

## Local Fish-Based Nutritious Menu Innovation for Stunting Prevention through Posyandu Cadre Capacity Strengthening in Sungai Piring

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### Abstract

**Background:** Stunting remains a significant global public health challenge. In 2024, an estimated 23.2% of children under five, approximately 150.2 million globally, were affected by stunting, defined as height-for-age below  $-2$  standard deviations of the WHO Child Growth Standards. Although Indonesia has demonstrated a downward trend in stunting prevalence, declining from 24.4% in 2021 to 21.6% in 2022 and 19.8% in 2024, the rate remains above the national target of 14% for accelerated stunting reduction, indicating the need for sustained multisectoral interventions. Strengthening community-based strategies that utilize locally available animal protein sources, such as fish, is essential. Posyandu cadres play a strategic role in delivering nutrition education and influencing child feeding practices at the grassroots level.

**Aims:** This community engagement program aimed to strengthen posyandu cadres' capacity in stunting prevention through nutrition education and innovation of nutrient-dense local fish-based complementary food (fish floss/abon ikan).

**Methods:** The program was conducted on 20 September 2025 at Posyandu Durian, Tasik Raya Village (Sungai Piring Health Center area), involving 20 cadres. Activities included structured nutrition education and a hands-on demonstration of fish floss preparation. Knowledge improvement was assessed using pre- and post-tests.

**Results:** The average knowledge score increased from 65 (pre-test) to 84 (post-test), representing a 29% improvement. Cadres acquired practical skills in processing locally available fish into an acceptable complementary food, which was well received by mothers and toddlers.

**Conclusion:** Integrating participatory education with practical food innovation effectively strengthened cadres' competencies and demonstrates potential as a sustainable community-driven strategy for supporting long-term stunting prevention

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## INTRODUCTION

Stunting among children under five remains a major public health concern globally and nationally. In 2024, approximately 23.2% of children under five, equivalent to about 150.2 million children, were affected by stunting, defined as a height-for-age below  $-2$  standard deviations (SD) of the WHO Child Growth Standards (UNICEF et al., 2025). In Indonesia, although the prevalence has declined from 24.4% in 2021 to 21.6% in 2022, it remains above the national target of 14%, indicating the need for sustained and effective community-based interventions (Kementerian Kesehatan Republik Indonesia, 2023).

One of the key contributing factors to stunting is inadequate intake of animal-source protein during the first 1,000 days of life, which is essential for optimal growth and development (Byrd et al., 2022; Semba et al., 2016). Local fish represents an accessible and affordable source of high-quality protein and essential micronutrients, particularly in coastal and riverine communities (Ngaisyah & Rohman,

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2019; Parikh et al., 2021). Previous studies have shown that fish-based complementary feeding can improve dietary quality and support child growth outcomes (Asare et al., 2022; Ngaisyah & Rohman, 2019).

At the community level, posyandu cadres play a crucial role as frontline health volunteers responsible for growth monitoring, nutrition education, and maternal-child health services (Nida et al., 2024). Strengthening their capacity is essential to ensure the effectiveness of nutrition interventions (Febria et al., 2024; Siswati et al., 2022). However, in the Sungai Piring area, although local fish resources are abundant in the area, they have not been fully utilized to develop innovative complementary foods for toddlers. In addition, previous programs have mainly focused on theoretical education, with limited integration of practical, product-based innovation that can be directly applied by cadres in posyandu activities (Bustami et al., 2023; Sukmawati et al., 2025).

This gap highlights the need for an integrated approach that combines nutrition education with practical skills in utilizing local food resources. Therefore, this community-based intervention was designed to strengthen the capacity of posyandu cadres through nutrition education and hands-on demonstration of fish floss processing as a nutrient-dense complementary food for toddlers at risk of stunting.

## METHOD

This community service activity employed a community-based participatory design using a one-group pre-test and post-test approach. The intervention was implemented through nutrition education and a hands-on demonstration of local fish processing as part of a program aimed at strengthening the capacity of posyandu cadres in stunting prevention. The participatory approach was selected to encourage active involvement of cadres and to ensure that the intervention was aligned with local resources and community needs.

Participants consisted of 20 active posyandu cadres from Tasik Raya Village, within the working area of Puskesmas Sungai Piring, Indragiri Hilir District. The activity was conducted on 20 September 2025 at Posyandu "Durian," Tasik Raya Village. The total duration of the program was approximately four hours comprising the following stages:

### 1. Pre-Test and Post-Test Assessment

Prior to the intervention, participants completed a structured questionnaire to assess their baseline knowledge of child nutrition and stunting prevention. The instrument consisted of 10 multiple-choice questions covering key topics, including the definition and causes of stunting, nutritional needs during the first 1,000 days of life, the importance of animal-source protein, and practical strategies to improve toddler feeding practices. Each correct answer was scored as one point, with a maximum total score of 10.

The pre-test was administered before the educational session, and the post-test was administered immediately after the intervention to evaluate changes in participants' knowledge. Participants were given approximately 10–15 minutes to complete each test.

### 2. Nutrition Education

The nutrition education session was delivered by lecturers from Poltekkes Kemenkes Riau using interactive lectures, group discussions, and visual materials such as leaflets and posters. The session was conducted as a single structured meeting lasting approximately 60–90 minutes. The content covered the definition, causes, and consequences of stunting, as well as nutritional requirements during the first 1,000 days of life. Particular emphasis was placed on the importance of animal-source protein, especially fish, in supporting optimal child growth and development. In addition, practical strategies to increase fish consumption among toddlers were discussed, taking into account locally available food resources.

The session applied adult learning (andragogy) principles, encouraging participants to engage actively in discussions, share their experiences, and reflect on local challenges related to child feeding

practices. This participatory approach aimed to enhance understanding while ensuring that the content was relevant to the cadres' daily roles in the community.

### 3. Fish Floss Processing Demonstration

The demonstration of fish floss processing was conducted after the nutrition education session and lasted approximately 60–90 minutes. The activity was facilitated by the research team, who demonstrated each step of the process, including preparation of raw materials, cleaning, cooking, seasoning, and appropriate storage techniques to ensure food safety and quality.

Participants were actively involved throughout the session and were encouraged to directly practice each step after the demonstration. Cadres participated in preparing the ingredients, cooking, and processing the fish into fish floss under the guidance of facilitators. This hands-on approach allowed participants to gain practical experience and enhance their confidence in replicating the process independently during posyandu activities.

The participatory and practice-based learning model aimed to strengthen not only knowledge but also practical skills, ensuring that cadres could apply the innovation in real community settings.

## RESULTS AND DISCUSSION

### Results

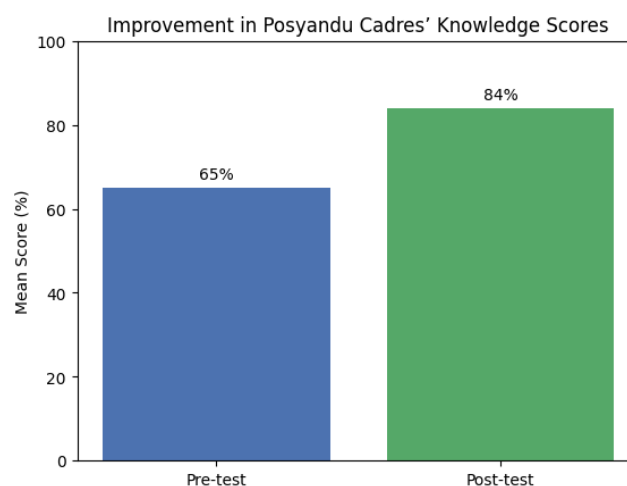
#### *Participant Characteristics*

All 20 invited posyandu cadres completed the activity (100% participation rate). The majority of participants were within the productive age range of 30–45 years and had served as cadres for more than five years. Regarding educational background, 67% had completed senior high school, while 33% held a diploma degree. A notable finding was that 80% of the cadres had never previously received specific training related to stunting prevention. This condition indicates a gap in technical capacity at the community level, particularly in evidence-based nutrition education and local food innovation strategies.

#### *Improvement in Cadres' Knowledge*

Pre-test results showed an average knowledge score of 65, indicating a moderate level of baseline understanding. Several aspects were identified as relatively weak, including:

- Understanding of the definition and long-term consequences of stunting
- Knowledge of animal-source protein requirements during the first 1,000 days of life
- Diversification of complementary feeding based on locally available foods



**Figure 1.** Improvement in posyandu cadres' knowledge scores before and after the training on fish floss menu innovation at Posyandu "Durian," Tasik Raya Village, Sungai Piring Health Center working area.

Following the intervention, which combined structured nutrition education and practical demonstration, the average post-test score increased to 84, representing a 29% improvement. All cadres demonstrated score increases, with several participants showing gains of up to 30 points. This increase suggests that short-term participatory interventions can produce significant cognitive improvements within a relatively brief period.

### ***Implementation of Nutrition Education and Fish Floss Processing Demonstration***

The program was conducted in two main phases:

1. Structured nutrition education
2. A hands-on demonstration of fish floss preparation using locally available fish (*Pangasius* sp.)

During the educational session, cadres actively engaged in discussions regarding the causes of stunting, the importance of animal-source protein, and strategies for diversifying local complementary foods.



**Figure 2.** Implementation of Nutrition Education for Posyandu Cadres at Posyandu "Durian," Tasik Raya Village, Sungai Piring Health Center Working Area

In the demonstration phase, cadres were directly involved in the entire process, including cleaning, processing, cooking, and storing the fish floss.



**Figure 3.** Cadres' Participation in the Demonstration and Introduction of Ingredients for Fish Floss Preparation.

The final product was then introduced and tasted by mothers and toddlers attending the session. Observations indicated good sensory acceptance, as reflected by the toddlers' enthusiastic consumption. This finding suggests that fish floss has strong potential as a culturally acceptable and practical complementary food alternative at the household level.

### **Discussion**

The 29% increase in knowledge scores following the intervention indicates that integrating nutrition education with hands-on training is effective in strengthening the capacity of posyandu cadres. This

improvement reflects not only enhanced knowledge but also increased readiness to apply nutrition-related practices at the community level. Consistent with previous studies, participatory training approaches have been shown to improve both competence and confidence among community health volunteers in delivering promotive and preventive services (Durrance-bagale et al., 2022; Werfalli et al., 2020).

The effectiveness of this program is closely related to the application of adult learning (andragogical) principles, which emphasize experiential learning and contextual relevance (Jamilah et al., 2023; Nicholas, 2011; Tampake et al., 2021). By combining theoretical knowledge with practical demonstration, cadres were able to better understand and apply nutrition concepts within their routine posyandu activities (Knowles et al., 2023). This approach has been widely recognized as effective in improving knowledge retention and supporting behavioral change in community health settings (Mediani et al., 2022; Weningtyas et al., 2023).

From a nutritional perspective, the introduction of fish floss as a locally based complementary food provides a practical strategy to improve the intake of animal-source protein, which is essential for child growth and development (Ngaisyah & Rohman, 2019). Fish contains high-quality protein and important micronutrients such as iron and zinc that support linear growth and immune function (Byrd et al., 2022; Ngaisyah & Rohman, 2019; Parikh et al., 2021). Previous evidence has shown that complementary feeding interventions incorporating animal-source protein are associated with improved growth outcomes and reduced risk of stunting in young children (Asare et al., 2022; Semba et al., 2016).

The use of locally available fish also strengthens a food-based approach to nutrition intervention, as recommended by the World Health Organization (WHO, 2023). This strategy not only addresses nutrient gaps but also enhances sustainability by utilizing accessible and culturally acceptable food resources. In this context, fish floss serves as a practical and adaptable innovation that can be implemented at the household level (Salsabella et al., 2025).

In addition, cadres who gained direct experience through hands-on practice have the potential to act as agents of change within the community. According to the Diffusion of Innovation Theory (Prayitno et al., 2025) individuals are more likely to adopt and disseminate innovations when they have practical experience and perceive clear benefits. The cadres' willingness to replicate the preparation of fish floss suggests a promising pathway for wider community adoption (Durrance-bagale et al., 2022; Srivarathan et al., 2019).

Overall, this intervention demonstrates that integrating education with practical skill development can strengthen both individual capacity and community-level nutrition practices. By linking cadre empowerment with locally relevant food innovation, the program contributes to sustainable, community-based strategies for stunting prevention (Sefrina et al., 2023; Shi et al., 2009).

### **Implication**

The findings of this program underscore that empowering posyandu cadres through an integrated approach combining education and practical training constitutes an effective community-based intervention strategy for stunting prevention. As frontline volunteer health workers, cadres maintain sustained and direct engagement with mothers and toddlers, positioning them as key actors in influencing feeding practices, growth monitoring, and the early identification of nutritional problems. Strengthening their knowledge and practical competencies ultimately generates a multiplier effect, whereby enhanced individual capacity contributes to broader behavioral change and improved health practices at the household and community levels.

Empowerment in this context extends beyond knowledge transfer; it involves enhancing cadres' confidence, practical skills, and decision-making capacity to implement contextually relevant nutrition strategies. According to community empowerment theory, capacity-building interventions that combine cognitive and experiential learning foster greater ownership and sustainability of health innovations (Weningtyas et al., 2023). Jamilah et al. (2023) emphasized that active and well-trained cadres significantly contribute to stunting prevention through consistent education, growth monitoring, and follow-up support for families. Similarly, optimizing collaboration between

posyandu cadres and local health centers has been shown to increase maternal engagement and participation in child nutrition programs, thereby strengthening community-level prevention efforts.

Empowerment strategies that integrate adult learning principles with practical training have been shown to enhance the competencies and confidence of frontline health volunteers, thereby improving their role in community health promotion and stunting prevention (Durrance-bagale et al., 2022; Werfalli et al., 2020). By strengthening the skills and decision-making capacity of health cadres, participatory training approaches contribute not only to individual knowledge gains but also to broader community-level behavioral changes, reflecting a multiplier effect in health practice adoption (Tampake et al., 2021).

### **Research Contribution**

This community-based intervention contributes to the strengthening of sustainable stunting prevention efforts at the grassroots level by integrating structured nutrition education with locally adaptable food innovation. Unlike conventional cadre development programs that primarily focus on theoretical knowledge, this intervention combined cognitive learning with experiential, hands-on practice. This integrated approach enhanced both knowledge acquisition and practical competence, thereby improving implementation readiness within the community health setting.

The program also demonstrates the strategic value of utilizing locally available animal-source foods to support complementary feeding practices. By introducing fish floss derived from locally sourced fish, the intervention provides a culturally acceptable, affordable, and resource-sensitive alternative that can be sustained within existing posyandu structures. This model offers a practical and replicable framework for community-level stunting prevention initiatives in similar low-resource contexts.

Furthermore, the intervention reinforces the importance of community empowerment as a foundational principle in public health programming. Strengthening cadres' capacity not only improves individual competencies but also creates a multiplier effect, whereby enhanced knowledge and skills at the cadre level influence household feeding practices and community health behaviors more broadly. In this regard, the intervention contributes to strengthening community resilience and supporting long-term improvements in maternal and child nutrition outcomes

### **Limitations**

Several limitations of this community-based intervention should be acknowledged. First, the program employed a single-group pre-test and post-test design without a control group; therefore, improvements in knowledge cannot be attributed solely and causally to the intervention. Second, the number of participants was relatively small ( $n = 20$ ) and limited to a single posyandu setting, which caution is warranted when generalizing the findings to broader contexts. Third, the evaluation focused primarily on short-term knowledge improvement and observational assessment of the acceptability of the fish floss product. This community-based intervention did not measure long-term behavioral changes, quantitative improvements in nutrient intake, or direct impacts on child growth status. Future implementation initiatives incorporating longitudinal monitoring and objective nutritional indicators would provide stronger evidence regarding the sustained effectiveness of the program.

### **Suggestions**

It is recommended that capacity-building activities for posyandu cadres be conducted regularly and integrated into primary health center programs to ensure the sustainability of cadres' roles in stunting prevention. Strengthening collaboration among health centers, local governments, and community stakeholders is also essential to support the replication and sustainability of locally based food innovation initiatives. In addition, continued mentoring and the development of diverse nutrient-dense menus based on local food resources should be considered to expand the impact of the intervention at the household and community levels.

## CONCLUSION

This community-based intervention successfully strengthened posyandu cadres' capacity in stunting prevention through integrated nutrition education and hands-on local fish-based food innovation. The program resulted in a substantial increase in knowledge scores (from 65 to 84) and improved cadres' practical skills in preparing fish floss as a nutrient-dense complementary food.

These findings indicate that combining participatory education with practical training is an effective strategy to enhance community-level nutrition practices and support sustainable stunting prevention efforts.

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## AUTHOR CONTRIBUTION STATEMENT

YA, conceptualized and designed the community service program, developed the educational materials, led the implementation of the intervention, conducted data analysis, and drafted the original manuscript. R, contributed to coordination with community partners and the primary health center, assisted in delivering the educational sessions, facilitated the fish floss demonstration activities, and supported data collection and manuscript revision. Both authors reviewed, revised, and approved the final version of the manuscript.

## AI DISCLOSURE STATEMENT

The author used ChatGPT (OpenAI) during the preparation of this work for language editing, structural refinement, and improvement of academic clarity. After using the tool, the author carefully reviewed, revised, and validated all content and assumes full responsibility for the integrity of the manuscript.

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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