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THE EFFECT OF MORINGA LEAF ANCHOVY NOODLES ON NUTRITIONAL INTAKE AND INCREASE IN HEIGHT OF ELEMENTARY SCHOOL STUDENTS

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Abstract

Introduction: *Stunting* is a problem of chronic malnutrition caused by a lack of nutritional intake over a long period due to providing food that is not for children's nutritional needs. Indonesia is the country with the third highest prevalence of stunting in Southeast Asia. **Objective:** This study aims to determine the effect of mitekor (moringa leaf anchovy noodles) on the intake and height increase of elementary school children. **Method:** This type of research is Quasi-Experimental with a Pre and Post Test Design. The population in this study were all 1st-grade stunting students at SDN 064026 and SDN 065015, Medan Tuntungan District. The intervention was giving Moringa leaf anchovy noodles for 30 days (100 g/day). Food intake data was collected by food recall and body height by taking anthropometric measurements. Data were analyzed using T-dependent, obtained p-value = 0.02 < 0.05. **Results:** Providing tekorr noodles showed an improvement in the level of nutritional intake and was proven to be significant in increasing the height of school children. The findings of this research provide a new understanding of the stunting prevention program by providing anchovy noodles with moringa leaves.

Keywords: Nutritional Intake, Noodles, Moringa Leaves, Anchovies, Height.

INTRODUCTION

Stunting is a problem of chronic malnutrition caused by a lack of nutritional intake over a long period of time due to providing food that is not in accordance with children's nutritional needs. The nutritional status of short (stunting) toddlers is based on the PB/U or TB/U index where in the standard athropometric assessment of children's nutritional status, the measurement results are at the threshold (Z-score) < -2 SD to -3 SD (short /stunted) and < -3 SD (very short/severely stunted)[1]. Stunting in Indonesia, it is still a nutritional problem that requires serious treatment [2]. According to the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in Indonesia in 2021 was 24.4% and in 2022 it was 21.6%. This means that the prevalence of stunting in Indonesia has decreased by 2.8%. Even though there has been a decline, this figure is still relatively high, because the prevalence of stunting according to WHO standards must be less than 20%.[3].

Stuntingcan occur before the child is born if the mother is malnourished and the mother cannot provide adequate nutrition to the baby she is carrying[4]. Impaired fetal growth in the womb can cause low birth weight so that the unborn child is at high risk stunting [5]. Apart from that, malnutrition can also be caused by poor feeding of babies and children, especially less than optimal breastfeeding and less responsive supplementary feeding along with the presence of infectious diseases such as

diarrhea.[6]. There are three main factors that cause stunting, namely unbalanced food intake, history of low birth weight (LBW) and history of disease.3 Balance of food intake is related to nutrient content including carbohydrates, proteins, fats, minerals and vitamins.[7].

Growth in infants and children is reflected in height that is not appropriate for age, this is an example of adaptation to low energy intake for a long time. If the lack of energy is not too long, the child will show catch-up growth. Stunting reflects chronic malnutrition and is detected as a linear growth disorder[8]. In toddlers, protein is used to maintain tissue, change body composition, and to synthesize new tissue. Astutik's research (2017) shows that protein intake influences the incidence of stunting where toddlers with low levels of protein adequacy have a 3,538 times risk of experiencing stunting compared to toddlers whose levels of protein adequacy are sufficient.[9].

Zinc (zinc) is a micromineral that plays a role in protein synthesis and cellular enzyme function, so the role of zinc in bone growth is very large. Currently, around 20% of the world's population of children under five are at risk of zinc deficiency from their daily diet.Zinc is a micronutrient that can be used as a source of nutrients that can help the bone growth process in stunted children so that linear growth can be corrected.[10]. Calcium (Ca) is the most abundant mineral in the human body. Calcium deficiency will affect linear growth if the calcium content in the bones is deficient and if it persists for a long time it will result in stunting[11].

Noodles are an alternative and popular food substitute for rice which is consumed by many people because the price is cheap and the processing and serving method is simple, and the carbohydrate content in it can contribute to energy in the body.[12]. The ingredients for making noodles are usually made from wheat flour with or without the addition of other permitted food ingredients and additional food ingredients, with a typical noodle shape.[13].

Moringa leaves (Moringa oleifera) have a high nutritional content and are easily available in the surrounding environment, but their use is still very lacking. People generally only use Moringa leaves as food which is processed into clear vegetables. Therefore, food processing diversification needs to be implemented with the aim of increasing the nutritional content and added value of food commodities so that they are more efficient for human needs.[14]. Anchovies (Stolephorus sp.) are rich in nutritional content. Anchovies have a longer and smaller body shape, taste delicious and are rich in health benefits. Anchovy is usually made with anchovy sauce, capcai and anchovy vegetables, as well as anchovy bakwan [16]. From a preliminary study conducted on the composition of noodles made from anchovies and Moringa leaves (Mie Tekor) with a composition of 200 g of wheat flour, 45 g of anchovy flour, and 5 g of moringa flour containing 26.42 g of carbohydrate nutrients, protein was 16.63 g, zinc was 1.46 mg, and calcium was 105.28 mg. This study aims to analyze the effect of giving tekor noodles on the intake and increase in height of elementary school children[17].

METHODS

Quasi-experimental research was applied in this research. The population in this study was all class 1 of SDN 064026 and SDN 065015, Medan Tuntungan District. Sampling was carried out by random sampling and the sample criteria were stunted school

children from 2 schools, SDN 067246 and SDN 065015 with anthropometric nutritional status-plus WHO-2007 determination to determine the height index for age (TB/U) Z-score value. The intervention carried out in this study was to give the samples 100 g/day of tekor noodles to the samples for 30 days at 10.00 WIB. The provision of short-cooked noodles was assisted by teachers and student enumerators.The tekor noodles given as an intervention were tekor noodles with a composition of 200 g of wheat flour, 45 g of anchovy flour, and 5 g of moringa flour which contained 26.42 g of carbohydrate nutrients, 16.63 g of protein, 1 g of zinc. .46 mg, and calcium of 105.28 mg.

Sample identity data was obtained by interview using a sample identity form. To determine the nutritional status of school children by collecting TB/U data or based on the height index for age (TB/U) with a threshold of <2 Standard Deviation (SD) (Ministry of Health of the Republic of Indonesia, 2011). Data on nutritional intake was collected using the food recall method by conducting interviews and using a 24-hour recall before and after the intervention using the interview method and processed using the Nutrisurvey program.

Approval Ethics

The research process has received approval from the ethics committee issued by the Medan Ministry of Health Polytechnic, No: 01.1729/KEPK Medan Ministry of Health Poltekkes.

Statistic analysis

The statistical analysis used in this study was univariate analysis which was carried out to describe various variables including: age, gender, initial TB, initial BW, final TB, final BW, initial food intake, final food intake, and nutritional intake before and after intervention, as information material. By using a frequency distribution table using a computer program, the minimum value, maximum value, average value and standard deviation can be obtained which are then presented in a frequency distribution graph and analysis based on percentages.

Apart from that, bivariate analysis was also carried out in this research which was carried out to see the effect of giving mitoros and sticks on preventing stunting in school children in Medan Tuntungan sub-district, Medan city using the independent t-test with $\alpha \leq 0.05$.

RESULT

Respondent Characteristics

Based on table 2, the majority of respondents were 7 years old (84.8) and 20 children were male (60.6%).

Table 1: Characteristics of Respondents Based on Age and Gender

Age	**n**	**%**
7 years	28	84.8
8 years	5	15.2
Gender	**n**	**%**
Man	20	60.6
Woman	13	39.4
Total	33	100

Average Increase in Nutrient Intake Before and After Giving Mitekor

Table 2: Average Intake Before and After Administration of Mitekor

No	Nutrients	Nutritional intake	
		Before Intervention	After Intervention
1.	Carbohydrate	203.6 g	206.5 g
2.	Proteins	27.3 g	34 g
3.	Zinc	3.3 mg	4.2 mg
4.	Calcium	527.2 mg	853.0 mg

Level of Adequacy of Nutrient Intake for Elementary School Children before and After Giving Tekor Noodles

Table 3: Level of Adequacy of Nutrient Intake for Elementary School Children Before and After Intervention

Carbohydrate	Before Intervention		After Intervention	
	N	%	N	%
Currently	20	60.6	25	75.8
Not enough	13	30.4	8	24.2
Proteins				
Currently	10	30.3	25	75.8
Not enough	9	27.3	8	24.2
Deficit	14	42.4	-	-
Zinc				
Good	-	-	5	15.1
Currently	11	33.3	13	39.3
Not enough	1	3	10	30.3
Deficit	21	63.7	5	15.1
Calcium				
Good	-	-	1	3.0
Currently	-	-	32	97.0
Deficit	33	100.0	-	-
Total	33	100	33	100

Table 3 shows that there is an increase in carbohydrate intake in children. Where the category of food intake that was classified as moderate before being given miteror was 20 people (60.6%) and after being given miteror it became 25 people (75.8%) meaning carbohydrate intake increased. Consuming more carbohydrates in the body will be converted into fat and stored as reserves in unlimited quantities. These reserves will be used by the body when the body lacks energy. Consuming fewer carbohydrates than fat stores will continue to be used and reduced, thereby reducing nutrient intake in the body. Low consumption of nutrients can affect a child's growth and development process[18]. The average carbohydrate intake before intervention was 203.6 g, compared to the nutritional adequacy rate (AKG) of school children of 250 g. The average carbohydrate intake has not yet reached the AKG, however after giving it the average carbohydrate intake of children has increased by 206.5 g, and when compared with the AKG of school children the average child's carbohydrate intake has not yet reached the AKG. It can be concluded that mycorrhea influences the increase

in the average carbohydrate intake of school children. The carbohydrate contribution made from the mites was 2.9 g.

Protein intake also showed an increase. Where the category of food intake that was classified as moderate before being given miteror was 10 people (30.3%) and after being given miteror it became 25 people (75.8%) meaning the child's protein intake increased. Protein is classified into two, namely vegetable protein and animal protein. Low quality of protein consumed can also be a cause of stunted growth. The amino acids found in vegetable protein are not as complex as animal protein to help growth. The recommendation for obtaining better quality protein and micronutrients is around 25% of the protein adequacy figure from animal protein.[19]. Therefore, consuming animal protein can minimize the occurrence of stunting in school children. The average protein intake before intervention was 27.3 g, compared to the AKG of school children of 40 g. The average protein intake has not yet reached the AKG, however after giving it the average child's protein intake has increased by 34 g, and when compared with the AKG of school children the average child's protein intake has not yet reached the AKG. It can be concluded that mites influence the increase in average intake

Our research findings also show an increase in zinc intake, where the zinc food intake category after the intervention which was classified as good became 5 people (15.1%), meaning that children's zinc intake increased. Zinc functions in accelerating growth. The role of zinc helps in cell replication and nucleic acid metabolism which are the main factors in growth and development[20]. Consuming zinc from animal sources is preferred because it is easier for the body to absorb and utilize. Considering that stunting is not a trivial matter, maximum efforts need to be made to reduce stunting in Indonesia. The average zinc intake before intervention was 3.3 mg, compared to the AKG for school children of 5 mg. The average zinc intake has not yet reached the AKG, however after administration the average child's zinc intake increased by 4.2 mg, and when compared with the AKG of school children the average child's zinc intake has not yet reached the AKG. It can be concluded that mites influence the increase in the average zinc intake of school children. The zinc contribution given from Mitekor was 0.9 mg.

Calcium intake before the intervention was a deficit for all (100%) and after being given the intervention it increased to the moderate category for 32 people (97%) where after giving the intervention calcium intake increased. Calcium deficiency will affect the bones, resulting in growth disorders. In babies, a lack of calcium in the bones can cause rickets, while in children a lack of calcium deposits can cause stunted growth[21]. The average calcium intake before intervention was 527.2 mg, compared to the AKG of school children of 1000 mg. The average calcium intake has not yet reached the AKG, however after administration the average child's calcium intake increased by 853.0 mg, and when compared with the AKG of school children the average child's calcium intake has not yet reached the AKG. It can be concluded that mites influence the increase in the average calcium intake of school children. The calcium contribution given from the mites was 325.8 mg.

The increase in nutritional intake of school children before and after giving tekor noodles to elementary school children can be seen in the table below:

Nutritional Status of School Children with TB/U Index

Table 4: Effect of Giving Mitekor on TB/U Levels in Elementary School Children

No	Category	Before		After	
		n	%	n	%
1	Short	33	100	31	93.9
2	Normal	0	0	2	6.1
	Total	33	100.0	33	100.0

Based on table 4, it shows that TB/U on the nutritional status of school children before and after has increased. Where the TB/U category which was classified as short before the intervention was given was 33 people (100%) and after the intervention it was 30 people (93.9%), meaning that there was an influence from giving mitor. If we look at intake, there are some children who don't consume enough food containing protein, zinc, calcium and many children don't eat breakfast before going to school. If left unchecked, children who experience stunting will have short bodies, will not grow optimally, have a level of intelligence below average, as a result, stunted children will not be able to absorb lessons well during school, get sick easily: malnutrition can cause children to have an immune system. those that are less than optimal are at risk of developing various other diseases: Children who are stunted are at high risk of developing cardiovascular disease as adults, such as coronary heart disease and stroke. Apart from that, various other health risks that can also occur in people with stunting include diabetes mellitus, hypertension and anemia.

The Effect of Giving Mitekor on the Height of Elementary School Children

Table 5: Effect of Giving Mitekor on the Height of Elementary School Children

	Category					
	n	Minimum	Maximum	Mean	Std. Deviation	*p value*
Z-score tb1	33	-2.99	-2.02	-2.25	.23604	
Z-score tb2	33	-3.01	-1.99	-2.28	.26044	
Valid N (listwise)	33					0.02

The average height of the 33 students before the gift was 112.89 cm, while the average height after the gift was 113.32 cm. So you can see an average increase in height of 0.43 cm. The results of statistical tests show that there is an effect of giving mitekor (moringa leaf anchovy noodles) on increasing the height of school children.

DISCUSSION

Sample Characteristics

Sample characteristics were obtained by fulfilling the inclusion criteria. Inclusion criteria: all school children at SDN 067246 and SDN 065015 aged 6-8 years. The most common age group was the 6 year age group at 3%, the 7 year age group at 66.7% and the 8 year age group at 30.3%. The largest gender is male at 60.6%. The total sample was 33 school children.

Nutritional Status of School Children

Children's nutritional status is based on height and age or using the TB/U index with WHO-2007 anthropometry-plus software to determine the TB/U Z-score value. The division of nutritional status categories is based on the WHO cut-off, namely a child is in the stunting category if the TB/U Z-score is < -2 SD, and in the normal category if

the Z-score is ≥ -2 SD. School age children in the research sample were categorized into stunting (a combination of very short and short) and normal.

Body height describes the growth of bones or skeleton. Under normal conditions, height increases with age, but is less sensitive to short-term nutritional deficiencies. The effect of lack of nutritional intake on height will only be visible over a long period of time. Thus, the TB/U index describes past nutritional status, so that low TB/U values (stunting) are used as an indicator of chronic malnutrition (Salimar et al., 2013).

Based on the TB/U index, stunting in school children before and after the intervention increased, where the stunting category before the intervention was given was 33 people (100%) and after the intervention it was 31 people (93.9%). The statistical results show that there is an influence of giving mitoros and sticks on preventing stunting in school children in Medan Tuntungan sub-district. In this study, it was found that the Z-score value < -2 SD before the intervention was 33 school children and after the intervention it was reduced to 31 school children and the Z-score value ≥ -2 SD before the intervention was none or all samples were in the short or stunting category but after intervention there were 2 people in the normal category who had a Z-score of 1.99. The minimum value before intervention was 2.99, the maximum value was -2.02, resulting in normally distributed data, then continued with statistical tests with p-value = 0.0.

The results of the study showed that the average height of school children before being given the intervention was 112.9 cm and after being given the intervention was 113.3 cm with a difference of 0.4 cm, meaning that the average increase in height of school children was 0.4 cm in one month of giving 100 grams of mitector and sticks and sticks for 30 days.

When compared with the height of children aged 7-9 years, it is 122-134 cm, so the average height deficiency for school children is 8.7 cm. This can happen because the nutritional intake of school children some time ago did not match the Nutritional Adequacy Rate (AKG) of school children or those aged 7-9 years.

Nutritional Intake

Nutritional Intake for school-aged children, the food provided must include staple foods (as a source of carbohydrates), side dishes (as a source of protein and fat), as well as vegetables and fruit (as a source of minerals and vitamins) and water in amounts adjusted to suit needs. Child's age. Nutritional problems arise due to various factors, such as the amount, type, frequency of food and food quality which depend on economic conditions, food practices, cultural traditions, knowledge and food allocation. Apart from that, the condition of a person's body also influences the ability to digest, absorb and utilize nutrients optimally. This ability can be hampered by infections and metabolic disorders (Almatsier, 2010).

Food consumption is the average amount of consumption per day that needs to be increased. Therefore, school children need nutrients that the body needs, such as carbohydrates, proteins, fats, vitamins, minerals and water which function to carry out daily physical activities or as energy substances, for the process of growth and development in children, replacing damaged body tissue. Or as a building substance, as well as to regulate all body functions. In this study, there were 33 samples who had carried out a recall before and after administering mitekor.

The results of the research to obtain nutritional intake using the food recall method in table 13 show that there was an increase in nutritional intake before and after the intervention, this was due to the provision of intervention or giving mitekor and sticks to the sample, namely: mitekor and sticks each at 100 gr/day. for 30 days, this provision is very helpful in meeting the nutritional needs of school children. As a macronutrient, energy has increased by 240.6 kcal, but when compared with the nutritional adequacy figure for school children, it is still not appropriate, and to fulfill it, 26.2 kcal is still needed. Also, 1.9 mg of micronutrients such as iron is still needed to meet the nutritional adequacy figures for school children. Some of the things found in school children at SDN Tuntungan sub-district are that they often don't eat breakfast, eat low protein and vegetables, rarely consume fruit, don't bring lunch to school, snacks at school in the form of junk food or ready-to-eat foods that are low in protein, iron, Zinc, folic acid and calcium are often consumed by school children, causing irregular eating patterns. Optimal nutritional consumption will support children to stay healthy. However, the fact is that there are still many elementary school children who experience nutritional problems.

Energy consumption is needed by children to support their physical activities, apart from that it also plays a role in the sustainability of the organ systems in the child's body. Meanwhile, protein consumption is needed to support the growth and development process in school children. Lack of energy and protein and mineral intake will cause children to become thin and short.

CONCLUSION

Based on the TB/U index, stunting in school children before and after the intervention increased, where the stunting category before the intervention was given was 33 people (100%) and after the intervention, it was 31 people (93.9%). Research findings show that giving tekor noodles to school children shows an increase in the average intake of nutrients. The results of statistical analysis show that there is a significant effect of giving loose noodles on increasing body height (TB/U) with a P value of 0.002. This research does not calculate a minimum sample size for statistical tests, for this reason, further research is needed with a larger sample by calculating the minimum sample size.

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