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The Effectiveness of BIMA-X (Biscuits and *Moringa oleifera* Leaf Extract) to Handling Children With Malnutrition

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Abstract. **Malnutrition is one of the leading nutrition causes of morbidity and mortality among children under the age of five-year-old in many countries. Children with severe acute malnutrition (SAM) are nine more likely to die than children without malnutrition. Malnutrition still become a serious health problem in Indonesia. One of the strategies implemented by the government to replace nutritional status is giving supplementary feeding. Government's Efforts to Improve Micronutrient and Psychomotor Status in Malnourished Toddler through Multi-Vitamin and Mineral Supplementation The high Nutrition in *Moringa oleifera* and Biscuits fortification for nutritional and health improvement from government aims to analyze the effectiveness of BIMA-X products (Biscuits and *Moringa oleifera* leave Extract) to handling children under five-year-old with malnutrition. This research method uses Quasy Experiment with a non-equivalent control group design. 16 samples of children under five-year-old, before and after the response of the BIMA-X product, anthropometric measurements will be carried out. This study seeks to analyze the effectiveness of BIMA-X on changes in underweight nutritional underweight children to the treatment and control groups. After cross-tabulation, it was concluded that there were differences in weight changes between the treatment group and the control group, while *p value* = 0,035 it could be found that there were differences in body weight changes in the treatment group and the control group after giving BIMA-X products. From these results, it can be seen that *Moringa oleifera* leaves and biscuits fortification for nutritional and health improvement from the government are very helpful in improving nutrition in children.**

Keywords: effectivity, BIMA-X, children, malnutrition

INTRODUCTION

Malnutrition with its 2 constituents of protein-energy mal nutrition and micronutrient deficiencies, continues to be a major health burden in developing countries. The most important risk factor for illness and death, with hundreds of millions of pregnant women and young children, particularly affected. Apart from marasmus and kwashiorkor (the 2 forms of protein-energy malnutrition), deficiencies in iron (Fe), iodine (I), vitamin A and zinc are the main manifestations of malnutrition in many developing countries, like Indonesia[1].

Malnutrition is one of the leading nutrition causes of morbidity and mortality among children under the age of five-year in low and middle-income countries. Children with severe acute malnutrition (SAM) are nine times more likely to die than children without malnutrition [2]. One of the malnutrition types is undernutrition, it is still a serious health problem in Indonesia. Indonesian Nutrition Status Monitoring results in 2016 shows that the prevalence of stunting in children under five year was 27.5%, thin 8.0%, very thin 3.1% and at thin risk 22.8% %. For Indonesian children free from malnutrition, one of the strategies run by the government to replace nutritional status is giving supplementary feeding [2].

The nutritional supplementation is an effort that can be done to meet the lack of nutritional needs from the consumption of the dairy product which results in the emergence of health, malnutrition, and nutrition problems in nutrition-prone groups. One of the supplementation programs currently being implemented by the government is Supplementary Feeding for children under five-year, elementary children, and pregnant women. The program is known as the Government's Efforts to Improve Micronutrient and Psychomotor Status in Malnourished Toddler Children through Multi-Vitamin and Mineral Supplementation [3].

According to Riskesdas in 2013, it is known that the prevalence of skinny toddlers and the prevalence of infants stunting respectively at 12.1% and 37.2%. Monitoring of Nutritional Status (PSG) in 2016 shows that the prevalence of stunting in infants is 27.5%, skinny toddlers 8.0%, toddlers are very skinny 3.1%, and toddler risk skinny 22.8%[4]. The administration of nutritional supplementation is an effort that can be done to adequately lack of nutritional needs from daily eating consumption which results in the onset of health problems and nutrition in the nutrition prone group. One of the current programs of supplementation is implemented by the Government, i.e. additional feeding on infants, elementary school children, and pregnant women [4].

Millions of Indonesian children remain threatened by staggering rates of stunting and wasting and the 'double burden' of malnutrition where under and over nutrition (obese) co-exist. In 2018, many studies have mentioned that close to 3 in 10 children under 5 years of age were stunted while 1 in 10 was wasted. A fifth (20 %) of primary schoolchildren and about 15 percent of adolescents are overweight or obese. In the world, two million children under 5 suffer from severe acute in malnutrition, a life-threatening condition if left untreated [5].

Larger working populations, the millennial era, longer commuting times, along with changing diets and modern lifestyles have contributed to the inadequate consumption of fresh and organic produce and increased intakes of processed and pre-prepared foods that are often high in carbohydrates (including sugar), salt, and fats, resulting in a spike in overweight in the country. The effects of "double burden" malnutrition are not only felt by people. The economy suffers too with malnutrition perpetuating the cycle of poverty. While poverty contributes to malnutrition (like stunting, wasting, marasmic-kwarsiorkor, and also obese), inadequate knowledge and practices of child-caring form their parents and child feeding also sustain the high rates of malnutrition. Maternal health also plays a role. Many women fall pregnant as teens, do not eat properly during pregnancy, macro deficiency, and micronutrient like (protein, iodine, iron, and folic acid) and often give birth to small or 'low birth weight' babies [5].

New evidence has emerged that maternal and fetal under-nutrition increases a population's susceptibility to over-nutrition (obese) and diet-related non-communicable diseases in adolescence and adulthood. Also, around 55 million people nationwide (22 % of the population) practices open defecation – a highly unsanitary habit that contributes to the high burden of childhood diarrhea and malnutrition [5].

Research by Elisabeth Kristiansson et al., 2016 based on the results of data analysis from 31 countries, shows that food supplementation shows weight gain in underprivileged families. Likewise, children aged 6-23 months who were given supplementary food for six months showed weight gain, then when MT was provided with nutrition education and local food-based interventions the weight-gain became greater [6].

The government usually distributes fortification for nutritional and health improvement biscuits in August at all primary health cares center in Indonesia. According to Nur Hayati's research, giving Biscuits is a form of supplementation to increase children under the five-year weight [6]. Every 100 grams of biscuits contains 450 calories, 14 grams of fat, 9 grams of protein, and 71 grams of carbohydrates. Biscuits for Children under five years have vitamins A, B1, B2, B3, B6, D, E, K, and folic acid and contain minerals in the form of iron, zinc, phosphorus, selenium, and calcium. Giving Biscuits without supervision from the government will not be effective and efficient. PMT Biscuit is one form of supplementation to increase the weight of toddler, and kelor leaf extract/100 gr has a protein content of 28.25%, Vit A in the form of β-carotene 11.92 mg, calcium 2241.19 mg, and Magnesium as much as 28.03 mg [7].

Moringa oleifera leaves are used in Brazilian folk medicine for their hypoglycemic and nutritional properties. In this context, the chemical and biological characteristics were determined. *Moringa oleifera* leaves grows a lot in Indonesia, according to the list of ingredients, it contains 82 calories of energy, 6.7 grams of protein, 1.7 grams of fat, 14.3 carbohydrates, 440 mg of calcium, 70 mg of phosphorus; 7 mg of iron, 11300 IU of vitamin A, 0.21 of vitamin B, and 220 mg of vitamin C. The lack of information about the *Moringa oleifera* leavemakes the public unaware of the many nutritional contents contained in *Moringa oleifera* leaf [8].

Children usually can accept sweet and eye-catching food more easily, like ice cream, pudding, nugget, and crackers. So, modification of *Moringa oleivera* leaves extract and governance's supplementary feeding biscuit can be good alternative food that delivers nutrients that are needed to support catch up growth in undernourished childrens that effective and efficient [9].

This research is an advanced study of community service activities before. On the activity of community service utilization of "Bi Saylor" as an alternative food product for sustainable nutrition development. "Bi Saylor" is a new variant of the form of Biscuit PMT given to the toddler on Posyandu activities. According to the Chairperson of TP PKK, Depok, TP PKK, Depok City has its own way to have a nutritious menu balanced and safe (B2SA) can be enjoyed by toddlers as an additional food delivery menu (PMT). Cadres must be able to display varied and diverse foods to the community on the implementation of "Posyandu" [9].

BIMA-X (Biscuits and *Moringa oleifera* leave extract) is a term for additional food products for malnourished children, which includes Biscuits mixed with *Moringa oleifera* leaves extract. BIMA-X products can be served in 3 food variations, namely: Ice Cream, Nugget, and Pudding. Therefore, researchers want to know the effectiveness of BIMA-X (Biscuits and *Moringa oleifera* leave Extract) to handle children with malnutrition.

METHOD

This research method used Quasy Experiment with a non-equivalent control group design with

probability sampling. The intervention was given in the sample in Gresik for three weeks. 16 sample of children under five-year, before and after consumption of the BIMA-X product, anthropometric measurements will be carried out. 16 samples of children under five-year measured their weight before and after consuming the BIMA-X product. During 3 weeks, children under five-year consuming BIMA-X product with 3 different variants. For qualified data, there are 7 college students assigned to do monitoring evaluation data of anthropometry and interview with the form of FFQeveryday. To measure the anthropometry, 7 college students brought a digital weight scale. This study seeks to analyze the effectiveness of BIMA-X products on changes in underweight nutritional underweight children to the treatment and control groups.

RESULT & DISCUSSION

Weight before and after giving BIMA-X products to the intervention group

Table 1: Children under five-year Body Weight Before and After Giving BIMA-X Products in the treatment group:

Weight	*Pretest*			W	*Posttest*			*P-Value*
	N	*%*	*M*		*N*	*%*	*M*	
W<	16	100	9,5	↓	3	18,8	9,9	0,000
				↔	1	6,3		
				↑	12	75		
	16	100			16	100		

* Note :↔: Stable, ↓ : Low, ↑ : Up, M : Mean

Based on the results of the paired t-test test with the provisions that if the test is significant in the treatment group p-value <α = 0.05 then there is a change in pre and post body weight after giving BIMA-X pudding, while p = 0,000 then the conclusion is drawn that in the treatment group there is a change in body weight pre and post giving the BIMA-X products.

Weight before and after giving BIMA-X products to the Intervention group

Table 2: Children under five-year Body Weight Before and After Giving BIMA-X Products in the control group:

W	*Pretest*			W	*Posttest*			*P-Value*
	N	*%*	*M*		*N*	*%*	*M*	
W <	16	100	9,4	↓	9	56,3	9,6	0,574
				↔	3	18,7		
				↑	4	25		
	16	100			16	100		

*Note :W : ↔: Stable, ↓ : Low, ↑ : Up, M : Mean

Based on the results of paired t-test statistics with the provisions that if the test is significant in the control group with p value> α = 0.05 there is no change in pre and post weight, while p = 0.574 it can be concluded that the control group has no change in pre-test weight and post-test.

Table 3: Children under five year Body Weight post treatment and post control after giving BIMA-X Products in:

Group	N	Weight						*M*	*P-Value*
		↔	%	↓	%	↑	%		
W*Post* Inter	16	3	18,8	1	6,3	12	75	9,9	0,035
W *Post* Control	16	9	56,3	3	18,7	4	25	9,6	

* Note :W : Weight↔: Stable, ↓ : Low, ↑ : Up, M : Mean

Based on the results of the independence t-test with the provisions that if the test is significant with p value> α = 0.05 there is a difference in weight change between the treatment group and the control group, while *p value* = 0,035 it can be concluded that there are differences in weight change in the treatment group and the control group after administering the BIMA-X products.

Body Weight of Children under Five-year Before and After Giving BIMA-X Products to the Treatment Group

Based on the cross-tabulation above, it is concluded that there were differences in weight changes between the treatment and control groups after the administration of BIMA-X products. Based on studies conducted by Church World Service in the country of Senegal, Africa.

In this project, precisely in the Southwest Senegal region, the ability of Moringa leaves has been tried to prevent or treat malnutrition in pregnant or breastfeeding women and their children. Malnutrition is the biggest problem in the area, with over 600 cases of malnutrition in infants every year. During the doctor's trial period, midwives, and nurses are trained to prepare and use Moringa leaf powder in cases of malnutrition. Mothers in the village are also trained in preparing and using Moringa leaf powder for various foods. The "Mother and Child Health Project" trial was conducted in 1997-1998, in the center of malnutrition treatment in children where there were 45 cases in children aged 1-5 years, 20 of them were cases of severe

malnutrition. The experiment was carried out by adding dried moringa leaf powder to their food. The result recorded that 17 children who experience severe malnutrition and 25 children who experience nutrition can recover completely [10].

Nutrition in 100 grams of fresh Moringa leaves is equivalent to 8 grams of dried *Moringa oleifera*leaves effective in increasing the weight of pregnant women with Calorie Energy Deficiency and malnutrition children under five years. From these results, it can be seen that BIMA-X products (Biscuits and *Moringa oleifera* leave Extract) are very helpful in improving nutrition in children.

The fact that moringa is easily cultivable make sit a sustainable remedy formal nutrition. Countries like Senegal and Benin treat children with moringa [11]. *Moringa oleifera*, an edible tree found worldwide in the dry tropics like India and Indonesia, is increasingly being used for nutritional supplementation for handling malnutrition. Its nutrient-dense leaves are high in protein quality, leading to its widespread use by doctors, healers, nutritionists, researchers, and community leaders, to treat under-nutrition and a variety of illnesses. Even though no rigorous clinical trial has tested its efficacy for treating under-nutrition, the adoption of *M. oleifera* continues to increase. The “Diffusion of innovations theory” describes well, the evidence for growth and adoption of dietary *M. oleifera* leaves, and it highlights the need for a scientific consensus on the nutritional benefits

In line with this research, nutritional intervention with *Moringa oleifera* leaves powder was significant to reach weight gain among children with grade I (one) and grade II (two) protein-energy malnutrition. The Moringa leaves powder can be effectively utilized for the treatment of Protein Energy Malnutrition (PEM) by spreading the awareness about the nutritional value of *Moringa oleifera* to mothers of children with Protein Energy Malnutrition (PEM) [12].

CONCLUSION

Based on the research findings and test results in the discussion implemented, the following conclusions can be drawn: 1) There is a significant increase in average body weight before and after the administration of BIMA-X products to the treatment group. 2) There is a minimum increase in body weight before and after giving BIMA-X to the control group. 3) The influence of giving BIMA-X Productto changes in underweight nutrition in Balong Panggang Gresik.

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