Fermented sorghum porridge fortified with moringa leaf powder for physical growth in stunted children in East Nusa Tenggara, Indonesia

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Fermented sorghum porridge fortified with moringa leaf powder for physical growth in stunted children in East Nusa Tenggara, Indonesia

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Abstract

Background: East Nusa Tenggara is one of the provinces in Indonesia that has a higher stunting problem compared to other provinces. This value is a contribution to the prevalence of stunting in various districts in East Nusa Tenggara, one of which is Ende District. Currently, East Nusa Tenggara Province is promoting the use of moringa and sorghum plants for re-cultivation as substitutes for rice and corn.
Purpose: To find out the effect of giving sorghum and moringa cookies on the growth and development of stunted children in Ende Regency.
Method: This research uses a quasi-experimental type of research with a one group pretest-posttest design. Carried out in the work area of the Ende Regency, research was conducted from 2 August-3 September 2021, totaling 96 people sampling was carried out using non-probability sampling so that the total was 55 people. The independent variable in this study was consumption of cookies made from sorghum and moringa, while the dependent variables were height, body weight, and upper arm circumference. The instruments used in this research were interview guides, observation sheets, and tools for measuring height, weight, and upper arm circumference.
Results: This research states that there is an effect of increasing height, weight, upper arm circumference in stunted children when given cookies sorghum and Moringa leaves because there is an increase after being given the intervention.
Conclusion: Providing sorghum and moringa has an effect on the growth and development of stunted children in Ende Regency.
Suggestion: Public health centers can provide education regarding providing additional food to stunted children by providing local foods such as sorghum and moringa. Meanwhile, the Regional Government of Ende Regency should encourage sorghum cultivation more massively.

Keywords: Fermented Sorghum; Moringa Leaf; Stunting.

INTRODUCTION

Short toddlers illustrate the chronic nutritional problems that are being experienced by these toddlers. Chronic nutrition problems experienced by toddlers are influenced by the condition of the mother / mother-to-be, fetal growth, and infancy / toddlerhood, including diseases suffered during toddlerhood and other problems that indirectly affect health (Ministry of Health of the Republic of Indonesia, 2016).

In 2017, 22.2% or around 150.8 million toddlers in the world were stunted. However, this figure has decreased when compared to the stunting rate in 2000, which was 32.6%. Worldwide, Indonesia has the fifth highest prevalence of stunting. More than

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half of the world's stunted children under five were from Asia (55%) while more than a third (39%) lived in Africa. Of the 83.6 million stunted children under five in Asia, the largest proportion came from South Asia (58.7%) and the smallest proportion from Central Asia (0.9%) (Ministry of Health of the Republic of Indonesia, 2018).

The national prevalence of stunting is 37.2% (almost 9 million people), an increase from 35.6% in 2010 and 36.8% in 2007 (Ministry of Health of the Republic of Indonesia, 2014). Based on Basic Health Research, the prevalence of stunting in Indonesia is the highest compared to other countries in Southeast Asia, such as Myanmar at 35%, Vietnam at 23%, and Thailand at 16%. In 2018, the national prevalence of stunting was 30.8% of children in Indonesia. Even though the prevalence of stunting decreased from 37.2% in 2013, the stunting rate still remains high (Ministry of Health of the Republic of Indonesia, 2018).

Babies under two years of age who are stunted will have a lower level of intelligence, making them more susceptible to disease and in later life may be at risk of decreased productivity (Walker, Chang, Wright, Osmond, & Grantham-McGregor, 2015). In the end, stunting can hamper economic growth, increase poverty and widen disparities (World Health Organization, 2018). Stunting also makes children more susceptible to disease. Children who experience stunting are at higher risk of suffering from chronic diseases in adulthood. In fact, stunting and various forms of malnutrition are estimated to contribute to the loss of 2-3% of Gross Domestic Product (GDP) each year (Ministry of National Development Planning/National Development Planning Agency, 2018).

East Nusa Tenggara is one of the provinces in Indonesia which has a high prevalence of stunting problems compared to the prevalence of stunting in other provinces, for two consecutive periods, namely 51.7% in 2013 and 42.6% in 2018 (Ministry of Health of the Republic of Indonesia, 2018). This value is a contribution to the prevalence of stunting from various districts in East Nusa Tenggara, one of which is Ende District. Based on data from the 2017 Nutritional Status Monitoring (NSM) for toddlers, the prevalence of stunting in Ende Regency was 34.1 percent, ranking 11th out of 22 districts/cities in East Nusa Tenggara province (Ministry of Health of the Republic of Indonesia, 2018).

The reason for the highest prevalence of stunting in Indonesia is because East Nusa Tenggara is a province that has a dry climate with very low rainfall (Prihutama, Rahmadi, & Hardaningsih, 2018). Poor food security is partly because people depend on rice as a staple food, while rice cannot grow well in the area. This certainly has a negative impact on people's nutritional status. Sorghum is a nutrient-dense food that is almost equivalent to rice and corn. A study analyzed the food intake of 218 mothers (aged >15 years) and their children (aged <5 years) in relation to traditional foods consumed daily, namely sorghum, beans and green vegetables. The results of this study show that sorghum contributes 29% energy, 33% protein, and 53% iron in daily intake (Kumar, Anuradha, Ramaiah, Grando, Frederick, Rattunde, & Pfeiffer, 2015). Apart from that, sorghum also has higher levels of dietary fiber and iron (Fe) than rice, wheat and corn (Jimoh, & Abdullahi, 2017).

Sorghum (Sorghum bicolor L. Moench) is a commodity originating from Africa and a subsistence crop for many farmers. Sorghum is ranked as the fifth largest food source in the world after wheat, rice, corn and barley (Food and Agricultural Organization, 2011). The largest sorghum producers are the United States with 12.1 million tons per year, Nigeria with 6.9 million tons, Sudan with 6.4 million tons, and Mexico with 5 million tons (Popescu, Dinu, & Stoian, 2018). However, sorghum production from Indonesia is barely taken into account. Sorghum has wide environmental adaptability, especially in dry land. East Nusa Tenggara Province has low rainfall and a prolonged drought that lasts 8-10 months, as well as a short rainy season (3-4 months). As much as 92.32% or around 1.5 million hectares of the total agricultural land is dry land.

Sorghum was once cultivated as local food but has long been abandoned, this is because people have experienced a transition to consuming rice. After being forgotten for a long time, sorghum was planted again about a decade ago. The development of sorghum in this area is very prospective because it is able to grow in marginal areas, its nutritional value is equivalent to corn, and most importantly, this food ingredient was previously consumed by local

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residents. Currently sorghum supports the achievement of food self-sufficiency in East Nusa Tenggara, sorghum farmers have formed a joint organization of sorghum farmers, moreover sorghum has also been programmed as an environmentally friendly commodity because it is cultivated without input of chemical fertilizers and pesticides, thereby reducing negative impacts such as greenhouse gas effects and combating stunting in children because it has high nutritional content (Winarti, Arif, Budiyanto, & Richana, 2020).

Apart from Sorghum, Moringa (Moringa oleifera) has long been known throughout the world as a nutritious plant and was introduced as an alternative food crop to overcome the problem of malnutrition (Islam, Islam, Hossen, Mahtab-ul-Islam, Hasan, & Karim, 2021). It is known that all parts of the plant, including leaves, stems, roots and seeds, have properties and benefits. The high nutritional content makes Moringa have properties that function to heal, maintain and improve the quality of human health and especially as a source of family nutritional intake (Krisnadi, 2015). The people of East Nusa Tenggara are very familiar with the Moringa plant because this plant is easy to grow and suits climate conditions. Apart from being used as a food ingredient which is processed as a vegetable (leaves, flowers and fruit), Moringa is also used for medicinal purposes. People call Moringa 'Marungge'. This plant has been known for generations since its roots, bark, leaves, flowers and fruit are rich in benefits (Bai, Widiatningrum, & Indriyanti, 2020).

Ende Regency is one of the districts in East Nusa Tenggara Province, the number of stunting cases in 2019 was 471 cases spread across 8 sub-districts, namely East Lio 152 cases, Maurole 109 cases, Ndori 73 cases, Ende 38 cases, Nangapanda 33 cases, Wewaria 31 cases, Wolojita 19 cases, and Lepembusu Kelisoke 16 cases. The high prevalence of stunting in Ende Regency is thought to be caused by multifactorial causes, including maternal knowledge of nutrition, low levels of nutritional awareness in family behavior, and clean and healthy living behavior by parents of stunted toddlers (Ende Regency Health Office, 2018).

Based on the prevalence of stunting cases in Ende Regency, and looking at the East Nusa Tenggara provincial government's program to redevelop local food sorghum and moringa, researchers are interested in providing sorghum and moringa that have been made into cakes and given to the community, especially children who are stunted. Cookies are a type of pastry that is liked by children. The use of sorghum flour as a substitute for wheat flour in making cookies is expected to increase its nutritional value. After being given sorghum cookies and Moringa leaves, the effect on children's growth and development was seen through measurements of height, weight and upper arm circumference.

RESEARCH METHOD

This research uses a quasi-experimental type of research with a one group pretest-posttest design. Carried out in the work area of the Ende Regency public health centers covering 5 locations, namely, the secondary community health center Roworena, Borokanda, Watusipi, the Geoghoma village health post, and Kota Ratu. This research was conducted from 2 August-3 September 2021, totaling 96 people sampling was carried out using non-probability sampling so that the total was 55 people.

The sample to be used is determined based on inclusion and exclusion criteria. Inclusion criteria included, toddlers aged 24–60 months, children not sick, 3, mothers willing to have their children as respondents, and willing to consume sorghum and moringa cookies for 3 weeks. Exclusion criteria are children who are sick and suffer from congenital defects.

The independent variable in this study was consumption of cookies made from sorghum and moringa, while the dependent variables were height, body weight, and upper arm circumference. The instruments used in this research were interview guides, observation sheets, and tools for measuring height, weight, and upper arm circumference.

Before being given the intervention, research subjects had their height, body weight, and upper arm circumference measured. Then intervention was given by providing processed sorghum and moringa products. Every week a posttest is carried out on research subjects. Participants who had received an explanation signed and informed consent, after that a structured interview was conducted, measurements were taken on the participant's

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children as pre-test data, followed by giving 7 packs of sorghum and moringa cookies which would be used as pre-test data. consumed one pack per day for one week by the child and on the 7th day the measurements were taken again for 3 weeks.

The analysis used was univariate, bivariate using the dependent T test (paired) with a confidence level of 95% p>0.05, before the T test the data was first tested for normality using Kolmogorov Smirnov.

This research received approval from the Kupang Ministry of Health Polytechnic Health Ethics Committee on September 3 2021 with Number: LB.02.03/1/0121/2021.

RESEARCH RESULTS

Table 1. Demographic Characteristic of Participan (N=55)

Variables	Result
Child's Age (Mean± SD)(Range)(Month)	(45.273±11.672) (24-60)
Gender (n/%)	
Female	25/45.5
Male	30/54.5
Mother's Age (Mean± SD) (Range)(Year)	(28.981±6.115)(20-38)
Mother's Education (n/%)	
Senior High School/High Education	24/43.6
Elementary School/Junior High School	31/56.4
Father's Employment (n/%)	
Laborers	28/50.9
Private Employee	6/10.9
Trader /Entrepreneur	7/12.7
Farmer/Fisherman	14/25.5
Monthly Income (IDR) (n/%)	
≥1.4 million	5/9.1
<1.4 million	50/90.9

Based on Table 1, it can be seen that the average age of toddlers is 45.273 months with a standard deviation of 11.672 age range 24-60 months. The gender of the toddlers was mostly male, 30 (54.5%), the average age of the mothers was 28.98 years with a standard deviation of 6.115, age range 20-38 years. The majority of mothers had elementary school/junior high school education 31 (56.4%). Most of the father's work is as a laborer 28 (50.9%) and has a low income of less than 1.4 million per month 50 (91%).

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Table 2. Evaluation of Having Foods From Sorghum With Moringa Leaf Powder (N=55)

Variables	Mean ±SD	Minimal	Maximal	p-value
Heights (cm)				
Pre-test	99.33±7.22	77	103	0.000
Post-test	99.41±6.91	79	104	
Weight (kg)				
Pre-test	11.80±1.77	6.1	14.5	0.000
Post-test	12.19±1.80	6.4	14.7	
Upper Arm Circumference (cm)				
Pre-test	14.48±1.04	13	16.6	0.000
Post-test	15.08±1.18	13	17	

Table 2 shows the average height data before intervention with a mean ± SD value of 99.33 ± 7.22. The minimum and maximum values before intervention were 77 and 103, while the minimum and maximum intervention values were 79 and 104. Data on average body weight before intervention with a mean ± SD value of 11.80 ± 1.77. The minimum and maximum values before intervention were 6.1 and 14.5, while the minimum and maximum values after intervention were 6.4 and 14.7.

The mean circumference of the upper arm before intervention was mean ± SD value 14.48 ± 1.04. The minimum and maximum values before intervention were 13 and 16.6, while after intervention they were 13 and 17.

The results of this study stated that there was an effect of increasing height, weight, upper arm circumference in stunted children on giving sorghum cookies and Moringa leaves because there was an increase after being given the intervention.

DISCUSSION

The sorghum and moringa given to stunted children in this study were made in the form of cookies considering that cookies are a type of snack that is popular with children. Cookies are cakes made from wheat flour, sugar and fat that have low water content, are small in size, usually have a sweet taste and are made through a baking process. Nutritional intake is one of the direct causes that can influence the nutrition of children under five (Eldridge, & Offord, 2020). Toddlers with adequate levels of energy and protein consumption and meeting their body's needs will be directly proportional to the nutritional status of toddlers (Lutfiana, 2018). Nutrient intake includes macronutrients such as carbohydrates, protein and fat. Macronutrients are substances that are needed in large quantities by the body and play a large role in providing energy. The level of macronutrient consumption can influence the nutritional status of toddlers (Mousa, Naqash, & Lim, 2019).

Moringa is a plant that has been scientifically recognized as having good nutritional value. The addition of Moringa leaves to children's daily diet can speed up recovery because they contain 40 important nutrients (Zakaria, Lestari, & Hartono, 2013). Moringa leaves have a high protein, vitamin and mineral content so they have the potential to be used as additional food for malnourished children. Another plant besides moringa that contains good nutritional value is sorghum. Sorghum has the main content of carbohydrates, protein, fat, fiber and micronutrients. The content of micronutrients such as vitamins, minerals and antioxidants makes sorghum rich in nutrients. Even though sorghum is a substitute for rice, it has a high protein content to meet daily protein needs. Seeing the diverse nutritional content in Moringa and sorghum leaves means that these two types of local plants can be used for health, including treating and preventing the emergence of certain diseases as well as overcoming the problem of stunting in children (Okoth, Ochola, Gikonyo, & Makokha, 2017).

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The problem of stunting is a health problem in children due to lack of nutritional intake. The negative impact of stunting can result in disruption of children's growth and development, decreased immune system, increased morbidity in children and death rates. The total sample in this study was 55 stunted children under five. Samples were given sorghum cookies and Moringa leaves for 21 days. Before and after the intervention, height, weight and upper arm circumference were measured. This intervention will be successful if the sample complies with the rules for consuming sorghum and moringa cakes. In this study, 98% of the sample liked the sorghum and moringa cookies given.

Previous research showed that there was a difference in body weight before and after giving additional moringa food to the treatment group. Before being given the average body weight was 10.29 kg, while after giving it it was 11.56 kg. Based on the results of statistical tests, it shows that the treatment groups between before and after giving additional food from Moringa leaves showed differences in body weight (Juhartini, 2016). This was also seen in this study where after being given cookies for 3 weeks stunting babies and toddlers showed changes in average weight gain of 0.39 kg, average height increase of 1.08 cm, and average increase in upper arm circumference of 1.08 cm. 06 cm.

Cookies made from sorghum and Moringa leaves can be used as an additional food program that is rich in nutrients so that it can overcome the problem of malnutrition in general and the problem of stunting in particular. The results of this research will also recommend that local governments again promote the cultivation of moringa and sorghum in addition to rice and corn.

CONCLUSION

Providing sorghum and moringa has an effect on the growth and development of stunted children in Ende Regency.

SUGGESTION

Public health centers can provide education regarding providing additional food to stunted children by providing local foods such as sorghum and moringa. Meanwhile, the Regional Government of Ende Regency should encourage sorghum cultivation more massively.

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