

## The nutrition literacy gap among millennial mothers and its implications for the free nutritious meals program

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### Abstract

**Purpose:** This study aimed to analyze the nutrition literacy gap among millennial mothers from the housewives' community participating in the Village Food Safety Movement (VFSM) Program and to explore its relevance to household practices beyond the scope of the Free Nutritious Meals (FNM) program. **Methods:** A descriptive one-group pre-post test design was conducted in 2024, involving 7,231 housewives (mean age: 35 years; classified as millennials) from 232 villages across 34 Indonesian provinces who were participating in the VFSM program. Participants were selected using purposive sampling with a consecutive approach based on predefined criteria. Data were collected using structured questionnaires, and descriptive analysis was used to assess the percentage of correct responses before and after the intervention. **Results:** The survey revealed a substantial knowledge gap. Correct responses to "What is stunting" (E1) and "The impacts of stunting" (E4) were moderate, ranging from 48% to 55%, while knowledge of "Types of foods that can prevent stunting" (E3) was very low, with scores below 25%. Descriptively, only limited improvements were observed after the intervention, and overall knowledge levels remained below the "adequate" threshold (>60%). These findings suggest limited improvement following the intervention and highlight the need for sustained educational efforts. **Conclusion:** The gap in practical nutrition literacy, particularly in identifying stunting-preventive foods, may influence the optimal utilization of the FNM program. As the program provides only 30–35% of daily energy needs, the remaining intake must be met through safe and nutritious foods prepared at home. Without sufficient knowledge of food safety and nutrition, this complementary intake may be inadequate. These findings highlight the necessity of practical, adaptive education—incorporating digital and visual methods—to strengthen household food safety and nutrition practices in support of the FNM program.

**Keywords:** food safety; free nutritious meals program; millennial mothers; nutrition literacy; stunting

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## INTRODUCTION

In 2024, 70.72% of Indonesia's population was in the productive age range (15–64 years) [1], with millennials accounting for a large proportion of current parents and caregivers. Despite this demographic advantage, malnutrition and stunting remain persistent public health concerns. Stunting affects child growth, cognitive development, and long-term productivity. At the same time, unsafe food and poor diet quality can further worsen nutritional outcomes by increasing the risk of infection and illness among vulnerable groups [2,3]. National strategies emphasize improving food and nutrition outcomes, including food safety [4]. Caregivers, particularly mothers, play a central role in shaping dietary patterns, food safety practices, and child-feeding behaviors within households [5,6].

Previous studies have shown that maternal knowledge and caregiving practices are closely associated with children's nutritional status. Research in Indonesia indicates that maternal education and nutrition knowledge influence feeding behavior, dietary diversity, and the risk of stunting [5,7,8]. Global evidence also highlights inadequate feeding practices and recurrent infections as key immediate determinants of growth faltering and stunting [9]. Limited knowledge of balanced diets, hygiene, and safe food handling is associated with suboptimal feeding practices and a higher risk of foodborne illness and infection, both of which contribute to growth faltering [3,10]. Community-based education and culturally appropriate communication strategies have been shown to improve health knowledge and literacy in vulnerable populations [11,12]. In response to these challenges, the Indonesian Food and Drug Authority (BPOM) has implemented the Village Food Safety Movement (VFMS) since 2014, providing community training and technical guidance to improve food safety awareness and practices at the village level. National nutrition programs, including the Free Nutritious Meals (FNM) program, also aim to improve dietary intake among vulnerable groups. However, households remain responsible for meeting most daily nutritional needs through safe and balanced meals [13].

Despite these initiatives, gaps in nutrition and food safety literacy among mothers remain evident. Evidence from program monitoring and previous studies suggests that many caregivers still face difficulties translating general nutrition knowledge into practical feeding decisions and safe food preparation practices. Strengthening literacy among millennial mothers is therefore considered important in the context of household food practices and the

implementation of national nutrition programs. According to the Standard Module on Nutrition and Food Safety for Ready-to-Eat Food Handlers (*Modul Standar Gizi dan Keamanan Pangan Siap Saji bagi Penjamah Pangan di SPPG*) issued by the Pusat Unggulan Nasional Pangan dan Gizi (2025), the FNM program provided to pregnant and breastfeeding women meets only about 30–35% of daily energy requirements [13]. Consequently, the remaining nutritional needs must be met through household-prepared foods that are both safe and nutritionally balanced. This makes household food preparation and food safety practices critical for ensuring adequate dietary intake. Mothers' understanding of stunting-preventive food types and basic food safety principles is therefore essential for selecting safe ingredients, practicing proper hygiene, and preparing balanced meals for themselves and their families.

However, evidence on nutrition and food safety literacy among millennial mothers participating in community-based food safety programs remains limited. This study, therefore, aims to describe the level of nutrition and food safety literacy among millennial mothers participating in the VFMS program and to explore potential associations with household food practices. By highlighting key literacy gaps and practice patterns, the findings are expected to provide preliminary insights to inform more adaptive and context-relevant education strategies that may support safe food consumption and stunting prevention at the community level.

## METHODS

### Study design and setting

This study used an operational research design with a descriptive one-group pre–post intervention approach to describe changes in knowledge, attitudes, and practices regarding food safety and nutrition between pre- and post-intervention measurements among community participants. The study was conducted as part of the VFMS program implemented by the Indonesian Food and Drug Authority (BPOM). The intervention consisted of three stages: (1) a pre-intervention assessment to establish baseline conditions, (2) implementation of a community-based food safety education intervention, and (3) a post-intervention assessment to describe conditions after the intervention period.

The intervention included community education and technical guidance activities delivered by trained facilitators from BPOM regional offices and local stakeholders. Education sessions were conducted in

community settings through group discussions and practical demonstrations. Key topics included safe food handling, prevention of food contamination, basic child nutrition, and practices supporting stunting prevention. Educational materials, such as presentations, printed guidance, and demonstrations, were used to support participants' understanding.

The study was conducted in 232 villages across all 34 provinces in Indonesia, through the BPOM regional offices, as part of the 2024 VFMS program implementation. Pre-intervention data were collected from February–October 2024, and post-intervention data from March–December 2024, following the completion of community training and facilitation activities. The study participants were housewives with children aged 0–5 years who were members of community groups participating in the VFMS program. This group was selected for their key roles in household food preparation, child feeding, and food safety practices.

Participants were included if they: (1) Resided in villages participating in the VFMS program in 2024; (2) Had at least one child aged 0–5 years; (3) Participated in both the pre- and post-intervention surveys; and (4) Completed the questionnaire. Participants were excluded if they did not complete both survey phases or had incomplete questionnaires. A total sampling approach was applied, including all eligible participants from intervention villages who met the inclusion criteria and had complete pre- and post-intervention data.

### Data collection

Data were collected by trained enumerators from BPOM across all provinces using structured questionnaires administered at two time points: before the intervention (pre-intervention survey) and after completion of intervention activities (post-intervention survey). Data collection was conducted face-to-face in community settings, with respondents completing the questionnaires independently and enumerators providing clarification as needed. The primary instrument used in this study was the Housewives' Community Questionnaire, which assessed knowledge, attitudes, and practices related to food safety, nutrition, and stunting prevention. The main variables assessed in this study were respondents' knowledge, attitudes, and practices related to food safety, nutrition, and stunting prevention.

### Data analysis

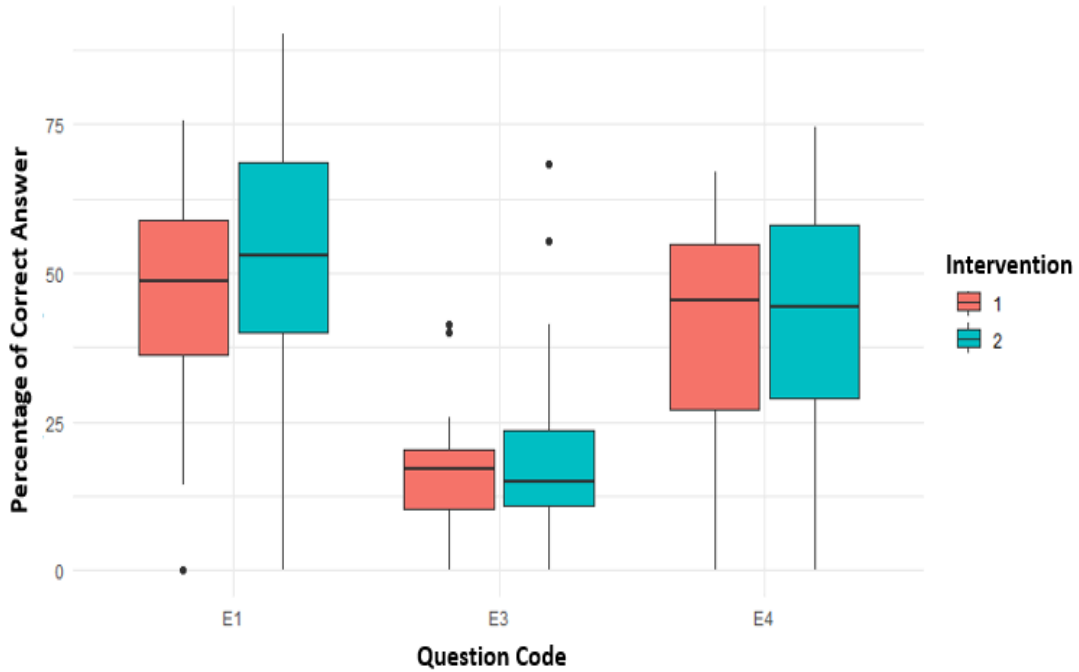
Data collected before and after the intervention were processed and analyzed using descriptive statistical methods. The analysis included calculation of

frequency distributions, percentages, measures of central tendency, and measures of dispersion for the study variables. Knowledge scores were calculated as the percentage of correct responses for each indicator. Univariate analysis was used to describe the distribution of knowledge, attitudes, and practices and to present observed differences between pre- and post-intervention measurements. Data analysis was conducted using R Statistical Software [14]. Only respondents who completed both the pre- and post-intervention questionnaires were included in the final analysis. Questionnaires with incomplete responses were excluded from the dataset. Data cleaning and verification were conducted prior to analysis to ensure the dataset's completeness and consistency.

The questionnaire was developed based on food safety and nutrition education materials used in the VFMS program and relevant national guidelines on food safety and stunting prevention. The instrument has been used by the Indonesian Food and Drug Authority (BPOM) for approximately three years for program implementation and monitoring. Content validity was ensured through expert review by BPOM specialists in food safety and public health, who assessed the relevance, clarity, and appropriateness of each item. Prior to national implementation, the questionnaire was pilot-tested with a small group of community participants to assess comprehension and feasibility. Feedback from the pilot testing was used to refine the wording and structure of the questionnaire before it was used in the pre- and post-intervention surveys. However, formal psychometric testing, including statistical assessment of validity and reliability (e.g., Cronbach's alpha), was not conducted in this study. As this study employed a descriptive-analytical approach without inferential statistical testing, the analysis was limited to describing differences and did not allow for causal interpretation of the findings.

## RESULTS

A total of 7,231 respondents from 232 villages across 34 provinces in Indonesia were included in the pre-post intervention survey. Respondents were selected using purposive sampling with a consecutive approach, based on predefined criteria: housewives with children aged 0–5 years who participated in the VFMS program. This approach was applied as part of a community-based program evaluation and was not intended to produce a nationally representative sample; therefore, the findings reflect the characteristics of the program participants rather than the general population.



E1 - What is stunting?  
 E3 - Types of foods that can prevent stunting  
 E4 - The impacts of stunting

Figure 1. Percentage of correct answers for questions related to stunting

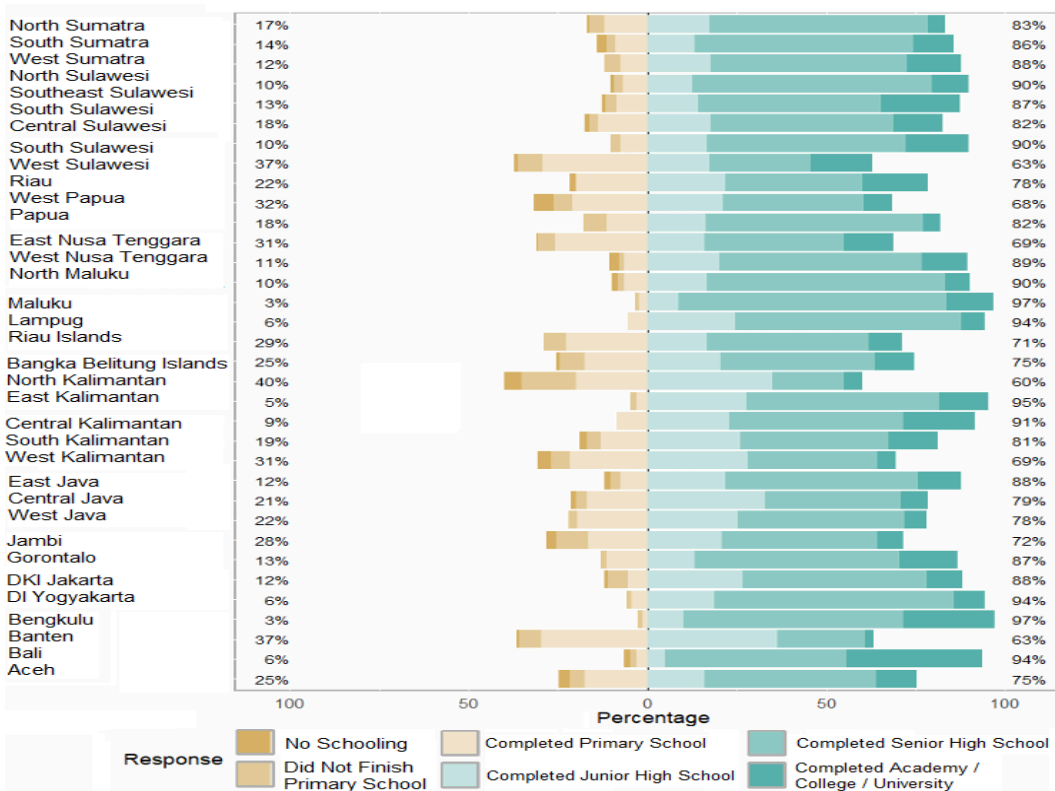


Figure 2. Educational level of respondents from the housewives' community

All respondents were women, with a mean age of 35 years, and classified as millennials. Overall, the results indicate that respondents' knowledge of stunting

remained low. Correct responses to "What is stunting" (E1) and "The impacts of stunting" (E4) were moderate, ranging from 48% to 55%, while knowledge of "Types

of foods that can prevent stunting” (E3) was very low, with scores below 25% (Figure 1). A more detailed examination of the E3 indicator showed that the low score was primarily driven by incorrect responses to the item assessing knowledge of appropriate food types for stunting prevention. The correct answer emphasized the importance of protein-rich foods; however, many respondents selected alternative options such as carbohydrate- or vitamin-rich foods, or assumed that all options were equally correct. This reflects a substantial gap in understanding the critical role of protein intake in preventing stunting. Although there was some improvement following the intervention, the overall level of knowledge had not yet reached the “adequate” level in Bloom’s classification, where scores of 80–100% indicate good knowledge, 60–79% moderate knowledge, and below 60% low knowledge (Figure 1).

The survey results also show that the majority of respondents from the housewives’ community had completed junior high school or higher education. The distribution of educational levels remained relatively consistent between the pre- and post-intervention surveys (Figure 2).

## DISCUSSION

This study highlights a gap in practical nutrition and food safety literacy among millennial mothers, particularly in recognizing foods that support child growth and translating general knowledge about stunting into everyday feeding practices. A specific example of this gap was observed in respondents’ limited understanding of appropriate food types for stunting prevention. Many participants were unable to correctly identify protein-rich foods as a key component, instead selecting carbohydrate- or vitamin-focused options, or assuming that all food types were equally appropriate. This reflects a gap in understanding of nutrition, particularly regarding the role of protein support in child growth. Although awareness of stunting may exist, it does not always translate into the ability to select appropriate foods, plan balanced meals, or apply proper feeding and hygiene practices at home. Previous studies in Indonesia have shown that limited maternal nutrition knowledge is associated with suboptimal feeding practices and an increased risk of stunting, highlighting the central role of caregivers in shaping early-life dietary patterns and child growth outcomes [5,7,8,18]. Maternal knowledge and feeding behavior are closely linked to children’s nutritional status, and limited understanding of balanced diets and appropriate food preparation practices may weaken stunting-prevention efforts [2,5,6]. Strengthening

caregiver literacy is therefore not only an educational priority but also an important factor influencing whether nutrition interventions can be sustained within households [17].

This finding suggests considerations for strengthening community-based interventions such as the VFMS. While VFMS has provided education on food safety and nutrition, current delivery approaches may not always incorporate practical and interactive learning formats. Evidence suggests that education relying solely on information provision may be insufficient to support lasting comprehension or behavioral change when messages are not presented in practical, context-relevant formats [11,15]. Studies on maternal education and feeding behavior indicate that caregivers are more likely to adopt healthy practices when information is clear, actionable, and aligned with daily routines [5,6]. For millennial mothers, digital literacy also shapes how they access and understand health information. Research shows that visual and mobile-based health communication can support parental understanding and reinforce daily practices [12,16]. Adapting VFMS education to include demonstrations, simple menu planning guidance, and visual or mobile-based tools may therefore improve message retention and application. Such adjustments strengthen program relevance without requiring major structural changes. These findings highlight the need for more practical and context-relevant education within VFMS to support better household feeding practices and the effectiveness of national nutrition programs.

### Implications for the Free Nutritious Meals Program

The findings of this study have several implications for the Free Nutritious Meals (FNM) program. Although this study does not directly evaluate the FNM program, the results provide indirect evidence that may inform its implementation. The FNM program is designed to complement household diets rather than replace them. According to the national nutrition and food safety module for ready-to-eat food handlers, meals provided through the program contribute only around 30–35% of daily energy requirements, meaning that most nutritional intake must still be fulfilled through foods prepared at the household level [13]. This suggests that the program’s implementation is closely related to caregivers’ ability to select safe, nutritionally adequate foods at home. When nutrition and food safety literacy are limited, the remaining dietary needs may not be adequately met, potentially limiting optimal program utilization at the household level. Limited caregiver nutrition literacy may also influence how program foods are stored, combined with household meals, and

utilized within the family, potentially affecting the overall nutritional benefits of the program. Maternal knowledge has been identified as a key factor influencing feeding practices and child nutritional outcomes [6,7]. Strengthening caregiver literacy through community platforms such as the VFSM may help align national supplementation programs with daily household practices. Integrating simple guidance on safe storage, portioning, and balanced meal preparation into community education activities may help ensure that program benefits extend beyond food provision.

The broader public health relevance of these findings lies in the close relationship between nutrition literacy, food safety, and child health. Limited knowledge of safe food handling and balanced feeding contributes not only to undernutrition but also to foodborne disease, which can further compromise nutrient absorption and growth [3,10]. Stunting is widely recognized as a multifactorial public health issue closely linked to inadequate dietary intake, infections, and suboptimal caregiving practices during early childhood [19]. Global reports emphasize that improving caregiver knowledge and early-life nutrition practices is a critical investment in human development and long-term national productivity [2,20]. In Indonesia, stunting reduction strategies highlight the importance of food safety as part of broader nutrition and food security efforts [4]. Improving nutrition and food safety literacy among caregivers may strengthen household feeding practices and reduce risks associated with inadequate diets and unsafe food handling, thereby contributing to better child health outcomes and supporting Indonesia's long-term human development goals.

Future research should examine scalable, responsive education models that accommodate generational learning preferences. Comparative studies evaluating conventional training against visual, digital, or hybrid approaches could help identify more effective strategies for improving caregiver understanding. Studies that follow participants over time are also needed to assess whether improvements in knowledge translate into sustained behavioral change and better child nutrition outcomes. Further investigation should examine how integrated nutrition and food safety education can strengthen the effectiveness of national programs across different settings. Such evidence would support the development of adaptive interventions that align community education with broader public health strategies [2,13].

Several limitations should be considered. The analysis relied on descriptive and univariate approaches without inferential statistical testing,

limiting the ability to examine relationships between variables. In addition, the one-group pre-post design without a control group restricts causal interpretation. The use of self-reported questionnaires may introduce response bias. Furthermore, the study assessed knowledge but did not directly observe feeding or food safety practices at home. The findings are drawn from a specific program context and may not be generalizable to all populations. Despite these limitations, the study provides useful insights into caregiver literacy gaps that are relevant to strengthening community-based education and supporting national nutrition initiatives.

Overall, improving practical nutrition and food safety literacy among caregivers is an important component in supporting the implementation and sustainability of community-based interventions and national nutrition programs. Education strategies that are more practical, visual, and contextually relevant strengthen household feeding practices and sustain improvements in child nutrition outcomes.

## CONCLUSION

Millennial mothers' understanding of stunting and food safety remains limited, particularly in recognizing foods that support optimal child growth and in applying safe feeding practices at home. This gap may affect the optimal utilization of the Free Nutritious Meals Program, which provides only about 30–35% of children's daily energy needs, with the remainder coming from foods prepared at home.

To address this gap, community-based education should be strengthened by integrating practical, simple, and actionable messages on balanced nutrition and safe food handling into existing platforms such as the VFSM. Policy efforts should prioritize context-relevant, visual, and mobile-friendly approaches to help caregivers translate knowledge into daily practice, thereby supporting the implementation of national stunting reduction programs. This study assessed caregivers' knowledge but did not directly observe actual feeding or food safety practices. Therefore, the findings should be interpreted with caution, as knowledge may not fully reflect real-world practices. Future studies incorporating longitudinal or inferential approaches are needed to better understand the relationship between caregiver literacy and household practices.

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#### Authors' contributions

N.A.F: 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 written informed consent was obtained prior to data collection. All personally identifiable information was handled confidentially and was not included in the analysis or publication. As this study was conducted as part of routine program monitoring and evaluation activities, formal ethical clearance with a reference number was not obtained. However, the study procedures followed standard ethical principles for research involving human participants.

#### Conflicts of interest

The author(s) declare no conflict of interest regarding the publication of this article.

#### Use of artificial intelligence (AI)

Portions of this manuscript were edited using ChatGPT (OpenAI) to improve grammar and clarity. All AI-assisted content was reviewed and validated by the authors, who take full responsibility for the final manuscript.

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