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THE UTILIZATION OF MORINGA LEAVES (MORINGA OLEIFERA) AS A NUTRITIONAL SUPPLEMENT IN PREVENTING STUNTING IN TODDLERS: NUTRITION STUDY AND THE IMPACT OF ROUTINE CONSUMPTION

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ABSTRACT
The problem of stunting could pose a challenge for Indonesia's Golden 2045. Consuming moringa leaves (Moringa Oleifera) is one alternative to address the nutritional issues present in Indonesia. This plant has super nutritional content, beneficial for food and medicine. This study aims to evaluate the potential of using Moringa leaves as a nutritional supplement for toddlers in preventing stunting, and to determine whether there are differences in toddlers before and after being given food with added Moringa leaves. This research uses a Quasi-Experimental research design, employing quantitative data analysis, specifically a one group pretest post-test design. Sample of 30 respondents, The sampling technique used is Purposive Sampling with inclusion and exclusion criteria. There was an increase in body weight before and after the administration of moringa leaves, amounting to 2.01 kg, while for height, there was an increase of 1.3 cm before and after the administration of moringa leaves. There is a difference between the measurements taken before the addition of moringa leaves to the diet and those taken after. After the addition of moringa leaves to the diet, there was a positive outcome, with 30 respondents experiencing weight gain. Additionally, there was a difference in height measurements before and after the addition of moringa leaves to the diet. The conclusion of this study is that there is an increase in both body weight and height after the addition of moringa leaves to the diet.

Keywords: moringa leaves; nutritional supplements; stunting; utilization

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INTRODUCTION

Stunting remains a serious health issue in Indonesia. Stunting not only affects a child's physical condition but also their cognitive development and long-term performance due to suboptimal brain development (Kementrian Koordinator Bidang Pembangunan Manusia dan Kebudayaan Republik Indonesia, 2023). The issue of stunting is a shared challenge. Globally, based on data from the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO), Indonesia ranks 27th out of 154 countries with stunting data, placing it 5th among countries in Asia. The stunting rate in Indonesia is still far from the target reduction of 14 percent by 2024. According to the 2023 Indonesian Health Survey (SKI), the national prevalence of stunting is 21.5 percent, a decrease of about 0.8 percent compared to the previous year (Rokom, 2024). The issue of stunting could pose a challenge for Indonesia Gold 2045, as stunting can hinder the physical and cognitive development of children, leading to health problems including decreased immunity, a high risk of infections, and other developmental issues, as well as negative impacts on their cognitive development, including learning and thinking abilities that could impede the potential of future generations.

Therefore, addressing stunting is crucial in achieving the vision of Golden Indonesia 2045 2045 (Lulus, 2023)

Efforts to realize the Primary Service Transformation in addressing nutritional issues in Indonesia involve enhancing more targeted promotive and preventive services throughout Indonesian society so that health quality can significantly improve. Nutritious food intake is one of the main behaviors for a healthy life. Dietary patterns and nutrition should be organized well according to the life cycle, meaning that infants and children should consume a lot of animal protein, teenagers should consume plenty of protein and carbohydrates, while adults and the elderly should eat more vegetables to lead a healthier life.(Paudpedia, 2024). Consuming moringa leaves (Moringa Oleifera) is one alternative to address the nutritional issues present in Indonesia. This plant has super nutritious content, good for food and medicine (Haidar and Hutama, 2016). Moringa leaves are beneficial in helping toddlers suffering from stunting to obtain additional vitamins that are important for their growth and development. In addition to providing supplementary food to toddlers suffering from stunting, researchers also provided moringa leaves to the community for their toddlers to consume, as moringa leaves contain twice as much protein as yogurt, three times more potassium than bananas, and four times more Vitamin A than carrots, making it very important for toddlers with stunting to consume in order to meet their vitamin needs(Iskandar, Ningtyias and Rohmawati, 2019). The world of science acknowledges that moringa is the most nutrient-rich plant discovered to date. Moringa contains more vitamins, minerals, antioxidants, essential amino acids, and other beneficial compounds(Krisnadi, 2012). The utilization of locally available food ingredients that are relatively easy to obtain and nutritious, such as moringa leaves, can be used as functional food products and a source of antioxidants. One part of the moringa plant that has been extensively researched for its nutritional content and benefits in both food and health is the leaves(Marhaeni, 2021). Moringa leaf powder has the highest mineral content of calcium (Ca), magnesium (Mg), potassium (K), phosphorus (P), manganese (Mn), and iron (Fe) compared to wheat flour (Zungu et al., 2020).

Moringa leaves can be beneficial for those who do not get protein from meat; in fact, moringa leaves contain arginine and histidine, which are particularly important for infants who are unable to produce enough protein for their growth. A comparative study on fresh moringa leaves compared to other foods shows that they contain 7 times the vitamin C of oranges, 4 times the vitamin A of carrots, 4 times the calcium of milk, 3 times the potassium of bananas, and 2 times the protein of yogurt(Isnan and Muin, 2017). The consumption of moringa leaves is one alternative to address the issue of malnutrition in Indonesia.The vitamin A found in moringa leaf powder is equivalent to 10 (ten) times the vitamin A found in carrots, 17 (seventeen) times the calcium found in milk, 15 (fifteen) times the potassium found in bananas, 9 (nine) times the protein found in yogurt, and 25 (twenty-five) times the iron found in spinach (Zakaria and Sirajuddin, 2012). This study aims to evaluate the potential of using Moringa leaves as a nutritional supplement for toddlers in preventing stunting, and to determine whether there are differences in toddlers before and after being given food with added Moringa leaves.

METHOD

This research uses a Quasi-Experimental research design, employing quantitative data analysis, which is a method to investigate the effect of a specific treatment on another under controlled conditions (Swarjana and SKM, 2022). This research uses a one-group pretest-posttest design. The pretest is used to obtain initial scores before the research is conducted. The posttest is used to obtain final scores after the research is carried out, This research approach involves three main stages as follows: Initial Stage (P1): In this stage, initial data

collection is conducted regarding the nutritional status of the toddlers who are the subjects of the research. The data includes height, weight, and the child's health condition to obtain a baseline picture before the intervention. Intervention (X1): At the intervention stage, toddlers are given supplements made from moringa leaves in specific amounts and frequencies. This consumption is carried out regularly over a specified period, for example, several months. In addition, monitoring of dietary patterns, other nutritional intakes, and adherence to supplement consumption is conducted. Final Evaluation (P'1): After the intervention is completed, a re-evaluation of the nutritional status of toddlers is conducted. Changes in parameters such as height, weight, and stunting indicators are compared with baseline data (P1) to assess the impact of moringa leaf consumption.

This research was conducted in the Peduruangan district from May to July 2024. The population in this study consists of toddlers in the Peduruangan sub-district who are experiencing stunting, malnutrition, or are below the green line on the KMS (Growth Monitoring Card). The sample for this study is 30 toddlers. The intervention provided involves adding food enriched with moringa leaves to the daily menu, which is varied each day and weighed beforehand. At the end of each month, measurements of the children's height and weight are taken. Data collection was carried out by the researchers with the assistance of community health workers and nutrition experts from the health center. Univariate analysis is used to determine the frequency distribution of characteristics such as age and gender. Bivariate analysis is used to identify differences in weight and nutritional status of toddlers before and after an intervention, which involves providing supplementary food by adding moringa leaves. In this study, bivariate analysis was conducted using the Wilcoxon test after performing a normality test on the data, which resulted in non-normal data. This study used a closed questionnaire with a Cronbach's Alpha result for the nutrition knowledge scale: 0.85 (reliable), and a Cronbach's Alpha for the consumption behavior scale: 0.82. (reliabel). This research has passed the Ethics Test with No: 103/EC-LPPM/UWHS/IV-2024.

RESULT

Data collection was conducted from May to July 2024 with a total of 30 respondents (toddlers) who were given supplementary food utilizing moringa leaves as a nutritional supplement to prevent stunting in young children. The results of this research are as follows:

Table1.
Characteristics of Respondents

Characteristics	f	%
Gender		
Male	19	63,3
Female	11	36,7
Toddler Age		
9-18 months	7	23,3
19-29 months	6	20
29-38 months	4	13,3
39-48 months	7	23,3
49-58 months	6	20
Weight Before Intervention		
6-9 kg	13	43,3
10-13 kg	17	56,7
Height Before Intervention		
68,8 - 78,8 cm	10	33,3
78,8 – 89,9 cm	2	6,7
90,8 – 100,8 cm	16	53,3
100,9 -111,8 cm	2	6,7

Characteristics	f	%
Weight After Intervention		
6-9 kg	5	16,7
10-13,9 kg	22	73,3
14 – 17 kg	3	10
Height After Intervention		
68,8 - 78,8 cm	9	30
78,8 – 89,9 cm	3	10
90,8 – 100,8 cm	14	46,7
100,9 -111,8 cm	4	13,3
30	100	

Based on the characteristics of the respondents in Table 1, there are more male respondents compared to female respondents, with 19 toddlers (63.3%). The majority of toddlers are aged 9-18 months with 7 toddlers (23.3%) and 39-48 months with 7 toddlers (23.3%). Before the intervention, the most common weight range was 10-13 kg, with 17 toddlers (56.7%) falling into this category. The most common height before the intervention was between 90.8-100.8 cm, with 16 toddlers (53.3%). After the intervention, the most common weight range was 10-13.9 kg, with 22 toddlers (73.3%). Additionally, the most common height after the intervention was also between 90.8-100.8 cm, with 14 toddlers (46.7%).

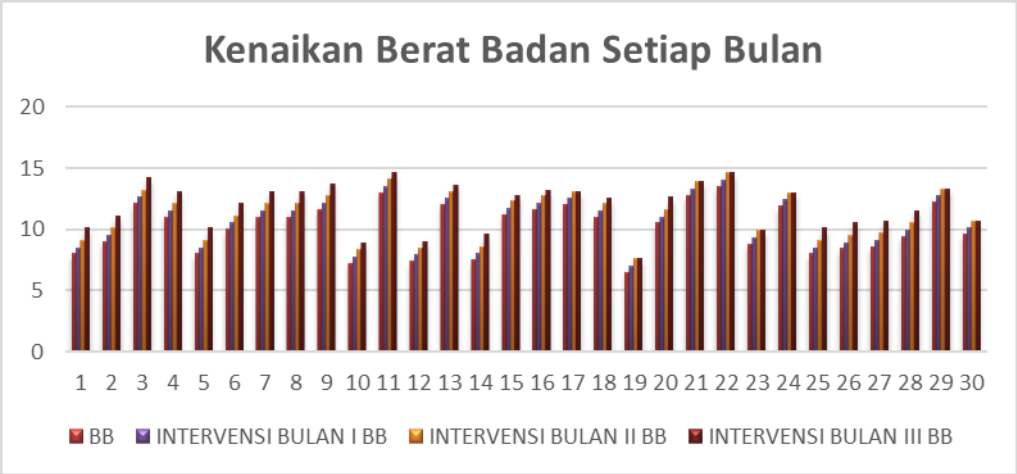

Figure 1. Monthly Weight Gain

The results from image 1 show that each month, after being given additional food by incorporating moringa leaves into the menu, the toddlers experienced weight gain every month.

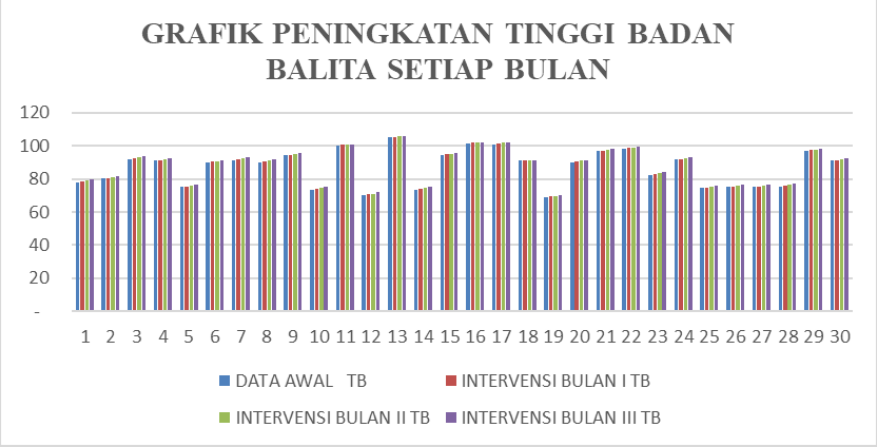

Figure 2. Monthly Increase in Toddler Height

The results from image 2 show that each month, after being given additional food by incorporating moringa leaves into the menu, the toddlers experienced weight gain every month.

Table 2.
Increase in Weight and Height Before and After the Administration of Moringa Leaves

Characteristic	Mean	Std Deviation
Increase in Weight Before and After the Administration of Moringa Leaves (Kg)	2,0100	,40288
Increase in Height Before and After the Administration of Moringa Leaves (cm)	1,2667	,40627

Table 2 shows that there was an increase in weight before and after the administration of Moringa leaves, amounting to 2.01 kg, while for height, there was an increase of 1.3 cm. Thus, it can be concluded that the weight and height of toddlers with malnutrition or stunting improved after being provided with food supplemented with Moringa leaves over a period of 90 days, as both the weight and height of the toddlers experienced an increase before and after the intervention

Table 3.
Wilcoxon Test

	Results of the Wilcoxon Test for the weight of toddlers before and after being given moringa leaves
Z	-4.795a
Asymp. Sig. (2-tailed)	.000

Based on Table 5 from the Wilcoxon test results, a significance value of 0.000 ($p<0.05$) was obtained, indicating that there is a difference between the measurements taken before the addition of moringa leaves to the food and after the addition. After the food was supplemented with moringa leaves, there was a positive increase, with 30 respondents experiencing weight gain..

Table 4.
Wilcoxon Test

	Results of the Wilcoxon Test for the Height of Toddlers Before and After the Administration of Moringa Leaves
Z	-4.845a
Asymp. Sig. (2-tailed)	.000

Based on Table 4 from the Wilcoxon test results, a significance value of 0.000 ($p<0.05$) was obtained, indicating that there is a difference in height before and after the addition of moringa leaves to the diet

DISCUSSION

Based on the results of the research conducted on the utilization of moringa leaves (Moringa Oleifera) as a nutritional supplement in preventing stunting in toddlers, several analyses were performed, revealing that the respondents used in this study consisted of 30 toddler respondents. Based on the characteristics of the respondents' gender, the majority are male, with 19 toddlers (63.3%). The majority of toddlers are aged between 9-18 months (23.3%) and 39-48 months (23.3%). The nutritional status of toddlers before intervention based on weight for age showed that the majority had poor nutritional status (93.3%). The nutritional status of toddlers before intervention based on height showed that 96.7% had normal body height. After the intervention, the nutritional status of toddlers based on weight for age showed that the majority had normal nutritional status at 96.7%, while the height for age with normal body height was 86.7%. The nutritional health of toddlers is very important for their optimal growth and development (Unicef, 2023). One solution to reducing stunting is through improving nutrition that is more focused on balanced nutrition (Triyasni, 2023).

Based on the results of the bivariate analysis, there was an increase in body weight before and after the administration of moringa leaves amounting to 2.01 kg, while for height, there was an increase of 1.3 cm before and after the administration of moringa leaves. Thus, it can be

concluded that the body weight and height of toddlers with malnutrition or stunting improved after being provided with food supplemented with moringa leaves over a period of 90 days, as both body weight and height of the toddlers showed improvement before and after the intervention. Although the increase experienced is not very significant, providing food by adding moringa leaves is more effective in improving and addressing stunting in toddlers. Based on the results of the Wilcoxon test, it was found that there is a difference between before the food was given with the addition of moringa leaves and after the food was given with the addition of moringa leaves. After the food was supplemented with moringa leaves, there was a positive increase, with 30 respondents experiencing weight gain. There is a difference in height before the food with the addition of moringa leaves is given and after the food with the addition of moringa leaves is provided. Based on the explanation above, it can be concluded that this research accepts the null hypothesis (Ho), which means that moringa leaves (Moringa oleifera) are effective as a nutritional supplement in preventing stunting in toddlers, as evidenced by the increase in weight and height in young children.

This is in accordance with the research conducted by Sutrisna, Maulida and Alkautsar, 2023 Based on the results of the paired sample T-test, it was found that for output pair 1, the significance value obtained was 0.003 < 0.05, which allows us to conclude that there is a difference in the height of toddlers before and after the cultural dietary development through moringa leaf products via fortification. The paired sample T-test on the non-treatment group showed that for output pair 2, the significance value obtained was 0.258 > 0.05, which allows us to conclude that there is no difference in the height of toddlers in the non-treatment group before and after 75 days. Based on the explanation above, it can be concluded that there is effectiveness in the development of dietary culture through the provision of moringa leaf products via fortification in addressing stunting in toddlers in the Simpang Keramat Health Center area. Based on the explanation above, it can be concluded that the hypothesis in this study is that the null hypothesis (Ho) is accepted and the alternative hypothesis (Ha) is rejected, which means there is an effectiveness in the development of dietary culture through the provision of moringa leaf products via fortification in the management of stunted toddlers in the working area of the Simpang Keramat Health Center, as the significance value is 0.000 < 0.05.

Moringa contains abundant nutrients that play a crucial role in meeting human nutritional needs. The leaves of the moringa plant are usually used in food because of their high nutritional value. Compared to other plants commonly consumed as vegetables or fruits, the nutritional content of moringa leaves is significantly higher. (Hekmat et al., 2015). It is explained that moringa leaves contain more vitamin C than oranges, higher potassium than bananas, more vitamin A than carrots, more calcium than milk, and have a higher protein content than yogurt (Gandji et al., 2018). Moringa leaves contain various antioxidant compounds such as ascorbic acid, flavonoids, phenolic compounds, and carotenoids that can act as natural antioxidants. The minerals contained in moringa leaves include iron, calcium, potassium, zinc, and other minerals, and almost all vitamins such as vitamins A, B, C, D, and E are found in moringa leaves(Falowo et al., 2018). The addition of moringa leaf powder can be used as an additive to improve the nutritional quality of food products. The inclusion of moringa leaf powder leads to a significant increase in protein content and minerals in several food products. The higher the concentration of moringa powder added, the better the increase in protein, fat, fiber, and minerals in various food products. However, the concentration of moringa leaf powder that can be accepted should not exceed 5%. (Angelina, Swasti and Pranata, 2021).

This is supported by research conducted by Sutrisna et al., 2023 to determine the effectiveness of moringa leaves in increasing the weight of toddlers in Mampree Village, Syamtalira Aron District, Aceh Regency. The intervention involved giving moringa leaves to toddlers for three consecutive weeks, with one bowl provided to each toddler. It was observed that toddlers receiving the moringa intervention experienced a greater weight gain compared to the control group. In the intervention group, 80% of toddlers gained weight of ≥ 2 kg, while in the control group, only 15% experienced similar weight gain

CONCLUSION

The utilization of moringa leaves (Moringa Oleifera) as a nutritional supplement in preventing stunting in toddlers resulted in an increase in weight before and after the administration of moringa leaves, amounting to 2.01 kg. Meanwhile, there was an increase in height before and after the administration of moringa leaves of 1.3 cm. Thus, it can be concluded that the weight and height of toddlers with malnutrition or stunting improved after being provided with food supplemented with moringa leaves over a period of 90 days, as both weight and height showed an increase before and after the intervention. Although the increase experienced is not very significant, providing food by adding moringa leaves is more effective in improving and addressing stunting in toddlers. There is a difference between before the food was given with the addition of moringa leaves and after the food was given with the addition of moringa leaves. After the food was supplemented with moringa leaves, there was a positive increase, as 30 respondents experienced weight gain. There is a difference in height before the food with the addition of moringa leaves is given and after the food with the addition of moringa leaves is provided. Based on the explanation above, it can be concluded that this research accepts the null hypothesis (Ho), which means that moringa leaves (Moringa oleifera) are effective as a nutritional supplement in preventing stunting in toddlers, as evidenced by the increase in weight and height in the children.

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