



## Additional Feeding Based on Local Food to Improve The Nutritional Status of Toddlers

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### Article Info

*Article History:*  
Submitted August 2020  
Accepted September 2020  
Published July 2021

*Keywords:*  
malnutrition,  
toddlers, moringa

**DOI**  
<https://doi.org/10.15294/kemas.v17i1.25862>

### Abstract

East Nusa Tenggara (NTT) occupies the first position in the incidence of malnutrition in Indonesia, with Kupang City as the third highest position in cases of malnutrition in NTT Province. The purpose of this study was to see the effect of supplemental feeding based on local food (Moringa nuggets) on improving status. Nutrition for toddlers. This research was conducted in 2020, using a quasi experimental research method with a pre-test-posttest control group design. A total of 90 respondents were selected using purposive sampling technique. The data were collected using a questionnaire, anthropometric measurements to measure nutritional status, and recording weight gain at the beginning and end of moringa nuggets. Each research subject in the case group was given Moringa nuggets for 30 days as many as 3 pieces of nuggets per day, where each piece contained 11.4% protein. Data analysis was performed bivariately using the Pearson correlation test with  $\alpha = 0.05$  and pre-post comparison analysis with paired samples T-test. The results showed that there was a significant difference in changes in nutritional status of children under five before and after giving Moringa nuggets to underweight children under the anthropometric index of weight / age indicated by  $p = 0.041$  ( $p < 0.05$ ). Meanwhile, the anthropometric index weight / height did not show a significant difference with a value of  $p = 0.052$ .

### Introduction

Child growth and development is a process that runs continuously from the womb to adulthood (Iskandar, 2017). Adequate nutritional intake during infancy and toddlerhood is vital to ensure optimal growth and development (Demilew, Tafere and Abitew, 2017). Childhood is the most precious period in the development of human life. At this stage, optimal brain and physical development occur (Mardani and dkk, 2015). About 35% of deaths in the world are related to nutrition. 4.4% of them are proven to be caused by the incidence of severe wasting (Workie et al., 2020).

Nutrition is one of the notable factors affecting the development of children under five. The condition of children who experience rapid weight loss or failure to gain weight due to hunger and/or disease is called wasting (Chaturvedi et al., 2018). The nutritional status

of children under five can affect several aspects (Rahim, 2014). Undernutrition in children under five harms physical and mental growth, which in turn will hinder learning achievement. Another result is a decrease in endurance, causing the loss of a healthy life span for children under five, and more consequences, namely the emergence of disabilities, high morbidity, and accelerated death (Rahim, 2014).

Nutritional disorders are caused by factors (determinants), namely primary factors and secondary factors. The primary factor is when a person's food source is wrong in quantity or quality due to lack of food supply, poor food distribution, poverty, ignorance, improper eating habits, etc. Meeting the level of protein and zinc needs helps children achieve better growth and health (Blaney et al., 2019). The practice of proper feeding for infants and toddlers, according to the recommendations,

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has been shown to protect against malnutrition in various situations (Anin et al., 2020). Secondary factors include all factors that inhibit nutrients to the body's cells after food is consumed (Lutviana and Budiono, 2010). Apart from poverty, household sanitation and low food diversity also affect malnutrition among infants and toddlers (Muhoozi et al., 2016). The relationship between education, knowledge, and income is an interrelated factor. Where education affects cognition and speed in absorbing and understanding information, including about health and nutrition. On the other hand, education can determine the type of work a person gets and generate income. However, this relationship is not always relevant because it is affected by other factors (Sophia, Suherni and Kuswardinah, 2017).

East Nusa Tenggara (NTT) is the province with the highest level of malnutrition in Indonesia. Based on statistics, the regions with the most malnutrition sufferers without clinical abnormalities are South Central Timor Regency which reaches 310 children under five, Southwest Sumba (204), and Kupang City (209) (Dinas Kesehatan Provinsi NTT, 2017). The 2017 profile of the Kupang City Health Office shows that the prevalence of under-fives with underweight results in 2017 was 372 under-fives or 2.63% of the total children under five who were weighed in Kupang City as many as 14,167 children under five (Dinas Kesehatan Provinsi NTT, 2017).

The Ministry of Health has established comprehensive policies, covering prevention, promotion/education, and overcoming malnutrition under five. Prevention efforts are carried out through growth monitoring at posyandu. Exclusive breastfeeding and breastfeeding for two years can reduce malnutrition risk (Lassi et al., 2020). Physiologically, breast milk can only provide nutrition until a certain age where the baby's diet requires adding solid foods. Nutritional intake needs to be increased to ensure optimal growth and development. It is important to note that early nutrition can have irreversible consequences because, after two years of age, stunting and other growth deficiencies can be very difficult to overcome (Lassi et al., 2020). The formula given to people with malnutrition

refers to the WHO standard. It consisting of milk, oil, sugar, flour, and water. Additional food (Pemberian Makanan Tambahan/PMT) is given in addition to the WHO formula, which is a modified formula in the form of a fair energy and protein-dense formula, consisting of ingredients that are available in the community at affordable prices (Mardani et al., 2015).

To enrich nutritional content, we can substitute the ingredients with local food sources of protein and vitamin A (Iskandar, 2017). One of the local food ingredients with high nutritional value as additional food easily accessible to people in NTT is moringa. According to DKBM Indonesia, the leaves contains 82 calories of energy; 6.7 grams of protein; 1.7 grams of fat; 14.3 carbohydrates; 440 mg calcium; 70 mg of phosphorus; 7 mg iron; 11300 IU of vitamin A; 0.21 vitamin B; and 220 mg of vitamin C (Dinas Kesehatan Provinsi NTT, 2017). The content of potassium is three times more than in bananas. The vitamin A contained is four times more than carrots. The iron is equivalent to 25 bunches of spinach. Vitamin C is equivalent to 7 oranges. Calcium, for the growth of bones and teeth, is equal to four glasses of milk and two times the protein from yogurt (Mardani et al., 2015).

*Moringa oleifera* lamk. (Moringa), a Moringaceae family. It is a medicinal plant that contains lots of vitamins and is effective for malnutrition. It contains seven times more vitamin C than oranges, ten times more vitamin A than carrots, 17 times more calcium than milk, nine times more protein than yogurt, 15 times more potassium than bananas, and 25 times more iron than spinach (Rahim, 2014).

Especially in NTT, the method of processing Moringa leaves is not so diverse. The most common preparations are stir-fried or soup. Less varied ingredients will make toddlers feel bored. So it is necessary to have a different variation of the processing of this Moringa vegetable. One of the foods that are easy to like and consume by toddlers is nuggets. By processing moringa into it, toddlers will be more interested in eating moringa, which nutritious for their growth and development.

## Method

The research method used in this

research is quasi-experimental. The design used was the pretest-posttest control group design. In this design, there are two groups selected randomly. Then a pretest to determine the initial state is applied. Is there a difference between the experimental group and the control group? The independent variable in this study is the provision of additional food based on local food, in this case, is moringa nuggets. The dependent variable is the nutritional status of children under five. The sample is children who experience malnutrition based on records from the Puskesmas in Kupang City, totaling 90 children. Secondary and primary data collection was taken. Secondary data was the weighing data for children under five at health centers throughout the city of Kupang to screen children with low nutritional status based on anthropometric measurements. Primary data was the interviews using a questionnaire instrument to obtain data on the characteristics of respondents. As well as to measure the initial body weight of research subjects before and after being given Moringa nuggets (after 30 days).

The sampling method used was the purposive sampling technique. Researchers selected 90 toddlers with malnutrition. They were divided into two groups. The case group was 45 children under five and would be given moringa nuggets, while no treatment for the 45 children in the control group. Initial data collection is an interview with the help of a closed questionnaire. The questions contained in the questionnaire included: the identity of the

research subject, family, and anthropometric measurements of the research subject at the beginning and end of giving Moringa nuggets to see changes or increases in body weight, especially for anthropometric measurements and nutritional status measurements carried out at the beginning and end of the study. To evaluate the results of supplementary feeding. Researchers expected that the respondents experience an increase in nutritional status from undernutrition to good nutrition. For anthropometric measurements, researchers measured themselves with the help of scales and measuring meters. Researchers carried out primary data collection from the house to the house of research subjects. Each research subject in the case group was given Moringa nuggets for 30 days, wherein one day the research subjects consumed three pieces, each containing 11.4% protein. It contains chicken by 70%, and moringa by 30% because the nuggets with this composition have a natural color, namely yellow with a bit green color, a more savory taste, the aroma of Moringa chicken is quite strong, the texture is dense, soft, as well as compact. Interviews, measurement of body weight, and provision of additional food (nuggets) were carried out after the research subjects filled out the informed consent represented by the mother as the respondent. The data processing and analysis use a statistical program. Data analysis was performed bivariate using the Pearson correlation test with  $\alpha = 0.05$  and pre-post comparative analysis with paired samples T-test.

## Result and Discussion

**Table 1.** Sample's Characteristics

Characteristics	Treatment (Case)		Control	
	n	%	n	%
Age				
12-24 months	25	27,8	22	24,4
25-36 months	12	13,4	10	11,1
37-48 months	4	4,4	7	7,8
49-59 months	4	4,4	6	6,7
Gender				
Boy	26	28,9	24	26,7
Girl	19	21,1	21	23,3

Source : Primary Data, 2020

Table 1 shows that most of the samples in this study in the treatment group (cases), namely 27.8%, and the control group, namely 24.4%, were age 12-24 months. Based on

gender, 28.9% of children in the treatment group (cases) and 26.7% in the control group were males.

**Tabel 2.** Mother's Characteristic

Characteristic	Case %	Control %
Age		
15-35 years	29 (32,2)	25 (27,8)
36-56 years	16 (17,8)	20 (22,2)
Education		
Low	27 (30,0)	21 (23,3)
High	18 (20,0)	24 (26,7)
Occupational Status		
Does not work	31 (34,4)	18 (20,0)
Work	14 (15,6)	27 (30,0)
Family's percapita Income		
≤ Rp 234.150,-	37 (41,1)	35 (38,9)
>Rp 234.150,-	8 (8,9)	10 (11,1)
Number or children		
1 – 2	14 (15,6)	20 (22,2)
>2	31 (34,4)	25 (27,8)

Source: Primary Data, 2020

Table 2 shows 15-35 years of age mothers are more in the case and control groups than the 36-56 years of age mothers. As for the education level, the number of respondents' mothers with low education is higher in the case group. While for the control group, respondents' mothers with high education are more. For employment status, more respondents' mothers did not work in the case group. In the control group, more respondents' mothers worked.

Most of the respondents' mothers had a per capita income of less than IDR 234,150 (80%). For the number of children, mothers with more than 2 (two) children were found more in the case group compared to those with less than 2 (two) children, while the control group showed that more respondents' mother had children less than 2 (two) than those who had children more than 2 (two).

**Table 3.** Nutritional Status Distribution Based on BW/BH Index

Nutritional Status from BW/BH Index	Treatment (Case)				Control			
	Before	%	After	%	Before	%	After	%
Very Thin	0	0	0	0	0	0	0	0
Thin	45	100	42	93,3	45	100	44	97,8
Normal	0	0	3	6,7	0	0	1	2,2
Fat	0	0	0	0	0	0	0	0
Total	45	100	45	100	45	100	45	100

Source: Primary Data, 2020

Based on table 3. The percentage of toddlers in the treatment and control groups with the thin category before being given Moringa nuggets was 100%. Before getting treatment, samples were 90 toddlers at Z-score between -3.0 SD to <-2.0 SD, with the highest Z-score being -2.42 SD and the lowest -2.87 SD. The percentage of toddlers in the underweight category in the treatment group given Moringa

nuggets decreased from 100% to 93.3%. And increase in the normal category from 0% to 6.7%. The treatment group consisted of 45 toddlers with the highest Z-score of -2.42 SD, and the lowest was -2.87 SD. After treatment, the highest Z-score was -1.96 SD, and the lowest was -2.80 SD.

Whereas in the control group without any treatment at all. Toddlers with the

underweight category experienced a decrease from 100% to 97.8%. While toddlers under the normal category experienced an increase from 0% to 2.2%. The research sample in the treatment group amounted to 45 toddlers. Who previously were at the highest Z-score was -2.42

SD, and the lowest was -2.87 SD. They did not experience any significant changes because they received no treatment at all. However, one toddler who was initially in the thin category changed to the normal with a Z-score of -1.90 SD.

**Table 4.** Nutritional Status Distribution Based on BW/A Index

Nutritional Status from BW/A Index	Treatment (Case)				Control			
	Before	%	After	%	Before	%	After	%
Malnutrition	0	0	0	0	0	0	0	0
Under Nutrition	45	100	39	86,7	45	100	43	95,6
Well Nutrition	0	0	6	13,3	0	0	2	4,4
Over Nutrition	0	0	0	0	0	0	0	0
Total	45	100	45	100	45	100	45	100

Source: Primary Data, 2020

Based on table 4. The percentage of toddlers in the treatment and control groups with undernutrition category before being given Moringa nuggets was 100%. Before getting treatment, all samples were 90 children under five at Z-score between -3.0 SD to <-2.0 SD, with the highest Z-score being -2.35 SD and the lowest -2.92 SD. The percentage of toddlers with malnutrition in the treatment group given moringa nuggets decreased from 100% to 86.7%. The increase in the good nutrition category was from 0% to 13.3%. The sample in the treatment group consisted of 45 toddlers. Previously with the highest Z-score was -2.35 SD and the lowest was -2.92 SD. After

treatment, the highest Z-score was -1.56 SD, and the lowest was -2.67 SD.

In the control group without any treatment, toddlers with undernutrition experienced a decrease from 100% to 95.6%. And toddlers with well-nutrition categories experienced an increase from 0% to 4.4%. The sample in the treatment group amounted to 45 toddlers had the highest Z-score was -2.35 SD, and the lowest was -2.92 SD. They did not experience any significant changes because they did not receive any treatment at all. However, one toddler who was initially in the thin category changed to the normal with a Z-score of -1.90 SD.

**Table 5.** Body Weight Description

Body Weight	Treatment (Case)		Control	
	Before	After	Before	After
Average	9,29	10,56	9,28	9,56
Minimum	5,9	6,4	6,1	6,3
Maximum	14,3	14,7	14,4	14,5

Source: Primary Data, 2020

Based on the results in Table 5, in the treatment or case group, the toddlers' bodyweight before being given Moringa nuggets had an average of 9.29 kg. After being

given Moringa nuggets, the average body weight increased to 10.56. In the control group, there was no significant increase.

**Table 6.** Mean Z-score value Changes

Anthropometric Index	Before	After	Changes	p-value
Z-score BW/BH	-2,51 SD $\pm$ 0,74	-2,0 SD $\pm$ 1,0	0,51 $\pm$ 0,26	0,052
Z-score BW/A	-2,96 SD $\pm$ 0,81	-2,35 SD $\pm$ 0,84	0,61 $\pm$ 0,03	0,041*

Source: Primary Data, 2020

Based on Table 6, there is a change in the mean Z-score value on the BW/BH anthropometric index, before and after the giving of Moringa nuggets. It is 0.51 SD with a standard deviation of 0.26, and a change in the mean anthropometric index BW/A is 0.61 SD with a standard deviation of 0.03. Paired T-test results showed no significant difference in changes in the mean Z-score value of the anthropometric index BW/BH as indicated by the value of  $p = 0.052$  ( $p < 0.05$ ). Whereas in the anthropometric index BW/A, there was a significant difference in the mean Z-score before and after giving Moringa nuggets indicated by a value of  $p = 0.041$  ( $p < 0.05$ ).

Malnutrition during childhood is the result of inadequate dietary intake, diarrhea and other infections, lack of sanitation, and low parental education (Amare, Ahmed and Mehari, 2019). Food insecurity, inadequate maternal and child care, and poor health and environmental services, causing Poor diet and disease. Child malnutrition accounts for nearly half (45%) of child deaths, especially in low socioeconomic communities in developing countries. In 2018, global estimation mentioned that 149 million toddlers are stunting and 49 million wastings (Amare, Ahmed and Mehari, 2019).

Age is a vital indicator in determining one's productivity. Young people, of course, have higher productivity than the older, because the physical condition and health of young people are more optimal (Yapo, 2020). Productive age also plays an important role. At the age range, it is easier to capture information related to health education about the importance of exclusive breastfeeding for six months, breastfeeding for two years, and improving hygiene in the neighborhood to increase children's health status (Yapo, 2020). Research conducted by Hoq et al. (2014) in Bangladesh shows that inappropriate feeding practices can be the major cause of acute malnutrition in toddlers (Hoq et al., 2019). Mothers or caregivers only use available resources regardless of the diversity basic in preparing food intake for children. Due to lack of money, they cannot buy meat and other foodstuffs in the market (Hoq et al., 2019).

The influence of a mother's education

is substantial in preventing malnutrition in children under five. Research conducted by Amare et al. (2016) in Ethiopia shows a significant relationship between maternal education and the incidence of stunting and wasting in toddlers (Amare, Ahmed and Mehari, 2019). Mothers with higher education can utilize all the resources they have compared to mothers who have low education. Maternal education affects maternal knowledge about nutrition. So nutrition, health, and knowledge is related (Rahim, 2014). The level of education will affect the type of work and have implications for the type and amount of income. The better the education level, the higher the opportunity to get a better job with regular income and a higher income (Rahim, 2014).

Tut Wie et al. research showed mother's education determine the child nutrition status (Tut and Tsegaye, 2020). Research conducted by Chowdhury et al. (2013) in Bangladesh shows that the wealth index or family income is closely related to underweight children (Chowdhury et al., 2018). Children from poor families tend to be underweight compared to those from the rich. Most of the population living in poverty cannot afford to buy nutritious food or access better health facilities to get health care (Chowdhury et al., 2018). In this study, the researchers conducted with 80% of the sample were families with per capita income less than Rp. 234,150.00 so that in their daily life, the mother prepared dishes intending to have the children and other family members can eat (full) regardless of the nutritional content of cooked food.

Research conducted by Hoq et al. (2014) shows that the number of children and family size is risk factors for malnutrition in several studies conducted in Ethiopia, Pakistan, India, and Malaysia. A large number of children can make children get less attention and have to share food with many (Hoq et al., 2019). In this study, the paired T-test results showed no significant difference in changes in the Z-score mean value of the anthropometric index BW/BH indicated by the value of  $p = 0.052$  ( $p < 0.05$ ). Whereas in the anthropometric index BW/A, there was a significant difference in Z-score mean changes before and after giving Moringa nuggets indicated by a value of  $p = 0.041$  ( $p$

<0.05). It can happen due to the calculation of nutritional status carried out by researchers used the BW/BH index. The height indicator at BW/BH has a lower sensitivity to nutrition deficiencies in the short term (Mardani et al., 2015). This research took time for one month, so the possibility of experiencing an increase in height is still low. For weight gain shows well results.

This research is in line with Mardani et al., 2015, which showed differences in nutritional status based on the index BW/BH, BW/A, and BH/A, after giving PMT-P (additional food and integrated health service) for 90 days. The contribution of energy and protein intake from PMT-P consumed by toddlers has increased every week. Supported by an increase in energy and protein intake from food other than PMT-P, the daily intake level is adequate (Mardani et al., 2015). Lack of proper diet will affect children's health and increase morbidity (Tariq et al., 2018). Therefore, it is necessary to fulfill the toddlers' nutritional needs. So the body grows and develops optimally.

One of the local food ingredients with a high nutritional value used as additional food easily accessible to people in NTT is Moringa. According to DKBM Indonesia, the content of the leaves are 82 calories of energy; 6.7 grams of protein; 1.7 grams of fat; 14.3 carbohydrates; 440 mg calcium; 70 mg of phosphorus; 7 mg iron; 11300 IU of vitamin A; 0.21 vitamin B; and 220 mg of vitamin C (Dinas Kesehatan Provinsi NTT, 2017). The content of potassium is three times more than in bananas. Vitamin A is four times than carrots. The iron in Moringa leaves equal to 25 bunches of spinach. Vitamin C is equivalent to 7 pieces of oranges. Calcium for the growth of bones and teeth in Moringa leaves is equivalent to 4 glasses of milk. Moringa contains protein two times more than yogurt (Mardani et al., 2015).

Moringa oleifera Lamk. (Moringa), the Moringaceae family is a medicinal plant that contains lots of vitamins and is effective for malnutrition. Moringa leaves have seven times more vitamin C than oranges, ten times more vitamin A than carrots, 17 times more calcium than milk, nine times more protein than yogurt, 15 times more potassium than bananas, and 25 times more iron than spinach (Rahim, 2014).

Consumption of adequate complementary foods and daily foods contributes to the children's growth, health, and development improvement. WHO recommends proper time introduction of foods that sufficiently nutritious, appropriate, and safe for all children. Further indicate that consuming various foods ensures children's nutritional needs are met (Gewa and Leslie, 2015). Besides, animal-based foods, fruits, and vegetables rich in vitamin A should be included in the daily diet or as often as possible. The recommendations for meeting the nutritional needs of children do not differ from country to country. But it is more emphasized in developing countries with low income that bear the burden of child malnutrition and limited resources (Gewa and Leslie, 2015).

### Conclusion

The results indicate a significant difference in the toddlers' nutritional status changes before and after giving additional food based on local ingredients. In this case, moringa nuggets for under-nutrition children according to the anthropometric index BW/A indicated by a value of  $p = 0.041$  ( $p < 0.05$ ). Meanwhile, the anthropometric index BW/BH did not show any significant difference in nutritional status before or after being given additional food (moringa nuggets) with a value of  $p = 0.052$ .

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