

Original Research

Additional Meal BABY CHIPS PROKA on Increasing Body Weight of Stunted Toddlers

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ABSTRACT

Background: Inadequate nutritional intake can hinder the growth and development of toddlers, particularly those suffering from stunting. One strategy to address stunting is to improve toddler nutrition by providing foods rich in omega-3, protein, and calcium, such as catfish. BABY CHIPS PROKA, made from catfish bone flour, is one such complementary feeding innovation. This study aims to investigate the effect of BABY CHIPS PROKA, a catfish bone-based complementary food product, on the weight gain of stunted toddlers.

Methods: This research employed a quantitative approach using a true experimental design with a two-group pre-post control test. The population consisted of 333 stunted toddlers. A cluster sampling technique was applied, resulting in a sample of 68 toddlers, divided equally into intervention and control groups. Statistical analysis included the Wilcoxon Signed-Rank Test to assess differences before and after the intervention within each group.

Results: The Wilcoxon Signed-Rank Test showed a significant difference in weight gain in the intervention group ($p = <0.001 < 0.05$).

Conclusion: The provision of BABY CHIPS PROKA as a complementary food significantly improves the body weight of stunted toddlers. Therefore, BABY CHIPS PROKA is recommended as a complementary nutritional intervention to support weight gain and improve the nutritional status of stunted toddlers.

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INTRODUCTION

Stunting is a condition resulting from chronic nutritional deficiencies that impede a child's growth and development, potentially affecting their social, emotional, and physical capabilities. Stunting remains a significant nutritional issue in Indonesia (Kemenkes, 2018). In 2018, Indonesia ranked 27th out of 154 countries in terms of stunting prevalence according to UNICEF and WHO surveys. Among Asian countries, Indonesia held the 5th-highest rate. In 2022, the national stunting prevalence was recorded at 21.6%, with East Java reporting a rate of 19.23%, which remains above the red zone threshold of 18.4%. Within East Java, Jember Regency recorded the highest

prevalence at 34.9%(SDG's Indonesia, 2022). Data collected through a preliminary study on December 11, 2024, indicated that Arjasa District had a population of 333 stunted toddlers with below-standard body weight.

If left unaddressed, stunting can lead to severe consequences including suboptimal growth, cognitive delays, lower intelligence, increased susceptibility to disease, and reduced productivity in adulthood (Umiyah & Hamidiyah, 2020). Siagian et al. (2020) classified the causes of stunting into direct and indirect factors, including infections and inadequate nutritional intake such as protein and calcium deficiencies (Beressa et al., 2025; Juniarti et al., 2025). Therefore, improving the quality of complementary feeding is considered one of the key strategies for preventing and managing stunting during early childhood.

Adequate nutrition in toddlers is closely linked to appetite. Catfish (*Clarias* sp.) is a nutrient-rich food source with high protein and low cholesterol. It contains 15–24% protein, 0.1–22% fat, 1–3% carbohydrates, 59.49% ash, and 66–84% water (Utomo Fitriyadi Cahyo, 2023). One of the by-products of catfish processing is the bones, which are rich in protein and calcium, essential for improving the weight of stunted toddlers. Per 100g of catfish bone flour contains 23.84% protein, 0.98% fat, 4.35% carbohydrates, 17.47% calcium, 59.49% ash, and 11.34% (Utomo Fitriyadi Cahyo, 2023). Utilizing catfish bone waste as an ingredient in modified complementary feeding (MP-ASI) in the form of crackers offers an alternative for parents struggling with nutritional interventions. Toddlers generally require 1.350 kcal per day, including 20 grams of protein, and the protein in catfish bones contributes to nearly half of this requirement (Ajeng Quamila, 2022).

Several studies have explored innovations in catfish bone-based foods. Purwanto et al., (2023) developed catfish bone crackers as a stunting prevention effort. Previous studies demonstrated that fortifying food products with catfish bone flour significantly increased their protein and calcium content, including in noodles and sweet corn milk. During a preliminary study conducted at the Arjasa Community Health Center, researchers observed that toddlers showed a preference for crunchy foods, such as crackers, rather than porridge or other soft-textured complementary foods (MP-ASI). This observation inspired the development of an innovative complementary food in the form of catfish bone crackers, named BABY CHIPS PROKA, which was designed to improve toddlers' acceptance while providing additional nutritional benefits (Purwanto et al., 2023).

Based on these findings, the researchers developed an innovative complementary food product, BABY CHIPS PROKA, formulated with catfish bone flour as a nutrient-rich ingredient to support the nutritional needs of stunted toddlers. The novelty of this study lies in the development of a crunchy, child-preferred complementary food that combines the nutritional benefits of catfish bone flour with improved acceptability among toddlers. This study aimed to evaluate the effectiveness of BABY CHIPS PROKA in improving the body weight of stunted toddlers at the Arjasa Community Health Center (Puskesmas Arjasa), Jember Regency. The findings are expected to contribute evidence for the development of locally sourced, affordable, and acceptable complementary feeding interventions to support stunting prevention and management programs.

MATERIALS AND METHOD

This study applied a true experimental quantitative design using a two-group pre-post control test. The participants were assigned to two groups: the intervention group receiving BABY CHIPS PROKA and a control group that did not receive the product. Measurements were taken before and after the intervention. This study employed a quasi-experimental quantitative design with a pretest–posttest control group design. Participants were assigned to an intervention group that received BABY CHIPS PROKA and a control group that did not receive the product. Body weight measurements were conducted before (pretest) and after (posttest) the intervention to evaluate the effectiveness of BABY CHIPS PROKA.

The study population consisted of 333 toddlers with below-standard weight, residing in the working area of Arjasa Public Health Center, Jember Regency. Cluster random sampling was used to select 68 toddlers, representing one village randomly chosen to represent the entire district. These were equally divided into two groups of 34 each. An additional 10% of the sample was included to anticipate potential dropout, maintaining 34 participants in each group.

The independent variable in this study is Catfish Bone Crackers BABY CHIPS PROKA while the dependent variable in this study is stunting and the confounding variables in this study are Inadequate Complementary Feeding, Breastfeeding and Dietary Habit. These potential confounding variables were assessed and controlled during the analysis to minimize their influence on the study outcomes.

The instruments and data collection methods used in this study included an infant weighing scale and a digital Mediscale for measuring body weight, food records to assess dietary intake, observation sheets, NutriSurvey software for nutrient intake analysis, the standard operating procedure (SOP) for preparing BABY CHIPS PROKA, organoleptic evaluation forms, and a questionnaire on factors associated with stunting. Body weight was measured before and after the intervention using standardized procedures to ensure measurement accuracy. Dietary intake and other relevant factors were assessed throughout the study to monitor participants' nutritional status and to identify potential confounding variables that could influence the intervention outcomes.

Data analysis included univariate and bivariate methods. Univariate analysis described each variable using frequency distribution tables. Bivariate analysis assessed the differences in body weight before and after the intervention using the Wilcoxon Signed-Rank Test and the Mann-Whitney U Test for post-test comparisons between groups. A p-value of <0.05 was considered statistically significant for determining the effect of the intervention on body weight.

This study received ethical approval from the Health Research Ethics Committee of Banyuwangi Health College (No. 144/03/KEPK-STIKESBWI/II/2024). Written informed consent was obtained from all participants' parents or guardians before data collection. The study adhered to the ethical principles of informed consent, anonymity, confidentiality, beneficence, and justice by ensuring voluntary participation, protecting participants' privacy and personal information, minimizing potential risks, and providing equal treatment to all respondents without discrimination.

RESULTS

Table 1. Distribution of Respondent's Characteristics

Variables	Category	Group			
		Intervention		Control	
		n=100	%	n=120	%
Age	Mean±SD	42.41		43.24	
Sex	Male	18	52.9	16	47.1
	Female	16	47.1	18	52.9
Stunting Factors	Inadequate Complementary Feeding	17	50	17	50
	Breastfeeding	17	50	17	50

Table 1 shows the characteristics of respondents in both groups. The average age of stunted toddlers who participated as respondents was 42.41 months in the intervention group and 43.24 months in the control group, which is equivalent to the age range of 3 to <4 years. The distribution of gender was balanced across the study, with the intervention group consisting mostly of male toddlers and nearly half being female. In contrast, the control group had a similar gender distribution, with the majority being female and nearly half being male. The distribution of stunting factors, both the breastfeeding factor and the inadequate complementary feeding (MP-ASI) factor, had equal distribution, with each accounting for 50% of the toddlers in both the intervention and control groups.

Table 2. Weight Differences Before and After BABY CHIPS PROKA of Two Groups

Group	n	Mean±SD	p-value
Intervention			
Pre-test	34	12.00 ± 2.803	<0.001 ¹
Post test	34	16.13 ± 2.808	
Control			
Pre-test	34	8.83 ± 2.492	0.650 ¹
Post test	34	12.00 ± 2.531	

¹Wilcoxon Test

Table 2 shows the results of the intervention group indicate an increase in the mean body weight before and after the administration of BABY CHIPS PROKA, along with a rise in standard deviation. The Wilcoxon test showed that among the 34 toddlers in the intervention group, the mean body weight increased from 12.00 kg at the pre-test to 16.13 kg at the post-test. The Z-score obtained was -4.651, and the standard deviation increased from 1.803 at pre-test to 2.808 at post-test. The p-value was 0.000 (<0.05). The control group indicates an increase in the mean body weight from 8.83 kg to 12.00 kg, along with a slight rise in the standard deviation from 2.492 to 2.531. However, the p-value obtained was 0.650 (>0.05), indicating that there was no significant difference in body weight before and after the study in the control group. Therefore, there was a significant difference in body weight before and after the administration of BABY CHIPS PROKA.

DISCUSSION

Factors Contributing to Stunting

The Indonesian Ministry of Health states that the age of 12-59 months is crucial because growth and development occur rapidly during this period. A toddler's nutritional status is influenced by adequate food and nutritional intake and proper early childhood care (Habimana et al., 2026; Kemenkes, 2018; Soviyati et al., 2023; UNICEF et al., 2025). Inadequate nutritional intake during this period can lead to stunting (Liu et al., 2026). According to Umiyah and Hamidiyah (2021), toddlers who do not receive exclusive breastfeeding have a higher risk of stunting reported that growth delays begin early, even during pregnancy.

Most stunting occurs during the complementary feeding period between 6–24 months. This finding is consistent with Beal et al. (2018), who identified inadequate breastfeeding and poor household sanitation as key factors in Indonesia's high stunting rate. These explain why the control group showed minimal improvement in weight due to insufficient daily protein intake. Juniarti et al. (2025) reported that stunting is caused by chronic nutritional deficiencies, primarily resulting from inadequate breastfeeding and complementary feeding (MP-ASI). This finding highlights the importance of adequate nutritional intake in toddlers as a key strategy for stunting prevention.

Nutritional Improvement as a Stunting Intervention

Stunting prevention can be achieved through improving toddlers' daily nutritional intake. A toddler who is not stunted is generally a healthy toddler. A healthy toddler is identified by appropriate weight, height, and head circumference according to age (Kemenkes, 2018). However, nutritional intake during early childhood is often disrupted by feeding refusal, commonly referred to as *Gerakan Tutup Mulut* (GTM) or "mouth-closing behavior." Addressing GTM requires identifying the primary reasons why toddlers refuse to eat (Goday et al., 2019). One innovation to overcome this challenge is diversifying complementary foods (MP-ASI). According Haque et al. (2023) a diverse variety of complementary foods increases toddlers' interest in trying new foods and can help overcome GTM, thereby supporting adequate nutritional intake.

Interviews with caregivers revealed that most toddlers in the intervention group regularly consumed BABY CHIPS PROKA either as a meal complement or snack, leading to weight gain of 1–2 ounces over 14 days. Consistent consumption significantly improved their nutritional status. This aligns with findings from Prabawani (2021) and Irwan (2019), who found that modified complementary foods prevent feeding monotony and support weight gain. also reported that adequate protein intake plays a vital role in improving toddler weight, and its deficiency is a major cause of stunting and undernutrition.

Furthermore, the study by Rini et al. (2023) stated that protein plays a significant role in toddler weight gain. In other words, when daily protein intake is adequate, a toddler's weight tends to increase consistently. The study also indicated that stunting and malnutrition in toddlers are primarily caused by insufficient daily protein intake (Husnida et al., 2026). Therefore, it can be concluded that adequate daily protein intake can help prevent stunting and malnutrition. Thus, improving nutrition through the use of BABY CHIPS PROKA can serve as an effective intervention to address stunting and support weight gain in toddlers.

The findings of this study have important implications for stunting prevention programs, particularly during the complementary feeding period (6–24 months). BABY

CHIPS PROKA provides a locally sourced, nutrient-rich, and acceptable complementary food alternative that can improve toddlers' nutritional intake and support weight gain, especially among children with feeding difficulties such as *Gerakan Tutup Mulut* (GTM). By incorporating catfish bone flour into a crunchy food preferred by toddlers, this intervention addresses both nutritional adequacy and food acceptability. Therefore, BABY CHIPS PROKA has the potential to be integrated into community-based nutrition programs through Posyandu and primary health care services as an innovative complementary feeding strategy to support stunting prevention and improve child growth outcomes.

This study has several strengths, including the development of an innovative, locally sourced complementary food based on catfish bone flour that is highly acceptable to toddlers and the use of a control group to evaluate its effectiveness. However, the study also has limitations, including the relatively small sample size, the short intervention period, and its implementation in a single health center, which may limit the generalizability of the findings. Future studies are recommended to involve larger and more diverse populations, extend the duration of the intervention, and evaluate the long-term effects of BABY CHIPS PROKA on anthropometric indicators such as weight-for-age, height-for-age, and weight-for-height, as well as its feasibility for integration into community-based stunting prevention programs.

CONCLUSION

The provision of BABY CHIPS PROKA as a modified complementary feeding product significantly improved body weight among stunted toddlers compared with the control group. These findings suggest that BABY CHIPS PROKA is a promising, locally sourced complementary food that can support nutritional improvement and contribute to stunting management. Further studies with larger sample sizes and longer intervention periods are recommended to confirm its long-term effectiveness and potential implementation in community-based nutrition programs.

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