

RESEARCH ARTICLE

OPEN ACCESS

Manuscript received June 9, 2024; revised June 18, 2024; accepted June 20, 2024; date of publication June 30, 2024

Digital Object Identifier (DOI): <https://doi.org/10.35882/ijahst.v4i3.346>

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How to cite: Yeni Bakti Megananda, Nana Usnawati, Tutiek Herlina, and Rahayu Sukmaningsih, "Effectiveness of Milk Supplementation on Weight and Height of Stunted Toddlers: A Pre-Experimental Study in Magetan, Indonesia", International Journal of Advanced Health Science and Technology, vol. 4, no. 3, pp. 144 - 148, June. 2024

Effectiveness of Milk Supplementation on Weight and Height of Stunted Toddlers: A Pre-Experimental Study in Magetan, Indonesia

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ABSTRACT Stunting or a short child was described as a toddler whose height was lower than the standard height for toddlers his age. Until now, the prevalence of stunted toddlers in Indonesia is still high. The prevalence of stunted toddlers at the Plaosan Community Health Center in the last 3 years showed an increase. The cause of stunting, apart from infection, is also related to nutritional deficiencies (micronutrients and macronutrients). The adverse effect of stunting in the short term are disruption of brain development, intelligence, impaired physical growth, and metabolic disorders in the body. Supplementary feeding is one of the solutions in handling stunting. This study aims to determine the effectiveness of milk feeding on the weight and height/length of stunted toddlers. The type of research used was pre-experimental with a one group pretest posttest design. The sample used a total population of 56 toddlers. The dependent variable in this study was the weight and height/length of stunted toddlers, the independent variable is the provision of milk for toddlers. Data collection used weight and height measurement sheets and milk feeding observation sheets. Comparative data analysis was conducted using the paired samples t test statistical test. The results of the study show that the average body weight before giving milk was 8737.5 mm and after giving milk 8923.2 mm. Body height/length before milk feeding was 804.6 mm and after milk feeding was 806.63 mm. Different test using paired samples t test obtaining the conclusion that there is a significant difference in the increase in body weight of toddlers with a significance level of 0.000 ($p < 0.05$) and there is a significant difference in increasing the height of toddlers with a significance level of 0.000 ($p < 0.05$). Conclusion: Milk is effective to increase the weight and height/length of toddlers, so it is advisable for mothers of toddlers to get their children used to a glass of milk everyday.

INDEX TERMS Stunting, milk feeding, body weight, height/length

I. INTRODUCTION

Reduction of Maternal Mortality Rate (MMR), Infant Mortality Rate (IMR), and stunting are priorities in health development, as stated in Presidential Regulation number 18 of 2020 concerning the Medium-Term National Development Plan for the years 2020-2024 [1]. Stunting, or short stature in children, is described as a condition where a toddler's height is below the standard height for their age [2], indicating a recurring and long-term nutritional problem.

In 2022, the global prevalence of stunting was 21.6%. In Indonesia, data from the Ministry of Health shows a stunting prevalence of 21.6%, with East Java Province recording 19.2% [3]. In Magetan, the prevalence of stunting in 2022 was 14.9%. The Performance Assessment of Plaosan Community Health Center (Puskesmas) in 2023 indicated a

stunting rate (short and very short stature) of 8.52%, below the Magetan District target of 16%. However, the prevalence of stunting at Plaosan Community Health Center has increased over the past 3 years from 7.54% in 2021, 7.91% in 2022, to 8.52% in 2023. Therefore, efforts are needed to reduce the incidence of stunting as outlined in the National Medium-Term Development Plan for the years 2020-2024 [1]. The causes of stunting, as indicated by various research findings, are not only related to infections but also associated with nutritional deficiencies (both macronutrients and micronutrients). Several nutrients are linked to stunting, such as protein, iron, zinc, calcium, and vitamins D, A, and C. Additionally, hormonal and genetic factors, low parental knowledge in caregiving, poverty, poor environmental sanitation, limited food accessibility at the family level, especially among impoverished families, and

inadequate access to basic healthcare services are risk factors for children experiencing stunting [4]

The negative impacts of stunting in the short term include disrupted brain development, intelligence, physical growth disturbances, and metabolic disruptions in the body. In the long term, the adverse consequences can lead to decreased cognitive abilities and learning performance, weakened immune systems making them susceptible to illnesses, and a high risk for developing diabetes, obesity, cardiovascular diseases, cancer, stroke, tuberculosis, disabilities in old age, non-competitive work quality resulting in reduced economic productivity [4]

Efforts to prevent stunting include specific nutritional interventions targeting priority groups such as pregnant women, breastfeeding mothers, and children aged 0-24 months, involving the provision of additional meals for pregnant women and iron supplementation tablets. For breastfeeding mothers and children aged 0-23 months, there is promotion and counseling on breastfeeding, Infant and Young Child Feeding (IYCF) practices, treatment for acute malnutrition, Supplementary Feeding Programs (SFP) for moderately malnourished children, and growth monitoring. Specific nutritional interventions targeting important groups such as adolescents, women of childbearing age, and children aged 24-59 months include iron supplementation tablets, treatment for acute malnutrition, SFP for moderately malnourished children, and growth monitoring [5]

The provision of additional food is one of the solutions in addressing stunting. The additional foods provided can be family-based meals using local ingredients and recommended recipes [6]. Furthermore, SFP can also include Processed Food for Special Dietary Needs (PFSDN), abbreviated as PDK, which are processed or formulated foods specifically designed to meet certain nutritional needs due to specific physical or physiological conditions [7]. Some foods classified under PFSDN include standard formula milk for ages 0-12 months and growth milk for ages 1-3 years [8]. Toddler Milk is a milk product chosen by Plaosan Community Health Center to be given to stunted toddlers for 45 days. The selection of this milk is because it contains more carbohydrates than other brands and contains n-6 polyunsaturated fatty acids (PUFAs) and 0.5% of n-3 PUFAs, with a linoleic/alpha-linolenic acid ratio ranging from 5-10. These contents are beneficial in meeting the child's energy needs. This program started in February 2024. Based on the outlined information, the researcher will conduct a study on the "Effectiveness of milk provision on the weight and height/length of stunted toddlers."

The general objective of this research is to determine the effectiveness of giving Batita milk on the increase of weight and height/length of stunted children. The specific objectives are as follows, To identify the characteristics of gender among the subjects, to measure the weight and height/length of the stunted children before and after receiving Batita milk., to analyze the effectiveness of giving Batita milk on the weight and height of stunted children

II. METHODS

This research utilizes a pre-experimental design, specifically a one-group pretest-posttest design, which involves conducting an experiment or treatment on the independent variable and then measuring the effects or influence of that treatment on the dependent variable. In this study, the treatment involved providing milk for 45 days, and the impact of this treatment was measured by comparing the weight and height/length of the children before and after the milk intervention.

The research location is conducted in the Working Area of Puskesmas Plaosan, Magetan District, with the study period from February 2024 to May 2024. The population of this study includes all toddlers aged 1-3 years who received Batita milk as part of the PMT in the Puskesmas Plaosan area, totaling 56 individuals who met the inclusion and exclusion criteria. The sampling technique used in this research is saturated sampling/census.

The dependent variables in this study are the weight and height/length of stunted children, while the independent variable is the provision of Batita milk. Data collection techniques include observation sheets. The research instruments used include measurement sheets for weight using an Endo brand electronic scale, height measurement using an Endo brand stadiometer (for children over 2 years old) and infantometer (for children under 2 years old), and an observation sheet for milk provision.

Data analysis in this study is presented descriptively and comparatively. Descriptive data presentation uses frequency distribution tables for gender and age of the toddlers. Meanwhile, data on weight and height/length measurements before and after the intervention are presented in tables of central tendency. Comparative data analysis is conducted using a paired samples t-test with a significance level of $\alpha = 0.05$. The conclusion from the statistical test results is that there is a difference if the p-value is ≤ 0.05 , and there is no difference if the p-value is > 0.05 .

III. RESULTS

This research was conducted in the working area of Puskesmas Plaosan, which comprises 2 urban villages and 6 rural villages, namely Kelurahan Plaosan, Kelurahan Sarangan, Desa Bulugunung, Desa Ngancar, Desa Dadi, Desa Plumpung, Desa Puntukdoro, and Desa Pacalan. Puskesmas Plaosan has 46 integrated health posts (posyandu) for toddlers spread across all villages/urban areas. Routine posyandu activities are conducted every month with the assistance of 230 active posyandu cadres.

The working area of Puskesmas Plaosan is dominated by hills and valleys on the slopes of Mount Lawu. However, all areas within the working area of Puskesmas Plaosan are accessible by land vehicles. The working area of Puskesmas Plaosan is located 10 km west of the capital city of Magetan District. The majority of the population in the Puskesmas Plaosan area work as farmers and vegetable traders. For families

where the wife does not work, to support the household economy, the wife/mother often assists her husband in the fields/farms. Mothers usually stay at home during pregnancy and after giving birth. However, once the child reaches 2 years old, they are often taken to the fields/farms. This p

Characteristics of Toddlers

The gender and age characteristics of the toddlers in this study can be seen in Table 1 as follows:

TABLE 1
Frequency Distribution of Toddler Characteristics

Charateristics	Frequency	Percentage
Gender		
Male	29	51,79%
Female	27	48,21%
Total	56	100%
Age		
1-2 Years old	24	42,86%
2-3 Years old	32	57,14%
Total	56	100%

TABLE 1 The table shows that the majority of toddlers (51.79%) are male, while the remaining (48.21%) are female. Based on age criteria, most toddlers are between 2-3 years old (57.14%), with the rest (42.86%) being between 1- 2 years old.

B. WEIGHT AND HEIGHT/LENGTH BEFORE AND AFTER MILK SUPPLEMENTATION

TABLE 2 There is a difference in the average weight of toddlers before and after milk supplementation. The same is true for height/length. There is a difference in the average height/length of toddlers before and after milk supplementation.

TABLE 2
Distribution of Weight and Height/Length of Toddlers Before and After Milk Supplementation

Variable	Group	Median	Mean	SD	Min- Max
Weight	Before	8400	8737,50		7000-11100
	After	8700	8923,21		7000-11300
Height	Before	800	804,66	52,42	711- 930
	After	803	806,63	52,44	711- 932

TABLE 2 There is a difference in the average weight of toddlers before and after milk supplementation. The same is true for height/length. There is a difference in the average height/length of toddlers before and after milk supplementation.

The normality test was conducted using the Kolmogorov-Smirnov test, and the result showed $p > 0.05$, indicating that the data are normally distributed. Therefore, we can proceed with the paired sample t-test

C. Comparison of Weight and Heigh/Length Gain Based on Characteristics of Toddler Children

The average weight gain in males is 189.66 grams, slightly larger than the average weight gain in females, which is 181.46 grams. Similarly, the average height gain in males is 1.96 mm, slightly smaller than the average height gain in females, which is 1.97 mm. The average weight gain based on age is almost the same across genders. The weight gain for ages 1-2 years is 191.67 grams, slightly larger than the weight gain for ages 2-3 years, which is 181.25 grams. Likewise, the average height gain for ages 1-2 years is 1.86 mm, slightly larger than the average height gain for ages 2-3 years, which is 2.07 mm.

To assess if there is a significant difference in weight and height/length between male and female toddler children, an independent samples t-test was conducted. The same was done for the height/length variable. To assess if there is a significant difference in height/length between toddler children aged 1-2 years and those aged 2-3 years, an independent samples t-test was conducted. The results of the tests are shown in Table 5.

TABLE 3
The results of the test on the difference between gender and age regarding the increase in weight and height/length of toddler children are as follows.

Characteristics	Variable	Levene's Test	p
Gender	Weighh	0,001	0,874
	Heigh/Length	0,000	0,577
Age	Weighh	0,000	0,838
	Heigh/Length	0,000	0,978

TABLE 3 shows the characteristics of gender in terms of homogeneity values, which are not homogeneous as the value is $p < 0.05$. Similarly, the characteristics of age in terms of homogeneity values are not homogeneous as the value is $p < 0.05$. The test for differences in gender characteristics regarding weight and height/length of the body shows no significant difference, with p-values of 0.874 and 0.577 ($p > 0.05$). The same results are observed for age characteristics regarding weight and height/length of the body, indicating no significant difference with p-values of 0.838 and 0.978 ($p > 0.05$).

IV. DISCUSSION

A. CHARACTERISTICS OF TODDLERS

Characteristics of toddlers based on gender are categorized into two categories: males and females. In this study, male toddlers outnumbered females. The toddler phase is a period of rapid body and brain growth. Gender is one of the factors influencing the growth of toddlers. Besides gender, other factors affecting growth include genetics, nutrition, environment, parenting style, and socioeconomic factors [9]. Previous research by Savita stated that there is no significant relationship between a toddler's gender and the occurrence of stunting. Male toddlers tend to experience stunting 1 time more than female toddlers [10]. Previous research by Aprilia indicated a relationship between gender and stunting. Gender

determines an individual's nutritional needs. Males require more energy and protein than females [11]

Researchers believe that the nutritional needs of boys differ from girls. Boys usually need more nutrients because they have higher physical activity levels. Gender determines the magnitude of nutritional needs for an individual. Males require more energy and protein than females. Gender is an internal factor that determines nutritional needs and affects nutritional status, thus establishing a connection between gender and weight and height/length increase in stunted toddlers.

The characteristics of respondents based on the age of toddlers are divided into two age groups: one to two years and two to three years. In this study, the majority fell into the two to three years age group. Stunting occurrence is influenced by conditions during the first 1000 days of life, from when the fetus is in the womb until the child is 2 years old. This period is called the critical window because rapid brain development or intelligence and body growth occur during this time. If sufficient nutrition is not provided to pregnant women, exclusive breastfeeding is not provided, and nutritionally inadequate complementary feeding is given to children, stunting can occur. Stunting can occur from ages 0-2 and continue to age 3-6 [12]. Age determines a toddler's nutritional needs, as nutritional requirements increase with age [13]

The recommended weight gain according to the toddler growth chart for ages 1-3 years is 200 grams per month [14]. Ideal height is the range of normal body length for age and gender. The increase in body length from age 1 to age 2 is about 13 cm, and from age 2 to age 3 is about 9 cm [15]. Growth rates vary for each child due to genetic factors, nutrition, growth stimulation, and growth hormone levels. However, there are ways to maximize child growth, one of which is by providing milk. Milk contains essential nutrients for growth, including protein (amino acids), fats, calcium, magnesium, zinc, vitamin A, and vitamin D [9].

The researcher believes that there are differences between the research results and theory. Minimal weight gain for toddlers using the growth chart is 200 grams, while the research results show an average increase of 185 grams. This could be due to some toddlers experiencing weight loss while others maintain their weight. However, many also experience weight gain, with some toddlers gaining as much as 500 grams. Weight loss or no weight gain in toddlers can be caused by post-illness recovery, not having breakfast or milk before measurement, or wearing thinner clothes during measurement than previously worn.

The average increase in height/length for toddlers is 2 mm. This variation can be attributed to some toddlers maintaining their height. However, many also experience height increase, with some reaching 6 mm. These varied increases can be due to the nutrients absorbed by the body and parental stimulation, such as swimming activities with the child.

B. EFFECTIVENESS OF MILK PROVISION ON WEIGHT AND HEIGHT/LENGTH OF TODDLER'S BODY

"In this study, a paired samples t-test was used, resulting in a significant difference in the increase in toddler's weight with a significance level of 0.000 ($p < 0.05$) and a significant difference in the increase in toddler's height with a significance level of 0.000 ($P < 0.05$). This research aligns with a study by Imas Rini, which stated that Provision of arenting pattern could potentially be one of the causes of stunting This research aligns with a study by Imas Rini, which stated that Provision of

Supplementary Recovery Food (PMT-P) to malnourished toddlers with the provision of F100 milk package for 3 months showed that all toddlers experienced weight gain as indicated by positive values in the change in weight of toddlers before and after the Provision of PMT-P [16]

The findings of this study are consistent with the theory that milk intake affects weight and height. Milk contains nutrients essential for a child's growth. Calcium, vitamin D, phosphorus, and protein are important nutrients in milk for bone formation and child growth. Calcium and phosphorus play a role in bone strengthening and growth, while vitamin D aids in bone resorption [17]. Furthermore, toddler milk is one of the Special Processed Foods (PKGK) containing sufficient nutrients consisting of 30% fat and 10-15% protein containing n-6 polyunsaturated fatty acids (PUFAs) and 0.5% of n-3 PUFAs, with a linoleic/alpha-linolenic acid ratio ranging from 5-15, which can meet the total energy needs of malnourished children [14].

The researcher believes that milk is a complete nutritious beverage suitable for all ages. Despite the health benefits of milk, the level of milk consumption in Indonesia is still low. The milk consumption rate in Indonesia is even lower than neighboring countries such as Malaysia at 50.9 L/capita/year, Singapore at 44.5 L/capita/year, and Thailand at 33.7 L/capita/year. Children who drink cow's milk have a relatively good nutritional status.

Based on the analysis in this study, milk supplementation is effective in increasing the weight and height/length of toddlers, indicating the need to encourage milk consumption among toddlers. For children up to 2 years old, breastfeeding should still be provided while also introducing milk consumption so that by the time the child is over 2 years old, they are accustomed to drinking milk. Monitoring of growth should be done regularly, with toddlers attending health centers or clinics to prevent stunting. If stunting is diagnosed, prompt and appropriate interventions will be provided to the child.

V. CONCLUSION

Based on the research findings and discussion, the following conclusions can be drawn is the majority of toddlers are male and aged between two and three years old. There is a significant difference in the average weight and height/length of the body before and after milk supplementation. Milk supplementation is

effective in increasing the weight and height/length of toddlers' bodies.

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