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THE EFFECTIVENESS OF SOYBEAN TEMPEH NUGGET CONSUMPTION ON WEIGHT GAIN IN UNDERNOURISHED TODDLERS

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ABSTRAK : EFEKTIVITAS KONSUMSI NUGGET TEMPE KEDELAI TERHADAP PERTUMBUHAN BERAT BADAN PADA BALITA KECIL

Pendahuluan: Status gizi mengacu pada kondisi tubuh manusia yang dipengaruhi oleh asupan makanan dan pemanfaatan zat gizi yang dikonsumsi oleh seseorang. Angka kejadian gizi buruk di dunia menurut WHO sebanyak 45 juta balita, di Indonesia mencapai 13,8%, Provinsi Lampung mencapai 14,8%. Sedangkan di Kabupaten Pesisir Barat terdapat 13,7% balita dan di Puskesmas Krui Selatan terdapat 5,7% balita mengalami gizi buruk. Gizi buruk pada anak balita dapat menghambat tumbuh kembangnya hingga dewasa dan cenderung bersifat irreversible. Salah satu upaya untuk mengatasi gizi buruk pada balita adalah melalui pemanfaatan olahan tempe kedelai dalam bentuk nugget tempe.

Tujuan: Tujuan penelitian ini adalah untuk mengetahui efektivitas konsumsi nugget tempe kedelai terhadap pertambahan berat badan pada balita gizi buruk di wilayah kerja Puskesmas Krui Selatan Kabupaten Pesisir Barat Tahun 2024.

Metode: Penelitian ini menggunakan metode kuantitatif dengan desain pre-eksperimental dan pendekatan one-group pretest-posttest. Populasinya adalah anak usia 1-5 tahun gizi kurang di Wilayah Kerja Puskesmas Krui Selatan Kabupaten Pesisir Barat pada tahun 2024 sebanyak 42 responden dan sampel sebanyak 30 orang. Teknik pengambilan sampel yang digunakan adalah purposive sampling. Intervensi berupa nugget tempe kedelai yang diberikan selama 4 minggu dengan asupan 30 g per hari. Analisis data menggunakan uji Paired Sample T-test.

Hasil: Hasil penelitian menunjukkan rata-rata berat badan balita gizi kurang sebelum mengonsumsi nugget tempe kedelai adalah 8630 gram, meningkat menjadi 9256,67 gram setelah dikonsumsi. Hasil uji Paired Sample T-test menunjukkan bahwa konsumsi nugget tempe kedelai efektif meningkatkan berat badan balita gizi buruk di Wilayah Kerja Puskesmas Krui Selatan Kabupaten Pesisir Barat pada tahun 2024 dengan p-value sebesar 0,000.

Kesimpulan: Konsumsi nugget tempe kedelai efektif meningkatkan berat badan balita gizi buruk di wilayah kerja Puskesmas Krui Selatan Kabupaten Pesisir Barat pada tahun 2024.

Kata Kunci: Nugget, Tempe Kedelai, Berat Badan, Balita, Gizi Kurang

ABSTRACT

Introduction: Nutritional status refers to the condition of the human body influenced by food intake and the utilization of nutrients consumed by an individual. The incidence of malnutrition in the world according to WHO is 45 million children under five, in Indonesia it reaches 13.8%, Lampung province reaches 14.8%. Meanwhile in Pesisir Barat Regency there are 13.7% of children under five and in the South Krui Health Center there are 5.7% of children under five with malnutrition. Malnutrition in children under five can impede their growth and development into adulthood and tends to be irreversible. One effort to improve undernutrition in toddlers is through the use of processed soybean tempeh in the form of tempeh nuggets.

Purpose: The aim of this study was to determine the effectiveness of soybean tempeh nugget consumption on weight gain in undernourished toddlers in the South Krui Community Health Center Working Area, West Pesisir Regency, in 2024.

Method: This research employed a quantitative method with a pre-experimental design and a one-group pretest-posttest approach. The population comprised children aged 1-5 years with undernutrition in the South Krui Community Health Center Working Area, West Pesisir Regency, in 2024, with 42 respondents and a sample of 30 individuals. The sampling technique used was purposive sampling. The intervention consisted of soybean tempeh nuggets administered for 4 weeks with an intake of 30 g per day. Data analysis utilized the paired sample t-test.

Results: The results of this study indicated that the average weight of undernourished toddlers before consuming soybean tempeh nuggets was 8630 grams, which increased to 9256.67 grams after consumption. The paired sample t-test results showed that the consumption of soybean tempeh nuggets was effective in increasing

the weight of undernourished toddlers in the South Krui Community Health Center Working Area, West Pesisir Regency, in 2024, with a p-value of 0.000.

Conclusion: Consumption of soybean tempeh nuggets was effective in increasing the weight of undernourished toddlers in the South Krui Community Health Center Working Area, West Pesisir Regency, in 2024.

Keywords: Nuggets, Soybean Tempeh, Body Weight, Toddlers, Undernutrition

INTRODUCTION

Toddlers are children under the age of five who experience rapid growth and development. During this period, they require a higher quantity and quality of nutrients. However, they are also highly susceptible to nutritional disorders and diseases due to insufficient dietary intake. The lack of essential nutrients in their meals can lead to malnutrition (Ariani, 2017).

Nutritional status refers to the condition of the human body influenced by food intake and the utilization of nutrients consumed by an individual (Suharsa, 2016). Nutritional status can be assessed through various indicators, one of which is the weight-for-height (WHZ) ratio. This measurement classifies individuals into six categories: severely wasted, wasted, normal, possible risk of overweight, overweight, and obese (Regulation of the Minister of Health of the Republic of Indonesia, 2020). In Indonesia, malnutrition remains a significant public health concern (Sambo et al., 2020). Malnutrition in toddlers can hinder their growth and development into adulthood and is often irreversible (Sir et al., 2021).

According to data from the World Health Organization (WHO) in 2020, approximately 45 million toddlers worldwide were malnourished, while 38.9 million were overweight or obese. The data also indicate that around 45% of deaths among children under five years old are attributed to malnutrition (WHO, 2021). Poor nutritional status has a profound impact on public health, as reflected in the high infant mortality rate, which reached 58 per 1,000 live births (Rahayu, 2019). The 2018 Basic Health Research (Riskesdas) survey reported that the national prevalence of undernutrition among children aged 0-59 months in Indonesia was 13.8%, marking a slight decrease from 13.9% in the 2013 survey (Ministry of Health, Republic of Indonesia, 2019).

The prevalence of undernutrition and severe undernutrition among toddlers showed a decline from 18.8% in 2013 to 14.6% in 2021. However, in 2022, it slightly increased by 0.2% to 14.8%. Based on district-level distribution, the highest prevalence was recorded in Mesuji District at 21.4%, while the lowest was in West Lampung City at 10.5%. In Pesisir Barat District, 13.7% of toddlers were classified as undernourished (Lampung Provincial Health Office, 2023). In 2022, the prevalence of undernutrition at Krui Selatan Public Health Center reached 2.87%, rising to 5.7% in 2023 (Krui Selatan Public Health Center, 2023).

According to Supariasa (2016), a child's nutritional status is influenced by two factors: direct and indirect factors. Direct causes include the type of food consumed and infectious diseases the child may suffer from. Meanwhile, fundamental societal issues contribute to inadequate nutrition indirectly through three main aspects: insufficient food availability, inadequate childcare practices, and poor sanitation and access to clean water, as well as inadequate basic healthcare services. These issues lead to dietary imbalances and increase the risk of infectious diseases, which are direct causes of malnutrition (UNICEF, 2020). These three indirect factors are closely related to the mother's level of education, knowledge, income, and skills (Latifah et al., 2018).

Nutritional disorders in toddlers have significant short- and long-term impacts. In the short term, malnutrition can impair brain development, intelligence, physical growth, and metabolism. In the long term, it can lead to reduced cognitive abilities, poor academic performance, and weakened immunity, which increases the risk of diseases such as diabetes, obesity, cardiovascular diseases, cancer, stroke, and disabilities in old age (Ministry of Health, Republic of Indonesia, 2020).

According to the 2016 Recommended Dietary Allowance (RDA), toddlers aged 6–11 months require a daily intake of 15 grams of protein and 1,350 calories. Toddlers aged 1–3 years need 20 grams of protein and 1,350 calories per day, while those aged 4–6 years require 25 grams of protein and 1,400 calories per day. The government has implemented the Supplementary Feeding Program (PMT) as an intervention to address toddler malnutrition (Ministry of Health, Republic of Indonesia, 2016). Providing PMT for 90 weeks has been shown to improve toddlers' nutritional status, as evidenced by weight gain (Iskandar, 2017). The protein standard for PMT in toddlers is 8–12 grams per 100 grams, with a minimum energy content of 400 calories per 100 grams. Soybeans have great

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potential as a PMT ingredient in Indonesia due to their high protein and energy content.

Soybeans, as a type of legume, contain high levels of protein and vegetable oil. With 40.4 grams of protein per 100 grams and an energy content of 381 calories per 100 grams (Aldilah, 2015), soybeans can help meet the nutritional needs of toddlers suffering from protein-energy malnutrition (PEM). However, soybeans also contain lipoxygenase enzymes, which produce an undesirable beany odor that may be unappealing to toddlers. To eliminate this odor, soybeans are processed using strong-flavored ingredients and heat treatment to deactivate the enzyme system (Anggraeni & Christyaningsih, 2016).

Numerous studies have been conducted to develop soybean-based food and beverage products. Examples include the use of soybean flour in brownies (Nidia, 2020), soybeans as a snack bar ingredient (Rahardjo et al., 2019), and soybeans in bread production (Lazo-Vélez et al., 2015), among other similar studies. One literature review explored the effects of soybean-based products on protein-energy malnutrition, such as the "effectiveness of consuming soybean tempeh nuggets in increasing weight among undernourished toddlers" (Mariyam et al., 2017).

One type of PMT that meets these nutritional needs is processed soybean tempeh. Transforming soybean tempeh into nuggets is expected to make the product more appealing to toddlers, increasing their willingness to consume it (Sukini, 2017). The high protein content in tempeh, which is easily digestible and widely available, makes it a valuable protein source for improving children's nutritional status (Imbransyah, 2022). This finding aligns with Sukini's (2017) study, which reported that undernourished toddlers at Tlogomulyo Public Health Center experienced an average weight gain of 0.20 kg after consuming soybean tempeh nuggets.

A preliminary survey conducted in the working area of Krui Selatan Public Health Center, Pesisir Barat Regency, found that in 2023, 39 (5.7%) out of 673 toddlers were malnourished, while in 2024, 31 (5.3%) out of 579 toddlers were classified as malnourished. In contrast, at Krui Public Health Center, only 23 (3.9%) out of 589 toddlers were malnourished. These findings indicate that the prevalence of malnutrition is higher in the Krui Selatan Public Health Center area. This issue is attributed to economic factors and the community's low awareness of balanced nutrition. Therefore, the effectiveness of locally sourced supplementary foods, such as soybean tempeh nuggets, needs to be evaluated in relation to weight gain among malnourished toddlers in this region.

Based on the problem statement above, this study aims to investigate "The Effectiveness of Soybean Tempeh Nugget Consumption on Weight Gain in Malnourished Toddlers in the Working Area of Krui Selatan Public Health Center, Pesisir Barat Regency, 2024."

RESEARCH METHODS

This study employs a quantitative research design with a pre-experimental approach using a one-group pretest-posttest design. The population in this study consists of children aged 1–5 years with malnutrition in the working area of Krui Selatan Public Health Center, Pesisir Barat Regency, in 2024, with a total of 42 respondents, from which 30 participants were selected as the sample. The sampling technique used is purposive sampling. The intervention provided consists of soybean tempeh nuggets, administered for four weeks with a daily intake of 30 grams. Data analysis is conducted using the paired sample test.

RESEARCH RESULT

Based on the table above, it is observed that among the 30 malnourished toddlers, the average weight before consuming soybean tempeh nuggets was 8,630 grams, with a standard deviation of 1,041.6 grams. The minimum weight recorded was 6,900 grams, while the maximum weight was 10,300 grams.

Table 1
Average Weight of Malnourished Toddlers Before Consuming Soybean Tempeh Nuggets

Toddler Weight	n	Mean (g)	Standard Deviation (g)	Min-Max (g)
Before consuming soybean tempeh nuggets	30	8,630.00	1,041.6	6,900 – 10,300

Table 2
Average Weight of Malnourished Toddlers After Consuming Soybean Tempeh Nuggets

Toddler Weight	n	Mean (g)	Standard Deviation (g)	Min-Max (g)
After consuming soybean tempeh nuggets	30	9,256.67	1,092.193	7,400 – 11,000

Based on the table above, it is observed that among the 30 malnourished toddlers, the average weight after consuming soybean tempeh nuggets was 9,256.67 grams, with a standard deviation of 1,092.193 grams. The minimum weight recorded was 7,400 grams, while the maximum weight was 11,000 grams.

Table 3
Effectiveness of Soybean Tempeh Nugget Consumption on Weight Gain in Malnourished Toddlers

Toddler Weight	n	Mean (g)	Standard Deviation (g)	Std. Error Mean (g)	P-value
Before intervention	30	626.667	88.329	10.649	0.000
After intervention	30				

The results of this study indicate that the average weight gain of malnourished toddlers before and after consuming soybean tempeh nuggets was 626.667 grams, with a standard deviation of 88.329 grams and a standard error mean of 10.649 grams. The paired sample test results showed a p-value of 0.000 (< 0.05), indicating that the consumption of soybean tempeh nuggets was effective in increasing the weight of malnourished toddlers in the working area of Krui Selatan Public Health Center, Pesisir Barat Regency, in 2024.

DISCUSSION

The results of this study indicate that the average weight gain of malnourished toddlers before and after consuming soybean tempeh nuggets was 626.667 grams, with a standard deviation of 88.329 grams and a standard error mean of 10.649 grams. The paired sample test results showed a p-value of 0.000 (< 0.05), indicating that the consumption of soybean tempeh nuggets was effective in increasing the weight of malnourished toddlers in the working area of Krui Selatan Public Health Center, Pesisir Barat Regency, in 2024.

The provision of supplementary food (PMT) is an intervention program for malnourished toddlers aimed at improving nutritional status and meeting children's nutrient needs, thereby achieving optimal nutritional status according to their age. PMT for children aged 6–59 months serves as a complementary food, not a substitute for daily main meals. PMT is designed based on local food ingredients, incorporating region-specific menus tailored to local conditions (Atasasih et al., 2023).

The Rhizopus sp. fungus, through the fermentation process, transforms the physical and chemical properties of soybeans into highly nutritious tempeh, making it a functional food. The protein in tempeh is easily digestible, making it an effective source of nutrition for weight gain, particularly in toddlers (Effendi & Widiastuti, 2019).

The nutritional content of tempeh is highly beneficial in meeting toddlers' dietary needs, thereby helping to prevent stunting. Tempeh is known as an affordable fermented food, a common part of daily meals, and an excellent source of protein and energy in Indonesia. With its rich content of protein, carbohydrates, fats, fiber, vitamins, and minerals, tempeh is easily digestible and suitable for all age groups, from infants to the elderly. A study has shown that the growth of children consuming tempeh is comparable to that of children consuming formula milk. With advancements in food processing technology, tempeh-based foods can be further developed into tempeh nuggets (Permatasari et al., 2018).

Tempeh nuggets are a processed frozen product that is ready to cook. Research findings indicate that the nutritional content of tempeh nuggets remains preserved after processing, and they may even become more nutritious, as they are high in protein and low in fat (Mariyam et al., 2020).

This study aligns with research conducted by Risma and Nurhaeda (2022), which demonstrated a positive impact of soybean tempeh nugget consumption on weight gain in malnourished toddlers as part of stunting prevention efforts. Additionally, Imbransyah (2022) found that after the implementation of tempeh nugget consumption, toddler weight increased, likely due to improved protein absorption through the "double protein" concept.

According to the researchers, the increase in toddler weight after the intervention is attributed to

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mothers paying more attention to providing appropriate supplementary foods, including tempeh nuggets, alongside daily meals, with proper portions and feeding techniques. Tempeh contributes to weight gain in toddlers due to its high protein content, making it a valuable nutritional intervention.

CONCLUSION

1. The average body weight of malnourished toddlers before consuming soybean tempeh nuggets in the Working Area of Krui Selatan Community Health Center, Pesisir Barat Regency, in 2024 was 8,630.00 grams.
2. The average body weight of malnourished toddlers after consuming soybean tempeh nuggets in the Working Area of Krui Selatan Community Health Center, Pesisir Barat Regency, in 2024 was 9,256.67 grams.
3. Consumption of soybean tempeh nuggets was effective in increasing the body weight of malnourished toddlers in the Working Area of Krui Selatan Community Health Center, Pesisir Barat Regency, in 2024, with a p-value of 0.000.

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