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The Effect of Consumption of JAKATE Cokkies (Corn, Green Beans, Tempeh) on the Nutritional Status of Toddlers

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Abstract
In Indonesia, the problem of nutrition in toddlers is still a public health problem, especially in areas with low levels of nutrition. The purpose of this study was to see how Cokkies JAKATE (corn, green beans, and tempeh) given as additional food affects the health of toddlers aged 24 to 59 months who are malnourished. In Ngrundul Village, Kebonarum District, Klaten Regency, there were 50 toddlers involved in this study, which was conducted using a quantitative approach with a single-group pretest-posttest design. Data were collected through anthropometric measurements before and after the intervention, and the Wilcoxon statistical test was used to analyze it. The results showed that after the 14-day intervention, the toddlers' weight increased by an average of 0.49 kg and the average height by 1.22 cm, with a p value of 0.05 each. This shows that the provision of Cokkies JAKATE has a significant impact on improving toddler nutrition. Foods such as green beans, corn, and tempeh contain vegetable protein, vitamins, and minerals that can help growth and increase weight quickly. This study shows that the use of local supplementary food can be an effective method to prevent malnutrition in children. To ensure that similar programs are successful at the community level, long-term implementation and sustainability monitoring are essential.

Keywords: Cookies, nutritional status, toddler

1. INTRODUCTION

Nutrition plays a vital role in toddler development, affecting physical, cognitive, and emotional growth. Protein intake, along with vitamins A and C, has been shown to significantly correlate with toddler growth and development. These nutrients are essential for brain development and overall physical growth (Awalia *et al.* , 2023) . Malnutrition can be caused by deficiencies in macronutrients such as carbohydrates (energy) and protein (building materials). Underweight, wasting, and stunting (low height for age) (Haldar *et al.* , 2022) .

According to the latest estimates from UNICEF and WHO, around 45.4 million children under five worldwide are wasted, and more than 340 million children suffer from one or more micronutrient deficiencies (UNICEF and WHO, 2023) . Nationally, the prevalence of nutritional problems in toddlers in Indonesia is still high. Based on *the 2022 Indonesian Nutritional Status Survey (SSGI)* , the prevalence of wasting in toddlers increased from 7.1% to 7.7%, while the prevalence of malnutrition increased to 17.1% (Ministry of Health of the Republic of Indonesia, 2023) . In addition, Indonesia still faces multiple nutritional problems. On the one hand, there are nutritional problems such as protein energy deficiency (PEM), iron deficiency anemia, vitamin A deficiency (VAD), and iodine deficiency disorders (IDD). On the

other hand, obesity, especially in urban areas, is a more common nutritional problem (Bose, Mondal and Sen, 2022) .

To combat child malnutrition, especially in developing regions, supplementary feeding programs using local foods focus on addressing cultural preferences and malnutrition by preparing nutritious foods that are easily accessible and appealing to children (Dharmaraj *et al.* , 2023) . Many studies have shown that such programs are successful in improving children's nutritional status and growth metrics. a 14-day supplementary feeding program using local foods resulted in weight gain in 88% of participating toddlers, with 18% showing improved nutritional status. The program was well received by the children, with 74% reporting liking for the food provided. Despite the success of these programs, challenges such as caregiver education and food preparation skills remain. In Tangerang, only 28% of mothers prepared their own supplementary food, highlighting the need for skills development (Krina and Purnamawati, 2023) .

As an effort to overcome these problems, one important intervention strategy is through the provision of additional food made from local foods that are nutritious, easy to make, and liked by children (Ariesthi *et al.* , 2021) . Cookies, as a form of solid food and have a distinctive taste, can be used as an alternative nutritious additional food. Cookies made with sweet potato and tempeh flour offer a balanced nutritional profile, providing carbohydrates and protein. These cookies meet most of the Recommended Dietary Allowance (RDA) for adolescents, making them suitable for malnourished individuals (Septiana, Nuhrlawangsa and Rahardjo, 2024) . Corn flour has been identified as a viable substitute for wheat flour in cookies, offering a good nutritional profile and functional characteristics. It can replace wheat flour by 50-80% while maintaining high consumer acceptance due to its favorable organoleptic properties (Suarni, 2017) . Tempeh is a source of vegetable protein from fermented soybeans which is rich in essential amino acids, while green beans are rich in iron, vitamins, and antioxidants such as isoflavones which function to ward off free radicals (Yoshari *et al.* , 2023) .

Based on *the Health Profile of the Klaten Regency Health Office 2023* , the prevalence of toddlers with malnutrition status reached 9.7%, placing Klaten in 10th position out of all regencies in Central Java. In Polanharjo District, the prevalence of toddlers with malnutrition even reached 28.2%, ranking second highest in the region.

Several studies have evaluated the use of local food ingredients in improving children's nutritional status, but most studies still focus on the nutritional content or effectiveness of providing additional food in conventional forms (porridge, steamed rice, and so on). Meanwhile, innovations in food products that are more attractive and adaptive to children's tastes—such as cookies based on local ingredients (corn, green beans, and tempeh)—are still very limited, both in terms of empirical research and field interventions. Furthermore, there have not been many studies that specifically examine the impact of consuming cookies made from a combination of corn, green beans, and tempeh on changes in the nutritional status of toddlers, especially in the context of areas with a high prevalence of malnutrition such as Klaten Regency. Therefore, this study attempts to fill the gap in the literature by comprehensively examining the effect of consuming locally sourced cookies on the nutritional status of toddlers. This condition shows the importance of intervention efforts based on local foods that are attractive, nutritious, and easy for toddlers to consume. This study aims to determine the Effect of Consumption of Corn, Green Bean, and Tempeh Cookies on the Nutritional Status of Toddlers.

2. METHOD (12 PT)

This study uses a **quantitative approach** with a **pre-experimental one group pretest-posttest design** , namely observations were made on one group of research subjects before and after being given treatment without a comparison group. This design was chosen to directly determine the effect of the intervention of providing additional food in the form of corn, green bean, and tempeh cookies (abbreviated as JAKATE cookies) on changes in the nutritional status of toddlers.

The research was conducted in three stages. First, the **preparation stage** , including making a proposal, processing research permits from the village government and health center, and requesting ethical approval from the Health Research Ethics Committee (Ethics Number : 1.794/VII/HPEC/2024). Cadre training was conducted to assist in product distribution and field data collection. Second, the implementation stage, starting with initial data collection (pretest) which includes measuring the weight and height of toddlers to determine the initial nutritional status based on the anthropometric index from WHO (Ministry of Health of the Republic of Indonesia., 2020) . Then, toddlers were given an intervention in the form of 100 grams of JAKATE cookies per day for 14 days as a snack. Each consumption was monitored and recorded through a compliance observation sheet. Third, the re-measurement stage (posttest) was carried out on the 15th day to see changes in nutritional status after treatment.

The tools and materials used in this study included a digital children's scale (accuracy ±0.01 kg), a portable height meter (accuracy ±0.1 cm), and an observation form and respondent identity sheet. JAKATE cookies are made from local ingredients, namely corn flour, green beans, and fermented tempeh according to the Ministry of Health's balanced nutrition guidelines (2021). Primary data were collected from direct measurements in the field, consumption documentation, and the results of brief interviews with mothers of toddlers. The sampling technique used purposive sampling with inclusion criteria: toddlers aged 24–59 months with malnutrition status and willing to participate in the intervention. Toddlers with allergies to cookie ingredients or chronic diseases were excluded from the sample.

Data analysis was conducted in two stages. Univariate analysis was used to describe the characteristics of the research subjects (age, weight, height, and nutritional status), which were displayed in the form of a frequency distribution table. Meanwhile, to determine the effect of JAKATE cookies intervention on the nutritional status of toddlers, bivariate analysis was used with the Paired t-Test, because it compares two measurements in the same group. Significance was determined at a $p\ value < 0.05$.

3. RESULT

The study was conducted in Ngrundul Village, Kebonarum District, Klaten Regency involving 50 toddlers. Data were collected through anthropometric measurements of toddlers and filling out observation sheets for Tempe Brownies consumption. The data were then processed using a computerized system. The results of the analysis include the frequency distribution of toddlers describing age. Gender, body weight data, height of toddlers. Frequency distribution of toddler mothers including age, mother's education level, mother's employment status. The results of the data analysis are as follows:

Table 1 Frequency Distribution of Characteristics of Toddlers in Ngrundul Village, Kebonarum Klaten

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Characteristics	Frequency (f)	Percentage (%)
Age		
0-24 Months	13	26
25-50 Months	37	74
Gender		
Man	22	44
Woman	28	56
Amount	50	100

Source: Primary Data from Ngrundul Kebonarum Village (2024)

Table 1 shows that out of 50 respondents, most of them are aged 25-50 months, as many as 37 respondents (54%). The gender of the toddlers is mostly female, as many as 28 respondents (56%).

Table 4.2 Frequency Distribution of Characteristics of Mothers in Ngrundul Village, Kebonarum, Klaten

Characteristics	Frequency (f)	Percentage (%)
Age		
Healthy Reproductive Age	41	82
Healthy Non-Reproductive Age	9	18
Education		
Base	0	0
Intermediate	34	68
College	16	32
Work		
Work	11	22
Doesn't work	39	78
Amount	50	100

Source: Primary Data from Ngrundul Kebonarum Village (2024)

Table 2 shows that most mothers with healthy reproductive age are 41 respondents (82%). The majority of mothers' education is secondary education as many as 34 respondents (68%) and most mothers do not work 39 respondents (78%).

Table 3 Frequency Distribution of Weight and Height Gain of Toddlers in Ngrundul Village, Kebonarum, Klaten

Variables	Frequency (f)	Percentage (%)
Weight Gain		
Go on	39	78
Still	11	22
Height Increase ?Body		
Go on	30	60
Still	20	40
Amount	50	100

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Source: Primary Data from Ngrundul Kebonarum Village (2024)

Table 3 shows that some toddlers' BB experienced an increase, namely 39 respondents (78%). The height of most respondents also increased by 30 respondents (60%).

Table 4 Average Weight and Height of Toddlers Before and After Being Given JKT Cokkies

Variables	Frequency (f)	Percentage (%)
BB increase		
Go on	39	78
Still	11	22
TB increase		
Go on	30	60
Still	20	40
Amount	50	100

Source: Primary Data from Ngrundul Kebonarum Village (2024)

Table 4 shows that the average weight of toddlers before being given brownies tempe was 10.48 after being given brownies tempe became 10.97. The height of toddlers before being given brownies tempe was 84.11 after being given brownies became 85.33.

Table 5 Effect of Giving Brownies Tempe on Toddler Nutritional Status

Variables	N	Median (Min-Max)	P value
BB before	50	10 (7.10-13.90)	0,000
BB after	50	10.60 (7.60-14.40)	
TB before	50	85.50 (66-97.5)	0.030
TB after	50	88 (66,97,5)	

Table 5 shows that the results of the statistical test using Wilcoxon obtained a p value = 0.000 for weight gain and a ρ value = 0.030 for height gain. This means that Ha is accepted and Ho is rejected, so there is an effect of giving tempeh brownies on the nutritional status of toddlers.

The results must summarize the findings scientifically, not provide very detailed data. Present the main findings if the article is in the form of research results. Please highlight the differences between the results or findings that you found compared to previous publications by other researchers. The results should be clear, concise, and relevant to the objective of the paper. The figures and the tables must be appropriately self-explanatory, correctly labeled, statistically accurate, and correct statistical test **.**

4. DISCUSSION

4.1. Characteristics

The results of the study showed that out of 50 respondents, most of the toddlers were aged 25–50 months, namely 37 children (74%). This indicates that the majority of toddlers in this study have entered the age of over two years, which is a critical development phase.

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According to (Annisa Nuradhiani, 2023) , the age of toddlers is one of the strong predictors of nutritional status because children at that age have very high energy and nutrient needs, and are more physically active. Toddlers aged 12–36 months are reported to be at 3.34 times greater risk of malnutrition compared to those aged 37–59 months, because their immune systems have not developed optimally (Noya *et al.* , 2019) .

In terms of gender, it is known that most toddlers are girls, namely 28 children (56%). Gender is one of the social factors that also influences children's nutritional status. The results of the study (Yani, Faidul Jihad and Silvia Putri, 2022) show that although gender differences in nutritional status at the national level are relatively small, in the local context there can be inequality in access to food and care, especially when there is a cultural preference for boys. This inequality can result in unbalanced parenting practices, which has an impact on meeting children's nutritional needs, including access to health services.

The characteristics of mothers in this study showed that most of them were of healthy reproductive age (20–35 years), which was 41 people (82%). Maternal age is an important factor in childcare. Mothers who are still very young tend to have limited experience and insight, so that parenting patterns for children are more influenced by hereditary practices than scientifically based knowledge (Andriani *et al.* , 2023) . However, mothers who are already of mature age are usually more psychologically and physically ready to pay attention to the growth and development and nutritional status of children. This is in line with the WHO study which emphasizes the importance of maternal age in determining the quality of feeding practices and health care for toddlers (Setiawati *et al.* , 2023) .

The mother's education level also plays a very crucial role. In this study, most mothers had secondary education (68%), and only a small portion had higher education. Research (Wahyuningsih, Lukman and Pannyiwi, 2020) shows that the mother's education level is significantly correlated with nutritional knowledge, feeding patterns, and the ability to access health services. Good education makes it easier for mothers to receive and apply information about balanced nutrition, immunization, and child care. This is in accordance with the statement (Wandani, 2021) which states that the higher a person's education, the greater their ability to choose good food for children.

In terms of employment, most mothers in this study did not work formally, namely 39 people (78%). According to (Notoatmodjo, 2021) , work is an activity that supports economic life, and the involvement of mothers in the world of work can affect family consumption patterns, both positively and negatively. Housewives tend to have more time to accompany their children, including in supervising daily food (Kurniawati, Sari and Islamiah, 2020) . However, this does not necessarily guarantee the quality of children's nutrition if it is not accompanied by sufficient knowledge. The mother's job can indeed have an impact on the balance of time between parenting and economic activities, but the status of not working also has the potential to limit the purchasing power of nutritious food if it is not supported by adequate family income.

4.2. Toddler Nutritional Status

The results showed that the weight of toddlers before being given JAKATE cookies (made from corn, green beans, and tempeh) was 10.48 kg, and increased to 10.97 kg after the intervention for 14 days, with a difference of 0.49 kg. Of the 50 toddlers, 39 (78%) experienced weight gain, while 11 (22%) remained the same weight. The results showed that giving JAKATE cookies increased the weight of toddlers with low nutritional status. Their height before being given cookies was 84.11 cm, but increased to 85.33 cm after the

intervention. A total of 30 toddlers (60 percent) experienced an increase in height of 1.22 cm, while the remaining 20 toddlers (40 percent) showed no change. Although the increase in height was less than the increase in weight, the upward trend still showed a positive response to the consumption of JAKATE cookies.

The theory that this increase in weight and height greatly affects the adequacy of macro and micronutrients obtained by children . However, indirect factors that can affect the success of nutritional interventions include parenting, sanitation, and access to clean water and basic health services. (Andriani *et al.* , 2023) . UNICEF (2023) stated that poor sanitation and repeated infections, such as diarrhea, will interfere with the absorption of nutrients and increase the risk of stunting or failure to thrive. Children's immune systems are susceptible to infectious diseases due to malnutrition. (Fuada *et al.* , 2020) . This can lead to a worse cycle of malnutrition. Malnutrition weakens the immune system, increases infections, decreases nutrient absorption, and ultimately decreases nutritional status (Al Rahmad *et al.* , 2020) . Gastrointestinal infections are common in children with poor nutritional intake, which can inhibit weight gain despite increased nutrient intake (Kwami *et al.* , 2019; Prasiwi *et al.* , 2021) .

The success of improving nutritional status in this study is closely related to the nutritional content of JAKATE cookies, especially tempeh as the main ingredient. In tempeh, you will find high protein, isoflavones, fiber, vitamin B complex, including vitamin B12, and complete essential amino acids. Complex proteins are broken down into simpler forms during fermentation, making them easier for the body to absorb (Y *et al.* , 2021) . In addition, tempeh has natural antibiotics and probiotic effects that can help gut health, increase appetite, and increase metabolism (Tamam *et al.* , 2019) .

A study conducted in Central Tapanuli Regency showed that consumption of tempeh nuggets caused a significant increase in the average weight of malnourished toddlers. Over a 14-day period, the average weight gain was 0.38 kg, with statistical analysis confirming the effectiveness of tempeh nuggets in promoting weight gain in this demographic (Simatupang and Nainggolan, 2022) .

4.3. The effect of giving JKT Cokkies on the nutritional status of toddlers

The results of the study showed that the Wilcoxon statistical test produced a p-value of 0.000 for changes in weight and a p-value of 0.030 for changes in height. These results indicate that Cokkies JKT increases the weight and height of toddlers. The alternative hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected, with p = 0.05. This means that Cokkies JKT really improves the health of toddlers.

Weight is the most sensitive anthropometric indicator of short-term changes in nutrition and health. (Hasanah, 2023) . In line with Ariani, Dhewi and (Ishak, 2022) explained that infection, decreased appetite, or insufficient food intake can cause rapid weight changes. Body weight is a very unstable anthropometric parameter and is the first indicator that shows the impact of an imbalance between children's nutritional consumption and needs.

JAKATE cookies, made from local ingredients such as tempeh, corn, and mung beans, have excellent nutritional value. Tempeh is a rich source of vegetable protein, which is essential for muscle repair and growth. Fortification with spices such as coriander can further increase its protein content, making it a functional food with increased nutritional

value (Khotimah *et al.* , 2024) . The inclusion of corn in food products such as donuts has been shown to increase the content of essential nutrients such as calcium, phosphorus, and vitamins, which are essential for overall health (Rosli and Robert, 2014) . The use of mung beans in cookies can contribute to a balanced nutritional profile, providing essential nutrients without excessive calories (Permana, Razak and Pudjirahaju, 2023) .

The intervention group experienced an average weight gain of 846.7 grams compared to the control group, which only experienced an increase of 326.7 grams. This shows that the protein and carbohydrate content of Cokkies JKT can be well absorbed and has an anabolic effect on the toddler's body. This effect is reinforced by the vitamin A and zinc contained in the ingredients, which are known to increase appetite and support growth metabolism (Purba et al., 2023).

Another study highlighted that tempeh nuggets increased energy adequacy and protein intake in underweight children, suggesting that tempeh nuggets could be a nutritious and cost-effective option to improve the dietary intake of undernourished children (Permatasari, Murwani and Rahfiludin, 2018) . The study also showed that the nutritional status of children was significantly improved, as measured by BB/A z-score.

These results are also supported by a study that focused on the effects of tempeh cake and red bean flour on malnourished children found a significant increase in body weight. The average weight of children in the treatment group increased from 8.88 kg to 9.33 kg after the intervention, compared to a smaller increase in the control group (Aprilia, Sartono and Siregar, 2023) .

Several limitations of this study should be considered. First, this study was designed to use a single pretest-posttest group without a control group. As a result, the results of children who received the intervention cannot be fully compared with children who did not receive the intervention. Second, the intervention period was only 14 days, which is still quite short to measure changes in nutritional status, especially for height parameters, which require a longer time to produce significant changes. Third, the consumption of JAKATE Cookies was carried out at each toddler's home, under the supervision of the mother or family, so variations in compliance with daily consumption can affect the final results. Fourth, external factors, such as toddler health problems such as gastrointestinal infections or fever, can affect nutritional changes during the intervention. These factors cannot be fully controlled.

During the intervention, each toddler who was sampled was expected to consume JAKATE Cokkies according to the specified dose and time. They also did not consume significant additional food from outside that could affect their weight or height. In addition, it is assumed that the person collecting the data used anthropometric instruments such as scales and height meters regularly and accurately.

5. CONCLUSION (10 PT)

With the Wilcoxon test value $p < 0.05$, the results of the study showed that giving Cokkies JAKATE (green beans, tempeh, and corn) for 14 days had a significant effect on improving the nutritional status of toddlers. There is evidence that local foods such as tempeh, corn, and green beans, which contain protein, carbohydrates, vitamins, and minerals,

can improve toddler health quickly and are easily absorbed by the body. Therefore, additional foods rich in nutrients such as Cokkies JAKATE can be used as a local food-based nutritional intervention strategy supported by health cadres and village governments. This will help reduce malnutrition rates and improve the quality of toddler growth and development in areas where nutritional problems are high.

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