



ORIGINAL ARTICLE

Effect of *Moringa oleifera* leaf powder supplementation on weight gain of toddler in the working area of Naibonat health center, Kupang regency

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Abstract

Introduction: Undernutrition prevalence in East Nusa Tenggara is very high. One of the intervention to overcome this problem is by providing foods enriched with vitamins and minerals. One of the plant that contains great amount of vitamins and minerals is Moringa which thrives in almost all of the mainland of Timor. This study aims to determine whether there is an effect of Moringa leaf powder supplementation on weight gain of children under five years of age at the working area of Naibonat Health Center in Kupang Regency.

Methods: Experimental study with pre-test post-test control group design was conducted among children aged 2-5 years in the working area of the Naibonat Health Center in Kupang Regency. The study was conducted with consecutive sampling technique with a total subjects of 50 children consisting of 25 children in the treatment group and 25 children in the control group. The intervention group was given 25 grams of Moringa leaf powder for 14 days. **Results:** There was a significant increase in body weight of the treatment group after supplementation of 25 grams of Moringa leaf powder for 14 days ($p < 0.001$). In the control group, there was no significant difference of body weight after the study. **Conclusions:** Moringa oleifera leaf powder supplementation of 5-10 grams has been able to increase body weight by 0.53 kg on children under five years of age at the working area of Naibonat Health Center in Kupang Regency by increasing the child's appetite.

Keywords Moringa leaf powder, weight gain, toddler

Introduction

Children under five years of age are one of the most vulnerable groups to malnutrition. Nutritional status in this group requires special attention because malnutrition that occurs can be irreversible, which can't be recovered and can cause physical growth, mental, and intellectual disruption. Furthermore, the growth process in this phase is relatively fast which make children need nutrients in relatively large quantities.¹⁻³

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Based on data from the Global Nutrition Report, approximately 41 million children under five years old have short stature and 50 million are underweight. Poor nutrition causes death in infants around 45%. It is known that the most severe malnutrition problems are commonly happen to middle to lower countries, including Indonesia.⁴ Based on Basic Health Research data in 2018, the percentage of undernourished children under five years of age in Indonesia in 2007 and 2010 is constantly 13.0% and decreased by 0.1% from 13.9% in 2013 to 13.8% in 2018.⁵

Based on the data of weight and nutritional status of children under five years old in East Nusa Tenggara were 11.6% in 2016 and 10.6% in 2017. Therefore, East Nusa Tenggara was ranked as second highest number of malnutrition in Indonesia. However, based on nutritional status measured by weight for age, East Nusa Tenggara was ranked as the province with the highest malnutrition rate with the percentage of 21.3% in 2016 and 20.9% in 2017.^{6,7} This result shows that the case of malnutrition in East Nusa Tenggara is very serious and needed proper handling.

The problem of malnutrition in East Nusa Tenggara spread throughout the region. Based on the data of the East Nusa Tenggara Food Security and Vulnerability Map, Kupang Regency is one of the districts with the highest prevalence of malnutrition in children under five years old in 2013 with the percentage of 33.39%.^{8,9} Based on the survey results, the Naibonat Public Health Center in Kupang Regency has the highest prevalence of malnutrition compared to any other Public Health Centers. The average number of children aged 2 to 5 years with malnutrition is 134 children in 2017, 88 children in 2018, and 231 children in 2019.¹⁰

One of the solutions to overcome the problem of malnutrition in Indonesia is to provide nutritional interventions, such as adding the supplementary micronutrients to food.¹¹ Moringa leaves are rich of minerals, vitamins, amino acids and antioxidants. Moringa leaf powder has excessively higher nutrient content than a fresh Moringa. Therefore, Moringa can be a solution to overcome the problem of malnutrition.^{12,13}

Based on Dudi Krisnadi,¹⁴ entrepreneur of Moringa from West Java, Moringa varieties of East Nusa Tenggara are superior compared to other

regions.¹⁴ Analysis results of Nutritional Standard of Moringa leaf powder per 100 g in Moringa leaves from East Nusa Tenggara is higher than Moringa leaves in general.¹⁵ This makes the potential use of Moringa is very possible in East Nusa Tenggara.

There are several studies on the effect of Moringa on weight gain. Research conducted by Srikanth et al¹⁶ showed that the addition of Moringa leaf powder as a supplementary food for toddlers can improve the nutritional status of the toddlers.¹⁶ Research by Zakaria et al¹⁷ also showed that there was an increase in body weight of toddlers when given the South Sulawesi Moringa leaf flour variety in their foods.¹⁷ However, all the studies that have been conducted have different quality of Moringa from the ones in East Nusa Tenggara. Therefore, the writer is interested in examining the effect of Moringa leaf powder supplementation in undernourished children under five years old in the working area of the Naibonat Health Center, Kupang Regency.

Methods

The research was conducted in the working area of the Naibonat Public Health Center, Kupang Regency from February to December 2019.

This is an experimental study with pre test-post test with control group design. This study used consecutive sampling. The subjects were children aged 2-5 years which was divided into 2 groups, the treatment group and the control group, each group consist of 25 children. The treatment group, were given 25 gram Moringa leaf powder supplementation for 14 days. Furthermore, at the beginning of the study, the body weight was measured to determine the nutritional status based on weight for height indicator and 2x24 hours food recall was conducted. The body weight measurement and 2x24 hours food recall were also conducted, in the middle and at the end of the study. The study then analyzed by using paired T test to see if the data distribution was normal and Wilcoxon test as an alternative if the data distribution was abnormal, this test used to assess differences in the average before and after treatment in each group. To see the difference in the average changes between the two groups the paired T test was used if the data distribution was normal and the Mann-Whitney as

an alternative test if the data distribution was abnormal.

Results

Characteristics of research subjects in the treatment group and the control group based were classified based on gender, nutritional status, and energy intake. Table 1 shows that from the sample there were more females than males. Females are more vulnerable to nutritional problems than males. This could be caused by higher priority in terms of food for males because of their higher rate of activity than women.¹⁸

Table 2 shows that from 50 research samples that were taken, subjects with poor nutritional status based on weight for height indicators are more than samples with good nutritional status. Factors that may affect the nutritional status of children are inadequate nutrients in food, poor family economy, poor knowledge of providing good nutrition for children, and availability of nutritious and affordable food by the community.¹⁹

Table 3 shows that the majority of children have less energy intake (54%), then followed by more (28%) and enough (18%) energy intake.

Toddler energy intake is obtained from the average food recall (kcal) of children for 2x24 hours. When doing a food recall, the researcher found that most mothers were unable to provide their children high protein source of food, especially animal protein. The following graph shows the comparison of children's energy intake before and after treatment for 14 days in the treatment and control groups.

Data obtained from observations for 14 days in each group were analyzed by Wilcoxon test in the treatment group showed that there was significant differences in the changes of energy intake before and after treatment ($p < 0.000$). However, in the control group it was found that there was no significant difference ($p = 0.545$). Mann-Whitney test is used to see whether there is a significant difference of energy intake between the treatment and control group. The result showed a significant difference ($p=0.001$). The energy intake from the treatment and control groups also showed a significant difference ($p=0.037$).

The following is a comparison chart of toddler weight before and after the intervention in both

groups. In the treatment group, there was a weight gained with an average of 0.61 kg after the intervention of Moringa leaf powder for 14 days. However in the control group, the increase of average body weight was 0.03 kg.

Data obtained from observations for 14 days in each group were analyzed by paired T test. Test results in the treatment group found a significant difference before and after the intervention ($p \leq 0.001$). However in the control group there was no significant difference ($p=0.678$). Data analysis was continued by conducting an unpaired T test to compare the difference in mean changes between the two groups by using a weight difference value before and after the intervention and the result was a significant difference ($p \leq 0.001$), however the result of the comparison between the weight after the intervention between both groups was not significantly difference ($p=0.662$).

Discussion

A child's nutrition can be influenced by various factors. One of the factors that might contribute to the nutritional status of children in the working area of the Naibonat Health Center, Kupang Regency is the inadequate food nutrients. After taking 2x24 hour food recall data at the beginning, middle, and the end of the study, most mothers admitted that their children didn't consume enough of high protein-source foods, especially animal protein. Even though protein is very important for children's growth, height and weight as well as the child's development.²⁰ This might be caused by the inability of the mother to afford the food.

The biological environment might also affect the nutritional status of children in the working area of Naibonat Health Center, Kupang Regency. Dense population can cause limited food availability. Population density in the working area of Naibonat Health Center is 233 inhabitants/km.^{2,21} Based on Indonesian National Standards 03-1733-2004, population density in this region is considered as high population density so the biological environment is probably one of the factors that is responsible to the nutritional problems that occurred.²² Furthermore, another factor that might affect a child's nutrition is the level of parental knowledge. Based on the health profile of the

Naibonat Health Center Kupang Regency, in general, the parental educational levels in the working area of the Naibonat Health Center is still low.²¹

Adding foods enriched with micronutrients is one of the intervention to overcome the nutritional problem among toddler. Moringa is one of the plant that is rich with minerals, vitamins, amino acids and antioxidants. In the treatment group, 25 grams of Moringa leaf powder were given to 26 children for 14 days, but there was 1 child who had diarrhea for 3 days when the study took place so the child was excluded, and added in the drop-out criteria.

In the treatment group, only 4 of 25 children in the treatment group used up all of Moringa leaf powder for 14 days with an average weight gain of 1.05 kg, while the other 21 children only spent 5-10 grams of Moringa leaf powder. This is because these children did not like the scent of Moringa leaf powder. This is because these children did not like the scent of Moringa leaf powder. Research by Zakaria et al¹⁷ stated that at the beginning of the administration of Moringa leaf flour, children also did not like the scent of Moringa leaf flour, but after it is given continuously little by little, the children start to like and get used to it.¹⁷ Even so, the weight of these 21 children increased by an average of 0.53 kg.

Energy intake in the treatment group increased and also gained the level of energy sufficiently. Qualitatively, parents of children in the treatment group stated that the child's appetite increased after the administration of Moringa leaf powder. This is in line with research conducted by Zakaria et al¹⁷ which stated that the Moringa leaf flour can increase child's appetite.¹⁷

The increased of appetite in children may be caused by vitamins and minerals contained in Moringa. Based on research by Lili and Mitriya²³ about the effect of giving papaya to the appetite of children aged 2-5 years in the working area of the Kuranji Public Health Center showed that the increased in appetite in infants was because papaya fruit contains vitamins and minerals. Vitamins and minerals restore the digestive system so that the child's appetite increases and improve nutrients absorption. The content of vitamin A can prevent keratinization of the gastrointestinal tract. Vitamin A in Moringa leaf powder is known to be 10 times

higher than in carrots. Children with vitamin A deficiency can cause symptoms of anorexia. The content of vitamin A in Moringa can prevent anorexia and have an impact on increasing appetite as well.²³

In the working area of Naibonat Health Center Kupang Regency, there are 1,734 children under five years old with good nutritional status and 104 children under five years old with undernourished status. In the treatment group there were 12 children with good nutritional status who experienced a weight gain with an average of 0.64 kg. While 13 other children with poor nutritional status experienced a weight gain with an average of 0.59 kg. In the control group, there were 12 children who experienced weight loss with an average of 0.2 kg, 12 children who experienced weight gain with an average of 0.3 kg and 1 child whose weight remained constant.

After the research, the body weight before and after the intervention in each group was analyzed and the result showed a significant increase in body weight in the treatment group, but not in the control group. The results of the comparison analysis of the average differences between the two groups also showed a significant difference. This proves that the weight of the subjects increased due to the supplementation of Moringa leaf powder for 14 days. While the results of the weight comparison analysis test after the intervention showed no significant difference. This is probably caused by the initial body weight in the treatment group that was lower than the control group.

The results of this study are not in line with the journal by Susanto et al²⁴ which stated that Moringa leaf powder of Madura variety can reduce body weight because it contains isothiocyanates.²⁴ The article by Wahyudi and Nurhaedah²⁵ with the title Variety of Benefits of Moringa Plants (*Moringa oleifera* Lamk) for the community also stated that Moringa leaves can cause weight loss because it gives effect to stimulate and launch metabolism in the body so that it can burn calories faster.²⁵ Several studies that support the results of this study, including research by Srikanth et al¹⁶ showed that the addition of Moringa leaf powder as a supplementary food for toddlers can improve the nutritional status of these toddlers. Moringa leaf powder was given as much as 30 grams to 30

toddlers with a lack of protein energy in the treatment group for 2 months.¹⁶ Of all 30 children, there were 3 children who gained weight more than 40%, 9 children with 30-40% weight gain, 10 children with 20-30% weight gain, 5 children with 10-20% weight gain, and 3 children with less than 10% weight gain. Research conducted by Zakaria et al¹⁷ also showed that there was a weight gain in 15 children aged 1-3 years in the treatment group when given the addition of 10 grams of South Sulawesi Moringa leaf flour variety for 30 days on their foods¹⁷. From the 15 children, there were only 13 children who were measured and found 10 children who gained weight after 14 days, 2 children who remained with their constant weight, and 1 child who loss weight.

In conclusion, Moringa oleifera leaf powder supplementation of 5-10 grams was able to increase body weight by 0.53 kg in children under 5 years old in the working area of Naibonat Health Center Kupang Regency ($p \leq 0.001$) by increasing the children's appetite.

Table 3. Characteristic of samples based on energy intake

Energy Intake	Group		Total
	Treatment	Control	
Less	14	13	27
Enough	4	5	9
Over	7	7	14
Total	25	25	50

Table 1. Characteristic of samples by gender

Sex	Group		Total
	Treatment	Control	
Male	11	10	21 (42%)
Female	14	15	29 (58%)
Total	25	25	50 (100%)

Table 2. Characteristic of samples based on nutritional status

Nutritional Status	Group		Total
	Treatment	Control	
Good	12	12	24 (48%)
Poor	13	13	26 (52%)
Total	25	25	50 (100%)

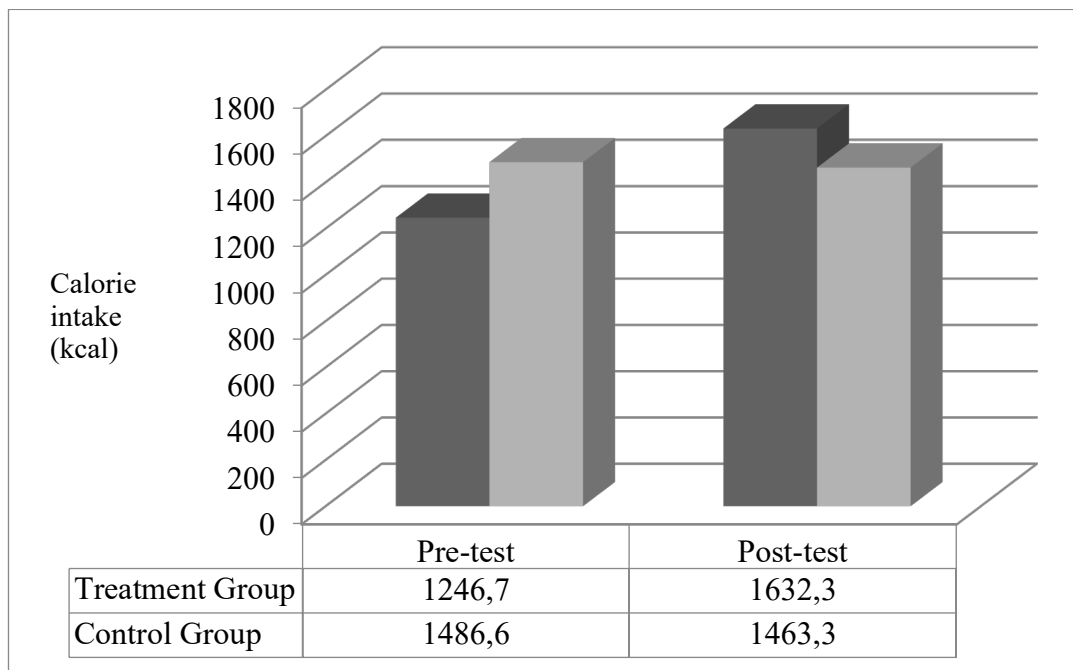


Figure 1. Subjects' energy intake before and after the intervention in the treatment and control groups.

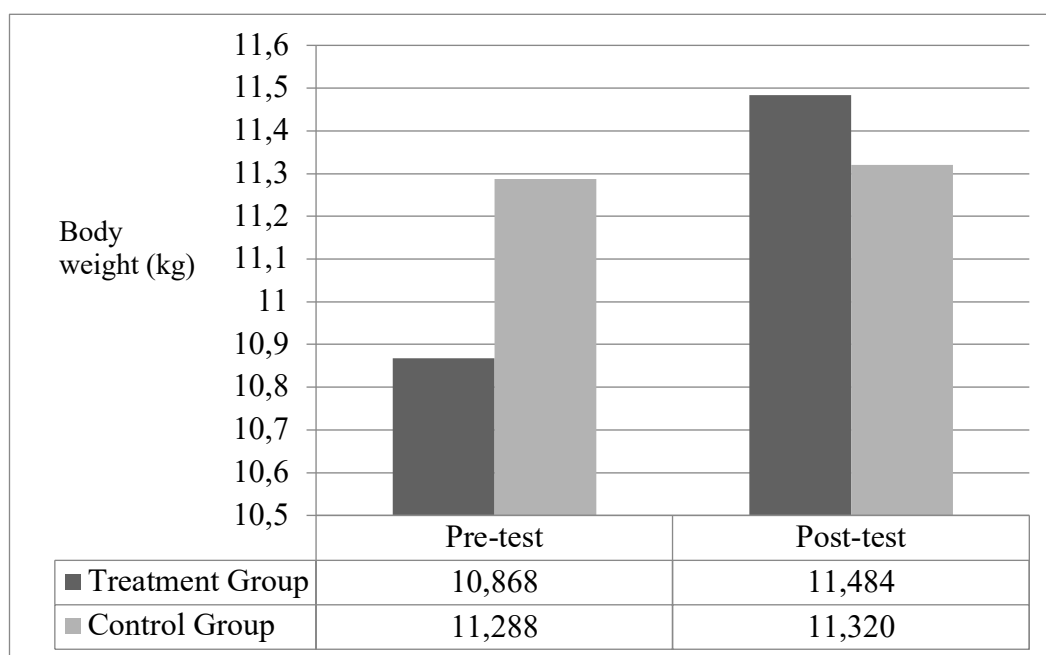


Figure 2. Increase of average body weight of subjects before and after the intervention in the treatment and control groups.

Conflict of Interest

Authors declared no conflict of interest regarding this article.

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