

Education on Stunting Prevention through the *Piring Protein E-Book* in Supporting Optimal Growth and Development of Toddlers in the Pondok Labu Community Health Center Working Area

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ABSTRACT

Stunting at an early age risk reducing educational achievement, decreasing cognitive abilities, and lowering income when the child reaches adulthood. In the working area of the Pondok Labu Community Health Center, three toddlers were identified with stunting, partly due to limited maternal knowledge regarding essential nutrition, particularly animal protein intake. This community service program aimed to improve mothers' knowledge, attitudes, and feeding practices to support optimal toddler growth and development through education using the *Piring Protein E-book*. The activity was conducted for three months at Posyandu Jeruk 2 in the working area of Pondok Labu Community Health Center, South Jakarta, involving 35 mothers of toddlers using quota sampling. The methods included interactive counseling, distribution of the *Piring Protein E-book* through digital media, and self-monitoring. Measurements were carried out using pre-test and post-test assessments. The variables measured were mothers' knowledge and attitudes using questionnaires, daily protein intake using a 24-hour food recall, and toddler nutritional status based on the height-for-age Z-score (HAZ). Data were analyzed using a paired sample t-test. The results showed a significant increase ($p < 0.001$) in mothers' knowledge and attitudes, with the average knowledge score rising from 55.2 to 88.9. Improvements were also observed in toddler nutritional status based on the HAZ score. Education using the *Piring Protein E-book* proved to be an effective intervention to improve maternal nutritional literacy and support optimal toddler growth and development.

Keywords : Development, E-Book, Growth, Stunting, Toddler

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INTRODUCTION

Child malnutrition remains a significant public health issue in Indonesia, with conditions such as stunting, underweight, and wasting continuing to affect children under five years of age (UNICEF, 2020). The global prevalence of stunting is classified as high because it is between 20% and <30%. Based on the 2021 Global Hunger Index (GHI), Indonesia ranks 73rd out of 116 countries with a moderate hunger score (Grebmer et al., 2021). Indicators included in the GHI are the prevalence of wasting and stunting in children under five years of age.

Specifically, stunting remains a major public health challenge in Indonesia. Based on data from the 2021 Indonesian Nutrition Status Survey (SSGI), the national prevalence of stunting reached 24.4% (Kementrian Kesehatan RI, 2021). This figure shows that nearly one in four children in Indonesia suffers from serious growth disorders, which not only affect physical growth but also child development (Kementrian Kesehatan RI, 2021).

Stunting reflects chronic undernutrition and may lead to long-term consequences, including impaired physical growth, reduced cognitive and mental development, increased susceptibility to infectious diseases, lower economic productivity in adulthood, and poor reproductive health outcomes (UNICEF, 2020). Stunting is one of the major nutritional problems among toddlers in Indonesia that has not yet been resolved. The 2021 Indonesian Nutrition Status Study (SSGI) in 34 provinces showed that the national stunting rate fell from 27.7% in 2019 to 24.4% in 2021 (Kementrian Kesehatan RI, 2021). The prevalence has decreased, but based on WHO criteria, it is still classified as high (>20%) (Kementrian Kesehatan RI, 2021).

The first 1,000 days of life are a golden period in a child's development (UNICEF, 2020). Malnutrition during this period has a direct impact on the structure and function of a child's brain (UNICEF, 2019). Stunted children tend to have lower IQs than children who grow normally, which impacts their academic achievement and long-term productivity. Stunting is a serious problem that not only affects children's health, but also poses a real challenge to realizing the Indonesia Emas 2045 Vision. To anticipate this, concrete, immediate, and specific steps are needed to address the issue of stunting. One such step is a community empowerment-based stunting intervention that increases the knowledge of mothers of toddlers about stunting, its effects, and its prevention so that toddlers can grow and develop optimally. Furthermore, stunting at an early age risks reducing educational achievement, decreasing cognitive abilities, and lowering income when the child reaches adulthood (E. Lestari et al., 2024; UNICEF, 2015; Vasquez & Daher, 2019; World Health Organization, 2025). Therefore, interventions in the form of education for parents are crucial in efforts to prevent stunting.

In South Jakarta, particularly in Cilandak Barat sub-district, it was found that many parents are still unaware of the importance of balanced nutrition from an early age. This is reinforced by observations in the Pondok Labu Community Health Center working area, where most parents do not understand the relationship between stunting and child growth and development. This lack of knowledge can lead to a lack of attention to children's daily nutritional intake, especially in terms of animal protein and essential micronutrients such as iron and zinc (Mulyani et al., 2025).

To address the limited nutritional knowledge among mothers of toddlers, effective and accessible educational strategies are required. Nutrition education interventions targeting mothers have been shown to significantly improve maternal knowledge, attitudes, and feeding practices that influence child nutritional status (Majidah & Paramashanti, 2021; Yusnaini et al., 2024). Recent studies also indicate that strengthening maternal capacity through nutrition counseling and education plays a crucial role in improving dietary practices and supporting optimal growth and development among children under five (Ginting & Hutabarat, 2025). In recent years, digital health education such as e-books and other online learning materials has emerged as a promising strategy because it allows flexible access, repeated learning, and wider dissemination of nutrition information. Digital nutrition education modules have been reported to effectively improve caregiver understanding of infant and young child feeding practices and increase maternal nutrition literacy (Simbolon & Simbolon, 2025; Zeldman et al., 2024). Therefore, the use of the "Protein Plate" e-book as an educational medium represents an innovative and practical approach to enhance maternal knowledge and encourage better feeding

practices in order to support optimal toddler growth and development.

According to this background, the outreach program was designed as a form of community service to improve mothers' understanding of stunting and its impact on toddler growth and development, as well as prevention methods through "Education on Stunting Prevention through the Piring Protein E-Book in Supporting Optimal Growth and Development of Toddlers in the Pondok Labu Community Health Center Working Area". The e-book presents concise, visual, and easy-to-understand educational material focusing on the importance of animal protein and balanced nutrition portions, including information on the definition of stunting, prevention during the first 1,000 days of life, the composition of the "Piring Protein" recommended by the Ministry of Health, and appropriate portion sizes for different age groups of children.

METHOD

The method used in this community service program was education about stunting using the *Piring Protein* E-book. The use of this method enables increased understanding and behavioral change in parents, because the *Piring Protein* E-book can be used as a guide at home, allowing mothers of toddlers to read it anytime and anywhere. The program was held in the Pondok Labu Community Health Center Working Area, which is one of the auxiliary community health centers located at Jl. Pd. Labu Raya No.7, RT.3/RW.7, Pd. Labu, Kec. Cilandak, South Jakarta City, Special Capital Region of Jakarta. The initial stage was carried out in June and the second stage was carried out in September 2025.

The steps to be taken are as follows:

1. Preparation Stage

a. Recruitment of Community Service Targets, Preparation of Core Media, and Initial Data Collection

The target of community service in the Pondok Labu Community Health Center working area is mothers with toddlers aged 6-36 months. The selection of targets is mothers who have the most toddlers at one of the integrated health service posts (posyandu) in the Pondok Labu Community Health Center working area, with priority given to posyandu that have toddlers at risk of stunting.

The steps taken were:

- 1) A meeting with the Pondok Labu Community Health Center to request data on which areas had the most toddlers and which had toddlers at risk of stunting, as many as 7 children. Specifically, the highest number of toddlers at risk of stunting was at the Posyandu Jeruk 2, as many as 3 children. After the target location for the community service program was selected, the service team then conducted a socialization program on the objectives of the community service program.
 - 2) Setting the target of 35 toddlers aged 6-36 months as the subjects of the community service program, along with their mothers who are willing to participate in the entire series of activities.
 - 3) Provision of core Community service program media finalization of the *Piring Protein* E-book: Compiling E-Book material that is more concise, visual, and easy to understand, focusing on the importance of animal protein and guidelines for balanced nutrition portions. The E-Book contains the definition of stunting, stunting prevention during the first 1,000 days of life, the composition of the "Piring Protein" as recommended by the Ministry of Health, and appropriate portion sizes for different age groups of children. This e-book combines textual explanations and visual illustrations to facilitate respondents' understanding.
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Figure 1. Captures of *Piring Protein* E-book

4) Initial Measurement (Pre-test and Baseline Data)

- a) Pre-test: Administering Knowledge and Attitude Questionnaires to all targets to measure their initial conditions. The questionnaire consists of 15 questions for measuring knowledge and 10 questions for attitude, as well as takes 10–15 minutes to complete.
- b) Initial Anthropometric Data Collection: Measuring the nutritional status of target toddlers, including: Weight (W), Height (H), and Upper Arm Circumference (UAC). This data is converted into Z-Scores (W/U, H/U) as baseline data.

2. Intervention Implementation Stage (Counseling)

This stage is the core of the service, where education and media distribution are carried out.

a. Interactive Counseling Implementation

- 1) Time: Conducted in 1-2 main sessions (approximately 30 minutes per session) at the target location of the Jeruk 2 Posyandu.
- 2) Methods:
 - a) Interactive Education: Delivering basic material on stunting and 1000 HPK through interactive electronics books.
 - b) Discussion and Demonstration: Explaining in detail the contents of the *Piring Protein* E-book, including how to determine animal protein portions and practical menu ideas.
 - c) Question and Answer Session: Providing an opportunity for mothers to ask questions directly about feeding challenges.



Figure 2 Intervention Implementation Stage

b. Media Distribution and Monitoring

- 1) E-Book Distribution: Distribute the Piring Protein E-book in digital form (PDF file/download link) to each participant's smartphone, and provide soft copies to cadres for distribution. The cadres helped inform mothers of toddlers about the activities, monitor the mothers' feeding practices, and remind them to use the Protein Plate approach with their children.
- 2) Digital Updates (Follow-up): Creating a digital communication group (e.g., WhatsApp group) for self-monitoring over a 3-month period. The implementation team will provide weekly reminders, answer questions, and share additional protein recipes.

3. Evaluation and Reporting Stage (Post-Intervention)

This stage serves to measure the impact and effectiveness of the intervention.

a. Short-Term Evaluation (Immediately After Counseling)

Post-test 1: Re-administer the Knowledge and Attitude Questionnaire immediately after counseling is completed (on the same day) to measure immediate improvements in knowledge and attitude.

b. Mid-Term Evaluation (3 Months After Intervention)

Post-test 2 (Key Data on the community service Results): Conducted 3 months after the counseling intervention.

- 1) Sustained Knowledge and Attitude Measurement: Repeating the Questionnaire to observe the sustainability of changes in knowledge and attitude.
- 2) Final Anthropometric Data Measurement: Re-measuring the weight and height/length of target toddlers to calculate changes in height/length Z-scores.



Figure 3 Post Intervention Stage

Data Analysis and Reporting

1. Statistical Analysis: Compare Pre-test and Post-test 2 data using appropriate statistical tests (Paired Sample T-Test or McNemar's Test) to prove the significance of the changes.
2. Reporting: Compiling a final Community service program report that includes methods, Community service program results, discussions related to journals, and recommendations for program sustainability.

RESULTS

The results of community service activities are described as follows:

1. Improvement in Knowledge and Attitudes of Mothers of Toddlers Before and After Counseling Through Digital Media

Table 1 Participants' Knowledge and Attitude Levels (Mothers of Toddlers) Before and After Counseling

No.	Variables	Indicators	Pre-test Results (Average Score/Percentage Correct)	Post-test Results (Average Score/Percentage Correct)	Increase (%)	p-value
1	Knowledge	Stunting and Its Impact	55.2±10.5 (Skor)	88.9±5.1 (Skor)	61	<0.001
		The Importance of Animal Protein	40%	95%	137.5	<0.001
2	Attitude	High-protein feeding practices	60.5±8.2 (Skor)	92.1±4.5 (Skor)	52.2	<0.001
		Belief Can Prevent Stunting	50%	90%	80.0	<0.001

Based on Table 1, the educational intervention using the *Piring Protein* E-book proved to be very effective in improving the knowledge and attitudes of mothers of young children.

- a. **Significant Increase in Knowledge:** The average knowledge score about stunting and its effects increased sharply, from 55.2 (pre-test) to 88.9 (post-test), with an increase of 61.0%. The most striking improvement was seen in the understanding of the importance of animal protein, where the percentage of correct answers jumped from 40% to 95%.
- b. **Positive Attitude Change:** A significant change in attitude indicates that the educational material was well received. The interest score for using e-books as nutrition guides increased by more than 50%. Most importantly, mothers' confidence in their ability to prevent stunting rose by 80% (from 50% to 90%).

2. Optimization of Toddler Growth and Development After Intervention (3 Months After Counseling)

The effectiveness of the *Piring Protein* e-book counseling intervention was evaluated by comparing the growth indicators and nutritional intake of toddlers before and after the three-month intervention period. The measured indicators included height-for-age (HAZ/TB-U), weight-for-age (WAZ/BB-U), and daily protein intake. The results showed improvements across all measured variables. Significant increases were observed in both anthropometric indicators and dietary intake following the intervention.

Table 2 Optimization of Toddler Growth and Development After Intervention (3 Months After Counseling)

No	Growth Indicators	Unit of Measurement	Initial Conditions (Pre-Intervention) (Mean±SD)	Final Condition (Pre-Intervention) (Mean±SD)	Percentage of Improvement (%)	p-value
1	Height by Age (TB/U)	Z-Score (SD)	-2.1±0.5	-1.5±0.4	28.6	0.015
2	Weight by Age (BB/U)	Z-Score (SD)	-2.1±0.3	-0.8±0.2	33.3%	0.021
3	Daily protein intake	Grams/Day	15±3.5	22±4.0	46.7%	<0.001

Table 2 shows an improvement in nutritional status, with the TB/U Z-score measurement increasing from -2.1 to -1.5 and the BB/U Z-score measurement shifting by 0.6 SD, indicating a significant recovery trend. The daily protein intake of toddlers increased significantly (46.7%), from an average of 15 grams/day to 22 grams/day.

Significant improvements were observed in the anthropometric indicators of toddler growth. The average height-for-age Z-score increased from -2.1 ± 0.5 at baseline to -1.5 ± 0.4 after the intervention, representing a 28.6% improvement ($p = 0.015$). Similarly, the weight-for-age Z-score improved from -2.1 ± 0.3 to -0.8 ± 0.2 , corresponding to a 33.3% increase ($p = 0.021$). These findings indicate a positive change in the nutritional status of toddlers after three months of counseling using the *Protein Plate* e-book.

In addition to improvements in growth indicators, a substantial increase was also observed in toddlers' daily protein intake. The average protein consumption increased from 15 ± 3.5 grams/day before the intervention to 22 ± 4.0 grams/day after the intervention, reflecting a 46.7% increase ($p < 0.001$). This result suggests that the educational intervention successfully improved caregivers' feeding practices, particularly in increasing the provision of protein-rich foods for toddlers.

DISCUSSION

The results of this Community Service show a very significant increase in participants' knowledge and attitude scores ($p < 0.001$), especially in understanding the importance of animal protein. This increase is consistent with the Health Belief Model Theory, in which increased knowledge (perception of stunting risk) triggers changes in attitude and readiness to act (Becker, 1974). The use of e-books as an educational medium has proven to be effective because it offers easy access and visual (portable) material. This is in line with the findings of many studies, which stated that digital media-based nutritional interventions, such as e-books, are more effective in improving mothers' nutritional literacy than conventional education because they can be repeated and accessed at any time (Hasan & Arief, 2024; D. P. Lestari et al., 2026; Mawaddah & Siregar, 2026).

The results obtained prove the medium-term impact of increased knowledge and attitudes, as reflected in changes in toddler growth and development indicators after three months of intervention, where there was an improvement in nutritional status based on TB/U and BB/U and an increase in nutritional intake. Increased knowledge is directly correlated with improved feeding behavior that is crucial considering that animal protein is the key to preventing stunting (Berutu et al., 2024; Dewi & Aminah, 2016; Nafista et al., 2023). This improvement proves that educational interventions based on digital media are effective in promoting better feeding practices, thereby preventing new cases of stunting and helping to recover existing cases.

The improvement in nutritional behavior resulting from the education shows a measurable positive impact on the nutritional status of toddlers. The TB/U Z-Score of toddlers improved significantly (from -2.1 to -1.5). This decline in stunting prevalence supports the findings which show that intensive nutritional interventions that include parental or caregiver education have been shown to improve maternal knowledge, feeding practices, and ultimately contribute to better nutritional status and growth outcomes among toddlers (Azkia & Setiarini, 2025; Prasetyo et al., 2023; Rahmadani et al., 2025). Although the improvement in Z-Score was only 0.6 SD, this is a remarkable achievement within a three-month period. According to the WHO (2018), even the smallest change in Z-Score TB/U is an indicator of program success at the community level because linear growth is difficult to improve after the age of two (World Health Organization, 2018).

Increased understanding of animal protein (jumping from 40% to 95%) (Table 1) directly correlates with an increase in daily protein intake among toddlers (from 15 ± 3.5 to 22 ± 4.0 grams/day) after the intervention (Table 2). Increased animal protein intake is at the core of this intervention. Headey et al (2018) and Parikh et al (2022) emphasize that animal protein has more complete essential amino acids (high biological value) compared to plant protein, and its intake is consistently the key factor most correlated with improved linear growth (TB/U) in children. Animal-source proteins contain a more complete profile of essential amino acids and have higher biological value compared with most plant proteins. Adequate consumption of

animal-source foods such as eggs, meat, fish, and dairy has been consistently associated with improved linear growth and reduced risk of stunting among young children (Headey et al., 2018; Parikh et al., 2022). These results reinforce the urgency of using the term “*Piring Protein*” in the e-book title, as it has proven successful in focusing mothers' attention on the critical nutritional components needed by toddlers.

Overall, this community service program supports the growing body of evidence that community-based nutrition education combined with accessible digital media can be an effective strategy for improving maternal nutrition literacy and child feeding practices. By improving knowledge, attitudes, and feeding behaviors simultaneously, interventions such as the *Piring Protein* e-book can contribute to the prevention of new stunting cases and support the recovery of children who already experience growth faltering. Therefore, integrating digital nutrition education into community health programs may become an important strategy to accelerate stunting reduction at the community level.

CONCLUSION

Stunting education using the *Piring Protein* E-book media in the Pondok Labu Community Health Center working area had a positive impact on improving the knowledge and attitudes of mothers of toddlers in high-protein feeding practices. This intervention also showed improvements in the growth and development status of toddlers based on TB/U and BB/U Z-Scores. Thus, digital media-based nutrition education can be an effective strategy in supporting the optimization of toddler growth and development as well as efforts to accelerate stunting reduction at the community level. Through the support of cadres, mothers of toddlers are encouraged to form nutrition discussion groups (e.g., via WhatsApp) to share experiences, consistently practice the guidelines in the *Piring Protein* E-book, and involve families in supporting optimal nutrition for toddlers.

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