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Effectiveness of Tijek Nugget Provision as Supplementary Food to Address Stunting in Toddlers in Pantai Labu Pekan Village

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Abstract

Stunting remains a chronic nutritional problem that impacts physical growth, cognitive development, and future productivity of children. One nutritional intervention effort to overcome stunting is the provision of supplementary food based on local foods rich in protein and calcium. This study aims to determine the effectiveness of providing TIJEK Nuggets (tempeh and anchovies) on improving the nutritional status of stunted toddlers. The study used a quasi-experimental, two-group pretest-posttest design. The study sample comprised 50 toddlers aged 2–5 years in Pantai Labu Pekan Village, divided into an intervention group (given 100 grams of TIJEK Nuggets/day for 14 days) and a control group. The results showed that providing TIJEK Nuggets significantly increased toddlers' weight, but did not significantly increase height in the short term. This study concludes that TIJEK Nuggets have the potential to be an innovative, nutritious, supplementary food made from local ingredients that can help improve toddlers' nutritional status, especially by increasing body weight.

Keywords: Stunting, Toddlers, Nutritional Status, TIJEK Nuggets, Local Food

INTRODUCTION

Short Toddlers (Stunting) is a nutritional condition measured by the PB/U or TB/U index in anthropometric standards to assess a child's nutritional status. When the measurement results are at the threshold (Z-Score) between -2 SD and -3 SD, the child is considered short or stunted, whereas if the Z-Score is less than -3 SD, the child is considered very short or severely stunted.[1]

Stunting is a nutritional problem that is often found in poor and developing countries. It is a condition where toddlers experience growth failure due to chronic malnutrition, which results in the child being shorter than what is expected for their age.[2]

Data from the 2023 Indonesian Health Survey (SKI) shows that the prevalence of toddler nutritional status by district/city in the North Sumatra province of Deli Serdang is the highest at 33.8%. Stunting that is not addressed through catch-up growth can lead to further growth decline. Stunting is a public health issue associated with an increased risk of disease, death, and stunted growth, both physically and mentally, in terms of motor and cognitive abilities.[1]

According to data from UNICEF and WHO, 21.3% of toddlers worldwide experience stunting. Two out of five children who experience stunting are in Southeast Asia. Globally, the prevalence of stunting in children under five has decreased from 39.7% in 1990 to 26.7% in 2010, and is expected to decrease further to 21.8% or

approximately 142 million children under five by 2020. Asia experienced a decrease to 28% in 2010 and is projected to continue to decline.[3]

According to the WHO, based on the Indonesian Nutrition Study Report (SSGI), in 2021, the prevalence of stunting in children under five (toddlers) in Indonesia reached 47.7%. In Deliserdang Regency, North Sumatra, the figure was 12.5%. Then in Pematang Siantar City, it was 15%, and in Tebing Tinggi City, it was 17.3%. According to the Indonesian Nutrition Status Survey (SSGI) of the Ministry of Health, in Hutabargot, the prevalence of stunting among toddlers decreased to 21.6% in 2022, down 2.8 points from the previous year.[4]

Analysis of stunting measurement data from Deli Serdang Regency in 2022 showed a stunting rate of 13.9%, down from the previous year. In 2021, the prevalence of stunting decreased from 1.52% to 0.63% in 2022. Deli Serdang has been a focus for stunting management since 2019.[4]

Socioeconomic conditions and sanitation are the main factors causing stunting. This relates to the family's ability to meet nutritional needs, access safe food, and receive adequate health services for pregnant women and toddlers. Malnutrition in early life can lead to growth failure, which in turn affects cognitive development, disease rates, and mortality. To achieve optimal growth and development, adequate nutritional intake, good parenting, and stimulation appropriate to the child's developmental stage are required.[5]

Toddlerhood is a highly sensitive period for the environment, particularly regarding adequate nutritional intake. Stunting in toddlers can hinder physical and cognitive development, increase the risk of non-communicable diseases, reduce productivity, and increase the risk of having a low birth weight. The causes of stunting are generally multifactorial, including inadequate intake of macronutrients (carbohydrates, fats, proteins) and micronutrients (vitamins and minerals), as well as a history of infections that directly affect growth.[2]

Tempeh is fermented soybeans using specific microbes, and has a distinctive shape and aroma. The development and variation of tempeh through processing it into tempeh flour aims to introduce new food varieties and improve their nutritional quality. Some processed tempeh products that have become the focus of research are tempeh chips, tempeh chocolate, tempeh cereal, and tempeh nuggets.[6]

Tempeh has a high protein content, with a PER (Protein Efficiency Ratio) value almost equivalent to that of cow's milk casein, and is low in fat. In addition, tempeh is rich in minerals such as calcium, phosphorus, and iron, as well as various vitamins. Research results show that unblanched tempeh flour has high digestibility, biological value, and NPU values. Every 100 grams of soybean tempeh contains approximately 20.8 grams of protein, 8.8 grams of fat, 13.5 grams of carbohydrates, 347 mg of calcium, and 1.4 grams of fiber. Tempeh flour is a processed material produced by milling or flouring. Tempeh flour is made from steamed tempeh, which is sun-dried until dry, then ground into flour. Another benefit of tempeh flour is that it can increase the product's protein content.[7]

In previous research, a 10% substitution of tempeh flour in cinnamon cookies contributed approximately 3.17% to the RDA for protein. In addition to protein, calcium is also important for optimal bone growth. Anchovies are a good source of calcium, with approximately 68.7 grams of protein and 2381 mg of calcium per 100 grams of dried, unsalted anchovies.[7]

Anchovies are a popular side dish that Indonesians have long favored. Nationally, anchovies play an important role in the fisheries industry, with approximately 65% of fishery products processed and preserved using salting methods.[8]

Although anchovies have a higher protein content, namely 68.7 grams per 100 grams, compared to tempeh, which is only 46.5 grams per 100 grams, in terms of quality, tempeh contains more essential amino acids, methionine-cysteine 171mg, compared to anchovies, which only contain around 32.60 mg. Therefore, the use of tempeh and

32 anchovies as substitute ingredients in making cookies aims to increase the protein and calcium content of the cookies. The study was conducted to analyze the levels of protein and calcium, and the organoleptic characteristics of cookies with the substitution of tempeh flour and anchovy flour.[7]

27
26 Nuggets made with anchovies as the main ingredient are high in protein and rich in omega-3 fatty acids, with 1.5 grams per 100 grams. Omega-3 fatty acids help neutralize excess cholesterol in the body. In addition to being high in protein, anchovies are readily available in the market [9]. Nuggets are a product available in various brands, including fish-based nuggets. This shows that nuggets, whether made from meat or fish, are a practical and popular consumption choice among the public. [8]

6 RESEARCH METHODS

a. Research Design

This study used a quasi-experimental one-group pretest–posttest design, with only one group of toddlers measured before and after the TIJEK Nuggets intervention, without a comparison control group. At the beginning of the study, toddlers' height and weight were measured as pretest values. Subjects then received an intervention consisting of TIJEK Nuggets for 14 days, and posttest measurements were repeated to assess changes in nutritional status. This design allows researchers to analyze the effect of TIJEK Nuggets on the height and weight of stunted toddlers by comparing pre- and post-intervention values within the same group.

b. Population and Sample

29 The study population consisted of all toddlers aged 2–5 years living in Pantai Labu Pekan Village, Deli Serdang Regency. From a population of 45, a sample of 30 toddlers was selected who met the research criteria: toddlers aged 2–5 years who were willing to participate in the intervention of providing TIJEK Nuggets and whose height and weight could be measured before and after the intervention. The sampling technique used was consecutive sampling, that is, all toddlers who met the criteria and were willing to participate were entered sequentially until the sample size of 30 people was reached. Thus, all samples received the same treatment: TIJEK Nuggets.

c. Data Collection

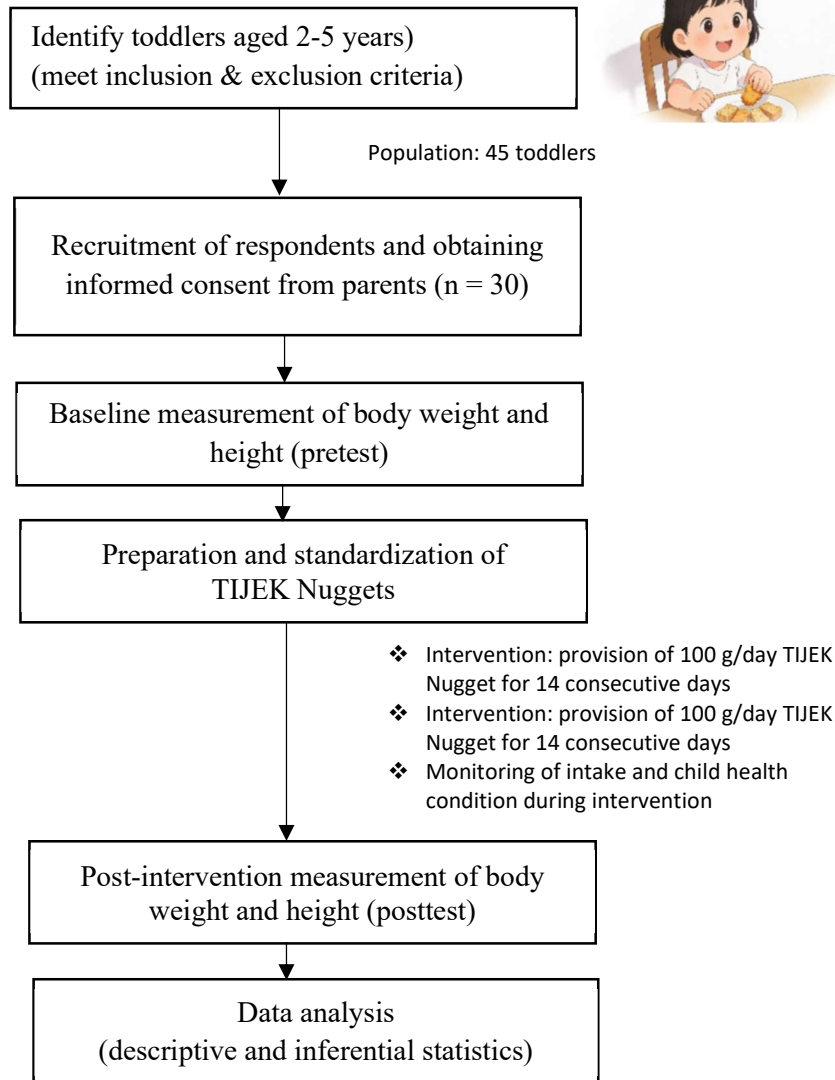


Figure 1. Research Flow

1 Data collection in this study was conducted in several structured stages, starting with the selection of the toddler sample and the anthropometric measurements taken before and after the intervention. After the sample was determined, the researchers provided an explanation to the toddler's parents or guardians regarding the purpose and procedures of the study, then requested written consent through an informed consent form before the child was included. The main data collected were the toddler's weight and height, measured using a digital scale and a stadiometer according to standards, to obtain pretest (before administering TIJEK Nuggets) and posttest (14 days after administering TIJEK Nuggets) values in the intervention group. During the intervention period, the researchers and team also monitored the administration of 100 grams of TIJEK Nuggets per day, divided into two servings. They ensured compliance with consumption to ensure that the data on changes in nutritional status accurately reflected the intervention's effects.

18 Nuggets are a snack liked by all age groups that temporarily relieves hunger. TIJEK nuggets, made from anchovies, chicken eggs, and other spices, are typically consumed for approximately 2 to 3 hours between main meals between 10 a.m. and 4 p.m., according to the results of a chemical laboratory examination by PT Saraswanti Indo Genetech Bogor in 2025.. in 4 pieces of nugget there are 100 grams, which contain energy of 150.61 kcal, carbohydrates 26.83 grams, protein 7.92 water 62.56 gr, ash 1.40 gr, fat 11.61. This additional food is provided as TIJEK nuggets, which can improve children's nutritional status and weight in Pekan Pantai Labu Village.



Figure 2. TIJEK Nuggets

d. Data Analysis

8 The data collected from the results of weight and height measurements before and after the intervention were then processed and analyzed statistically to assess the effectiveness of providing TIJEK Nuggets. The analysis was carried out by calculating the average, standard deviation, and the difference between pretest and posttest values for both weight and height in the intervention and control groups. The statistical test used was a difference test (descriptive test with significance testing), with a significance limit of $p < 0.05$; if the p value is less than 0.05, it is stated that there is a significant difference. The analysis showed that providing TIJEK Nuggets for 14 days did not significantly affect toddler height but did significantly increase body weight, suggesting that TIJEK Nuggets have the potential to serve as an additional food source to improve the nutritional status of stunted toddlers in the short term.

e. Code of Ethics

17 This research was conducted by observing the principles of the code of ethics for health research, starting from the submission and approval of ethics to the Health Research Ethics Committee of the Medan Ministry of Health Polytechnic, before field activities were carried out, with the ethical feasibility statement number No.01.26.1380/KEPK/POLTEKKES KEMENKES MEDAN 2025. Before data collection, researchers provided clear and complete information to the parents or guardians of toddlers regarding the purpose, benefits, research procedures, types of interventions to be provided, and possible risks or discomforts that may arise, and then obtained voluntary informed consent. The confidentiality of respondents' identities was maintained by not including the full names of children and parents in the report; instead, codes or initials were used, so that the reported data were anonymous and the privacy of the subjects remained protected in accordance with the ethical guidelines' confidentiality and privacy standards.

1 Throughout the research process, researchers ensured that the TIJEK Nugget intervention provided was safe for toddlers to consume, made with appropriate local food ingredients and processed according to hygienic procedures, and committed to stopping or adjusting the intervention if conditions arose that could endanger the respondents' health. Researchers also ensured that participation in the research was voluntary, without coercion or excessive persuasion. Parents had the right to withdraw their children

from the research at any time without consequences to their access to routine health services, in line with the principles of benefit, fairness, protection against risks, and informed consent as stated in the 2011 WHO Standards and 2016 CIOMS Guidelines.

RESULTS AND DISCUSSION

Respondent characteristics in this study included the child's age, maternal occupation, and the mother's education level as a parent of a toddler. Based on age distribution, the majority of toddlers were 3-year-olds, followed by 4- and 5-year-olds, while the smallest proportion were 2-year-olds. In terms of occupation, the majority of respondents' mothers worked as housewives, while a small proportion worked as traders and teachers. In terms of education, more than half of the respondents' mothers had a high school/vocational high school education, followed by junior high school and diploma 3 education. In contrast, only a few had an elementary school education. Complete details of the respondents' characteristics are shown in Table 1.

Table 1. Frequency of respondent characteristics

Characteristics	Amount	Percentage
Age (years)		
2	5	16.6
3	10	33.3
4	8	26.7
5	7	23.4
Work		
Housewife	26	86.7
Teacher	1	3.3
Trader	3	10.0
Education		
Elementary School	1	3.3
JUNIOR HIGH SCHOOL	9	30.0
High School/Vocational School	17	56.7
D3	3	10.0
Total	30	100

The characteristics of respondents in Table 1 show that the largest number of toddlers were 3 years old (33.3%), followed by 4 years old (26.7%), 5 years old (23.4%), and the least were 2 years old (16.6%). Between the ages of 2 and 5 years, it is said that toddler growth is more effective when additional food is provided, aiming to increase the child's physical development. (Komalasari et al., 2021) In terms of occupation, the majority of respondents were housewives (86.7%), while a small number worked as traders (10.0%) and teachers (3.3%). In terms of education level, the majority of mothers had a high school/vocational high school education (56.7%), followed by junior high school (30.0%), diploma 3 (10.0%), and only a few had an elementary school education (3.3%). Overall, the study included 30 respondents (100%).

Average Increase in Children's Height

After an intervention was carried out in the form of providing TIJEK nuggets to increase the height of children in Pantai Labu Pekan village, the results of the average score for increasing the height of children were as follows:

Table 2. Distribution of Height Before and After Treatment

	N	Min	Max	Mean	Elementary School	P Value
BB Before	30	79.50	105.00	92,7200	7.688803	0.001
BB After	30	79.50	105.00	92,7200	7.688803	

Table 2 shows that the average height of children before and after the TIJEK nuggets intervention was 92.72 cm, with a range from 79.50 to 105.00 cm and a standard deviation of 7.69 cm. The p-value was 0.001, but because there was no change in average height before and after treatment, the 14-day intervention did not increase children's height. This illustrates that, in a relatively short intervention period, the provision of TIJEK nuggets has not had a measurable impact on toddlers' linear growth.

Average Child Weight Gain

After an intervention was carried out in the form of providing TIJEK nuggets for weight gain in children in Pantai Labu Pekan village, the results of the average score for weight gain in children were as follows:

Table 3. Body weight distribution before and after treatment

	N	Min	Max	Mean	Elementary School	P Value
BB Before	30	9.25	16.80	12,7667	2.02673	001
BB After	30	9.40	17.30	13,3867	2.03922	

Table 3 shows that the average weight of children before the TIJEK nuggets intervention was 12.77 kg, with a minimum of 9.25 kg and a maximum of 16.80 kg, and a standard deviation of 2.03 kg. After 14 days of intervention, the average weight increased to 13.39 kg, with a range of 9.40 kg to 17.30 kg and a standard deviation of 2.04 kg. A p-value of 0.001 indicates a statistically significant difference in weight before and after TIJEK nugget administration, suggesting that this intervention significantly increases toddlers' weight in Pantai Labu Pekan Village.

DISCUSSION

The results of the study indicate that the toddlers who became subjects were mostly aged 3–5 years, with the largest proportion at age 3, while the 2-year-olds were the smallest group. The age range of 2–5 years is a very active growth period, so the need for nutrients, especially energy and protein, is relatively high to support children's physical growth and cognitive development. The dominance of homemakers as primary caregivers and the majority of high school/vocational high school graduates provide a fairly good opportunity for acceptance and understanding of nutritional interventions, including the introduction of locally produced, food-based supplementary foods such as TIJEK Nuggets. Higher education is generally associated with greater nutritional

knowledge, which can contribute to more informed decision-making when choosing food for children, including a willingness to try innovative, nutritious products.

The 14-day TIJEK Nugget intervention did not show any change in average height; the pre- and post-treatment averages remained at 92.72 cm, with a range of 79.50–105.00 cm. Biologically, height growth is a long-term process that is heavily influenced by chronic nutritional status, general health, and environmental stimulation, so that linear changes in the body over two weeks are very small and difficult to detect anthropometrically. Stunting is defined as a disruption in linear growth due to chronic malnutrition, so short-term interventions through supplementary foods are more realistically expected to first improve body weight before having an impact on height. Thus, the finding that TIJEK Nuggets have not increased height within 14 days is consistent with the concept that preventing and overcoming stunting requires continuous, multifactorial interventions, rather than a single type of supplementary food over a short period.

In contrast to height, toddlers' weight increased significantly after the TIJEK Nugget intervention. The average pre-intervention weight of 12.77 kg increased to 13.39 kg after 14 days of TIJEK Nugget administration, with a p-value of 0.001 indicating a statistically significant difference. This weight gain can be explained by the high energy and protein content of TIJEK Nuggets, as 100 grams (4 pieces) of TIJEK Nuggets contain approximately 150.61 kcal of energy, 26.83 grams of carbohydrates, 7.92 grams of protein, and fat, which contribute to the total energy. The basic ingredients of tempeh and anchovies provide a combination of high-quality vegetable and animal proteins, with tempeh rich in protein and essential amino acids. In contrast, anchovies contain high amounts of protein and calcium, which are important for bone growth. Previous research also shows that processed tempeh and anchovy flour products can increase the protein and calcium content in snacks, thus potentially improving children's nutritional status when consumed regularly.

From a supplementary food concept perspective, TIJEK Nuggets meet the principle of using local, safe, nutritious, and preferred foods for children, thereby increasing the likelihood of full consumption by toddlers. Nuggets, as a processed form, also offer sensory advantages (taste, texture, and appearance) that are generally preferred by children, thereby addressing the problem of low appetite for certain nutritious foods when presented in less appealing forms. In the context of stunted toddlers, significant short-term weight gain is an important achievement because it indicates improvement in acute nutritional status, which, if maintained in the longer term, has the potential to support linear growth and overall child development. However, without extending the intervention duration and continuing monitoring, the impact on height and structural stunting status cannot be optimally assessed.

The findings of this study are consistent with previous studies reporting that providing supplementary foods based on locally available, high-protein, energy-rich foods can increase the weight of malnourished toddlers over several weeks to several months, while changes in height are usually only apparent after a longer intervention period. This confirms that TIJEK Nuggets have the potential to serve as an alternative local supplementary food to increase toddlers' energy and protein intake, especially in areas with high stunting rates, such as Deli Serdang Regency. However, the use of TIJEK Nuggets should be viewed as part of a comprehensive intervention package that includes improving daily diets, nutrition education for parents, improving sanitation and environmental health, and regular growth monitoring. Furthermore, the limitations of the one-group pretest–posttest design without a control group and the relatively short intervention duration need to be considered when interpreting the results. Therefore, further research with a more robust design, a larger sample size, and a longer intervention period is highly recommended to assess the long-term impact of TIJEK Nuggets on linear growth and stunting status in toddlers.

Research Implications

The results of this study indicate that providing TIJEK Nuggets for 14 days can significantly increase toddlers' weight. However, it has not yet provided a measurable impact on height in the short term. This finding implies that TIJEK Nuggets have the potential to be used as a locally sourced, supplementary food to help improve nutritional status, especially weight, in toddlers at risk of or already experiencing stunting. For health workers at community health centers, integrated health posts (Posyandu), and nutrition cadres, this product can be used as a practical, nutritious, and more readily accepted PMT (supplementary food) menu option for children, given its familiar and preferred form.

For policymakers at the regional level, the results of this study can serve as an initial basis for developing more systematic local food-based nutrition intervention programs, for example, including TIJEK Nuggets or similar products into toddler nutrition intervention packages in areas with a high prevalence of stunting. On the other hand, for academics and researchers, this study offers opportunities to develop further the formulation, fortification, and long-term effectiveness testing of TIJEK Nuggets for other nutritional indicators, such as micronutrient status and cognitive development. Another important implication is the need to integrate supplementary food interventions with nutrition education for parents, so that improvements in toddler nutritional intake do not only depend on one type of product but are also reflected in overall daily eating patterns.

Research Limitations

This study has several limitations that should be considered when interpreting the results. First, the design used was a one-group pretest–posttest without a control group, making it difficult to completely rule out the influence of factors beyond the intervention (e.g., changes in home diet, physical activity, or other health conditions) on weight change. Furthermore, the intervention lasted only 14 days, which is understandable given that linear growth takes longer and is influenced by chronic nutritional status.

Conclusion

This study shows that providing TIJEK Nuggets, a supplementary food based on local foods, for 14 days to toddlers aged 2–5 years in Pantai Labu Pekan Village significantly increased weight gain but did not result in significant changes in height during that period. TIJEK Nuggets, formulated from tempeh and anchovies, have been proven to be a nutritious alternative snack that can help improve toddlers' nutritional status, especially in terms of weight gain, as an initial step toward better nutrition.

Suggestion

For health workers and integrated health post (Posyandu) cadres, TIJEK Nuggets can be considered a locally sourced, food-based PMT menu regularly provided to toddlers at risk of stunting, accompanied by nutritional education for parents on the importance of a balanced diet. For future researchers, it is recommended to conduct studies with a control group, a larger sample size, and a longer intervention duration to assess the impact of TIJEK Nuggets on body weight, height, and other nutritional indicators.