2025 tentang Rencana Pembangunan Jangka Menengah Nasional Tahun 2025-2029. Jakarta: State Secretariat; 2025. Available from: [Website]
6. Badan Pengawas Obat dan Makanan. Peraturan Badan Pengawas Obat dan Makanan Nomor 4 Tahun 2022 tentang Program Desa dan Kelurahan Pangan Aman. Jakarta: BPOM; 2022. Available from: [Website]
7. Center for Indonesia's Strategic Development Initiatives (CISDI). Makan Bergizi Gratis: Menilik Tujuan, Anggaran dan Tata Kelola Program. Policy Paper Series: Mengkaji Ulang Program Makan Bergizi Gratis. Jakarta: CISDI; 2024. Available from: [Website]
8. National Center for Excellence in Food and Nutrition. Modul standar gizi dan keamanan pangan siap saji bagi penjamah pangan di SPPG. Jakarta: National Center for Excellence in Food and Nutrition; 2025
9. United Nations Environment Programme. Global waste management outlook 2024: beyond an age of waste – turning rubbish into a resource. Nairobi: UNEP; 2024. Available from [Website]

10. Naina HSBA, Kuswardinah I, Dewi S. Knowledge, attitude, and practice on food safety among senior high school students in Jatinangor from August–November 2013. Althea Medical Journal. 2016;3(2):206–11.
11. Ananda RR. Pengaruh metode intervensi terhadap pengetahuan dan perilaku ibu rumah tangga di Desa Puraseda tentang keamanan pangan [Undergraduate Thesis]. Bogor: IPB University; 2016. Available from: [Website]
12. Kaugi RW, Kariuki JG, Odongo AO, Koech MJ, Njoroge HC. Impact of food hygiene and safety training on knowledge, attitude, and practices of food hygiene and safety practices among food handlers in boarding schools of Embu County, Kenya. International Journal of Community Medicine and Public Health.2023;10(12):4660–8.
13. Hermawati B, Kartini A, Indarjo S, Nugroho E. Effectiveness of food safety education for early children's health. Journal of Health Education. 2020; 5(1):1–10.
14. Feleke BT, Wale MZ, Yirsaw MT. Knowledge, attitude and preventive practice towards COVID-19 and associated factors among outpatient service visitors at Debre Markos Comprehensive Specialized Hospital, north-west Ethiopia, 2020. PLoS ONE. 2021;16(7):e0251708.
15. Ashebir W, Yimer B, Alle A, Teshome M, Teka Y, Wolde A. Knowledge, attitude, practice, and factors associated with prevention practice towards COVID-19 among healthcare providers in Amhara region, northern Ethiopia: a multicenter cross-sectional study. PLoS Global Public Health. 2022;2(4).
16. Azanaw J, Dagne H, Andualem Z, Adane T. Food safety knowledge, attitude, and practice of college students, Ethiopia, 2019: A cross-sectional study. BioMed Research International. 2021;2021:1–8.
17. Amodio E, Calamusa G, Tiralongo S, Lombardo F, Genovese D. A survey to evaluate knowledge, attitudes, and practices associated with the risk of foodborne infection in a sample of Sicilian general population. AIMS Public Health. 2022;9(3):458–70.
18. Msrahi N, Turkistani A. Assessment of the association between foodborne disease and food safety knowledge and practices among pilgrims during Hajj in Saudi Arabia. Journal of Health Population and Nutrition. 2025;44:248.
19. Palupi IR, Budiningsari RD, Khoirunnisa FA, Hanifi A S. Food safety knowledge, hygiene practices among food handlers, and microbiological quality of animal side dishes in contract catering. Italian Journal of Food Safety. 2024;13(3):12554.
20. World Health Organization. Food safety is everyone's business. Geneva: WHO; 2019. Available from: [Website]
21. FAO, IFAD, UNICEF, WFP, WHO. The state of food security and nutrition in the world 2022: repurposing food and agricultural policies to make healthy diets more affordable. Rome: FAO; 2022. Available from: [Website]
22. Septivani N, Indra P IM, Fandayani EK, Maulana W. Risk assessment and stakeholder analysis of the Free Nutritious Meals Program (MBG) for school-aged children in Indonesia. International Journal of Multidisciplinary Research and Literature. 2025;4(4):645–55.
23. World Health Organization. Food safety. Geneva: WHO; 2026. Available from: [Website]
24. Ministry of National Development Planning/Bappenas. Studi Integrasi Konsep Ekonomi Sirkular untuk Pengelolaan Sisa Pangan pada Program Makan Bergizi Gratis (MBG). Jakarta: Bappenas; 2025. Available from: [Website]
25. Kechagias EP, Gayialis SP, Panayiotou N, Papadopoulos GA. A holistic framework for evaluating food loss and waste due to marketing standards across the entire food supply chain. Foods. 2024;13(20):3273.
26. National Food Agency. Buku Saku Pencegahan Sisa Pangan pada SPPG. Jakarta: NFA; 2025. Available from [Website]