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Provision of Moringa Leaf Cake Products (Moringa Oleifera) to the Hemoglobin (Hb) Levels of Young Girls

Nita R. Momongan[1],
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado.
North Sulawesi Province. Indonesia

Olfie Sahelangi[2],
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado.
North Sulawesi Province. Indonesia

Grace KL Langi[3],
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado.
North Sulawesi Province. Indonesia

Ana B. Montol[4],
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado.
North Sulawesi Province. Indonesia

Meildy E. Pascoal[5],
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado.
North Sulawesi Province. Indonesia

Lea S.L Rumbarar[6]
Department of Nutrition, Health Polytechnic,
Ministry of Health, Manado,
North Sulawesi Province .Indonesia

Abstract:- Hemoglobin is a tetrameric protein of erythrocytes that binds molecules, namely iron porphyrin compounds called heme. Hemoglobin has two important transport functions in the human body, namely transporting oxygen to tissues and transporting carbon dioxide and protons from peripheral tissues to respiratory organs. As children, teenagers often experience iron deficiency problems which can cause anemia. In adolescent girls, if the hemoglobin level in the blood is <12g/dL, anemia will occur. This study aims to determine the effect of giving moringa leaf talam cake on hemoglobin levels in adolescent girls at SMP Negeri 2 Manado. This type of quasi-experimental study with a one-group pre-test - post-test research design. The population in this study was 58 people and the sample was 36. The study was carried out in May 2023, namely for 4 weeks of research with the provision of moringa leaf talam cake intervention which was given for 12 times with a total of 120 g (2 pieces of moringa leaf talam cake). Sampling using random sampling techniques. Data were analyzed using a paired T-test, with data normality testing using*Kolmogorov-Smirnovtest.* **Based on the calculation results of the Parried Sample T-test in per by p-value 0.000 <α = 0.05 (p-value is smaller than α = 0.05). This means that there is a significant effect on hemoglobin levels before giving moringa leaf talam cake and after giving moringa leaf talam cake to female adolescents at SMP Negeri 2 Manado. *Conclusion:*provision of moringa leaf talam cake products. Likewise, with the intake of iron (fe), protein and energy, there were significant differences before and after the provision of moringa leaf talam cake products.

***Keywords*:-** *Moringa Leaf Talam Cake, Hemoglobin Levels.*

I. INTRODUCTION

Good nutrition will produce quality human resources, namely healthy, intelligent and have a strong and productive physique. Nutritional improvement is needed throughout the life cycle. Efforts to improve nutrition for the development of quality human resources must essentially begin as early as possible, one of which is through adolescents. Adolescence between the ages of 10-19 years is a transition period experienced by someone with physical and psychological changes. Changes in adolescence cause several health problems. One of the health problems that occurs in adolescents is anemia.[1].

Adolescent girls are one of the groups that are prone to anemia because at that time they also experience menstruation and moreover they have less knowledge about anemia. When adolescent girls experience their first menstruation, they need more iron to replace the blood loss due to menstruation. Adolescent girls need a lot of iron intake to replace the iron lost with blood during menstruation.[2].

Moringa leaves are one of the plants that grow abundantly in Indonesia. Moringa leaves have many benefits ranging from leaves, flowers, stems, fruits, and seeds. Every part of it has been utilized well by the community. One of the local plants that has been known for centuries as a multipurpose plant that is dense in nutrients and has medicinal properties contains more and more diverse natural compounds than other types of plants.[3].

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Moringa leaves contain various macro and micro nutrients and active ingredients that act as antioxidants such as ascobic acid, flavonoids, phenolics and carotenoids, in addition to other important nutrients such as iron (Fe) 28.2 mg, calcium (Ca) 2003.0 mg and vitamin A 16.3 mg, protein, vitamin B such as thiamine, riboflavin, niacin, pantothenic acid, biotin, vitamin B6, B12 and folate. Moringa leaves contain high iron (Fe), even the iron content in Moringa leaves is high, namely 28.2 mg. The content of other nutrients is also high, such as vitamin C 7 times higher than oranges, vitamin A 4 times greater than carrots, 4 times the calcium in milk, 3 times the potassium in bananas, 3 times the iron in spinach so it is very good to be consumed as an alternative to prevent anemia and efforts to increase hemoglobin levels in adolescent girls.[4].

World Health Organization (WHO 2019) estimates that the incidence of anemia in adolescent girls in 2019 was 29.9% of the global prevalence of anemia in women of reproductive age, equivalent to more than half a billion women aged 15-49 years.The prevalence of anemia in Indonesia is 21.7% with anemia sufferers aged 5-14 years amounting to 26.4% and those aged 15-24 years 18.4%.[5]. According to the Indonesian health demographic survey, the prevalence of anemia is 75.9% in adolescent girls (SDKI. 2012).According to the results of the 2018 Riskesdas in North Sulawesi Province, the provision of iron tablets to adolescents aged 10-19 years obtained from health facilities was 23.5%.[6].

Based on this description, the researcher wants to conduct further research regarding the analysis of the influence of providing moringa leaf talam cake products. (*moringa*oleifera*)*on hemoglobin (hb) levels andnutrient intake (fe, protein, energy)in teenage girls at SMP Negeri 2 Manado

II. METHOD

The type of research used is a quasi-experimental study that aims to determine cause and effect, with a pretest and posttest one group research design, namely research conducted by only one group and measurements were taken before and after treatment. The research time was carried out in May 2023, namely for 4 weeks of research with the provision of moringa leaf talam cake intervention which was given for 12 times with a total of 120 g (2 pieces of moringa leaf talam cake). The variables in this study consisted of independent variables, namely the provision of moringa leaf talam cake and dependent variables, namely the hemoglobin levels of adolescent girls. The population of this study was 58 adolescent girls with a sample size of 36 respondents who were at SMP Negeri 2 Manado.

The data sources in this study are primary data and secondary data. Primary data includes personal identity data (name and age), hemoglobin level data, nutrient intake data (fe, protein and energy). While secondary data, namely general description data of the research location, is taken through the basic data of education at SMP Negeri 2 Manado. Primary data collection is obtained through measuring hemoglobin levels using the Easy Touch GCH tool and food intake data is carried out using the 24-hour recall method. While secondary data is obtained from literature / library studies that support or are relevant to this study.

Data processing and analysis were carried out using univariate and bivariate analysis. Univariate analysis is an analysis carried out by describing each variable in the study including age, hemoglobin levels before and after treatment. Bivariate analysis is an analysis carried out on variables that are suspected of having an effect or correlation. The analysis in this study was carried out using the normality test and then using the Parried T-test to analyze the difference in hemoglobin levels before and after giving the Moringa leaf talam cake product. Hypothesis decision making was carried out H0 was rejected if the p-value $\geq \alpha$ (0.05) and H1 was accepted if the p-value $<\alpha$ (0.05).

III. RESEARCH RESULT

Table 1. Age Distribution of Female Teenage Respondents

Age	n	%
12	20	55.6
13	12	33.3
14	4	11.1
Total	36	100

Based on table 1. The sample taken in this study was aged 12-14 years. In this study it can be seen that the most dominant age group of female adolescents is 12 years old with a total of 20 people (55.6%) aged 13 years (13%) and the least age group is 14 years old with a total of 4 people (11.1%).

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Table 2. Distribution of Subjects According to Hemoglobin Level Status Before and After Intervention in Adolescent Girls.

Classification Of Hb Levels Hb Level Status (G/Dl)		**Before Intervention**	**After Intervention**
		N %	**N %**
Normal	>12 g/dl	33 91.7	35 97.2
mild anemia	10-11.9 g/dl	3 8.3	1 2.8
moderate anemia	8-9.9 g/dg/dl	0 0	0 0
Total		36 100	36 100

Based on table 2. It shows that in the treatment group before the intervention, 3 people (8.3%) had mild anemia and after the treatment after the intervention, 1 person (2.8%) had mild anemia, and 2 other people were normal.

Table 3. Analysis of Differences in Hb Levels before and After Intervention

	n	**Average**	***t (p-value)***
Hb levels before intervention	36	14.633 g/dL	Sig : 0.000
Hb levels after intervention	36	15.011 g/dL	

Based on table 3. Shows that there is a significant difference in hemoglobin levels in respondents with a sig value (2-tailed) of 0.000 <0.05. The results of the Hb measurements show that there was an increase seen from the average hemoglobin, namely 14,633 g/dL, in the initial measurement and 15,011 g/dL in the final measurement.

Table 4. Iron (Fe) Intake of Adolescent Girls

Category	**Before Intervention**	**After Intervention**
	n %	**n %**
weight deficit	34 94.4	0 0
moderate deficit	2 5.6	21 58.3
mild deficit	0 0	6 16.7
Good	0 0	9 25.0
Total	36 100	36 100

Based on table 4. It can be seen that the results of the 24-hour recall before and after the intervention in 36 respondents showed differences where before the intervention, 34 people (94.4%) had a severe deficit, 2 people (5.6%) had a moderate deficit and for iron intake after the intervention of 36 people there were 21 people (58.3)% in the moderate deficit category, 6 people (16.7)% had a mild deficit, and 9 people (25.0)% had good iron nutrient intake in the good category.

Table 5. Analysis of Differences in Iron (Fe) Intake before and After Intervention

Intake	**Average Fe Intake (mg)**		***(p-value)***
	Before Intervention	**After Intervention**	**Sig : 0.000**
Fe (mg)	5.158	7,431	

Based on table 5. Shows that there is a significant difference in iron nutrient intake in respondents with a sig. (2-tailed) value of 0.000 <0.05. The results of the 24-hour recall of iron intake before and after the intervention showed an increase seen from the average intake of iron (Fe) nutrients, namely in the initial 24-hour recall data 5,158 and 7,431 in the final 24-hour recall data.

Table 6. Protein Intake of Adolescent Girls) Before and After Intervention

Category	**Before Intervention**	**After Intervention**
	n %	**n %**
weight deficit	14 38.9	
moderate deficit	10 27.8	10 27.8
mild deficit	4 11.1	7 19.4
Good	8 22.2	19 52.8

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More	0 0	0 0
Total	36 100	36 100

Based on table 6. It can be seen that the results of the 24-hour recall before and after the intervention in 36 respondents showed differences where before the intervention, 14 people (38.9%) had severe deficits, and 10 people (27.8%) had moderate deficits, 4 people (11.1) had mild deficits, and 8 people were in the good intake category (22.2%). And for protein nutrient intake after the intervention from 10 (27.8%) people there was a moderate deficit, 7 people (19.4)% in the mild deficit category and 19 people (52.8%) in the good category.

Table 7. Analysis of Differences in Protein Intake Before and After Intervention

	Average Protein Intake (gr)		***T (p-value)***
Intake	**Before Intervention**	**After Intervention**	**Sig : 0.000**
Protein	40,222	47,403	

Table 7. Shows that there is a significant difference in protein nutrient intake in respondents with a sig.(2-tailed) value of 0.000 <0.05. The results of the 24-hour recall of protein nutrient intake before and after the intervention showed an increase seen from the average protein nutrient intake, namely in the initial 24-hour recall data 40,222 and 47,403 in the final 24-hour recall data.

IV. DISCUSSION

In this study, the characteristics of the respondents obtained were that all respondents were female, the sample in this study were 36 female adolescents at SMP Negeri 2 Manado (100%). Based on the age of the research subjects, the most dominant sample age was 12 years old (55.6%), 13 years old (33.3%), and the least 14 years old (11.1%). This shows that the characteristics of the research subjects in the study were mostly in their early teens (12-14 years). The results of the hemoglobin level examination in this study before the administration of the Moringa leaf talam cake product from 36 respondents were 33 people (91.7%) normal and 3 people (8.3%) had mild anemia, while the hemoglobin level after the administration of the Moringa leaf talam cake product was 35 people (97.2%) normal and 1 person (2.8%) had mild anemia. The results of this study are in line with research conducted by [7]. Which shows that consuming extra moringa leaves can increase hemoglobin levels in adolescent girls who suffer from anemia. Moringa leaves contain a variety of multi-micronutrient elements, including beta carotene, thiamine B1, riboflavin B2, niacin (B3), calcium, iron, phosphorus, magnesium, zinc, and vitamin C.[8].

Based on the results of the statistical test of the paired sample t-test, there is a significant difference in the average between hemoglobin levels before and after the administration of moringa leaf talam cake with a Sig value (2-tailed) of (0.000) <0.05). The measurement results show that there is an increase seen from the average Hb initial measurement of 14,808 g / dL and 15,001 g / dL in the final measurement. So H1 is accepted which means there is an increase in hemoglobin levels in female adolescents at SMP Negeri 2 Manado.

The results of the 24-hour recall of iron intake before the administration of moringa leaf cake products in 36 people showed that before the intervention, iron intake was in 34 people with a severe deficit and 2 people with a moderate deficit. Food intake in this study sample was mostly eating 2 times a day, rarely consuming vegetables and fruits and preferring to consume snacks compared to rice, animal side dishes, vegetables and fruits. Iron is a mineral that the body needs to form red blood cells (Hemoglobin) acts as one of the components in forming hemoglobin, iron also functions in the body's defense system [9]. After being given the moringa leaf talam cake product, most of the respondents had iron intake, namely 21 people had a moderate deficit, 6 people had a mild deficit, 9 people were in the good category.

Based on the research results, it can be seen that the average results of the 24-hour recall before and after the intervention in 36 respondents showed a difference where the results of the 24-hour recall of iron intake before the intervention were 5,158 mg and after the intervention the intake of iron nutrients was 7,431 mg. This shows that there was a significant increase in iron (Fe) nutrient intake in respondents with a sig. (2-tailed) value of 0.000 <0.05. The results of this study are in line with research conducted by[10](Sholicha, CA, & Muniroh, L. 2019). Which states that there is a significant relationship between iron intake and hemoglobin levels in adolescent girls.

The results of the 24-hour recall of protein intake before and after in 36 people obtained results where before the intervention, protein intake was in 14 people with severe deficit, 10 people with moderate deficit, 4 people with mild deficit, and 8 people in the good category. Based on the results of the study after the intervention, it can be seen that the results of the 24-hour recall after the intervention were 10 people with moderate deficit, 7 people with mild deficit, 19 people in the good intake category. Protein plays a role in supporting the existence of every cell in the body and strengthening the body's immunity. The results of the 24-hour recall before and after in 36 respondents obtained results where before the intervention the average protein intake was 40.22 and after the intervention the average

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protein intake increased to 47.40 in the results of the statistical test of the difference in protein intake after the intervention in 36 respondents there was a difference with a sig. (2-tailed) value. of 0.000 <0.05. The results of the 24-hour recall of protein nutrient intake before and after the intervention showed an increase seen from the average protein nutrient intake, namely in the initial data and after the intervention. Analysis of the difference in protein intake before and after the intervention showed an increase that occurred during the intervention.

Adequate protein intake is almost mostly experiencing good protein adequacy, which is 80-120%. Protein has an important role in the absorption of iron in the body if protein intake is lacking then iron absorption is inhibited and causes iron deficiency the lower the protein intake the lower the hemoglobin levels of teenage girls with insufficient protein intake have a greater chance of experiencing anemia[11].

The results of the 24-hour recall of energy intake based on the results of the study before the intervention, there were 24 people with severe deficits, and 7 people with moderate deficits, 5 people with mild deficits. While after the intervention of giving moringa leaf talam cake, 15 people were in the moderate deficit category, 13 people with mild deficits, 8 people in the good category.

Analysis of differences in energy intake before and after the intervention can show an increase that occurred during the intervention, there was a significant difference in energy intake in respondents with a sig. (2-tailed) value of 0.000 <0.05. The results of the 24-hour recall of energy intake before and after the intervention showed an increase seen from the average intake of energy substances, namely 1106 kcal in the initial data and 1433 kcal in the final data.

Adequate energy intake is almost the majority of good energy adequacy, namely 80-120%. One factor that can affect hemoglobin levels is nutrient intake. Adequate energy intake is important for maintaining body health and meeting the energy needs required by the body. If the energy supply that is very necessary for various physiological processes in the body is continuously lacking, then there will be a breakdown of proteins that play a role in the absorption, storage, and delivery of iron. Insufficient iron supply does not directly cause disorders such as a rapid decrease in hemoglobin levels. However, it is marked by low hemoglobin as an indicator factor for anemia due to low iron stores.[12]

V. CONCLUSION

Hemoglobin levels before intervention in adolescent girls, there were 3 respondents who experienced mild anemia with an average of (8.3%) and after intervention in adolescent girls, 2 others were normal and 1 person remained mildly anemic. There was a significant difference in hemoglobin levels in adolescent girls at SMP Negeri 2 Manado before and after giving the moringa leaf talam cake product. Likewise, with the intake of iron (Fe), protein and energy, there was a significant difference before and after giving the moringa leaf talam cake product. In the age group of adolescent girls, efforts are made to consume foods rich in protein, iron and other nutrients so that needs are met. Moringa leaf talam cake products are used as one of the foods to increase hemoglobin levels. In addition, there is still a need for consumption of blood-boosting tablets to be more effective in increasing hemoglobin levels.

For other researchers who want to develop further research, it is better to do it over a longer period of time so that the results are more significant and do it by giving other foods or drinks that can increase hemoglobin levels.

- *Conflict of Interest*

The authors declare no conflict of interest.

- *Ethical Approval*

This research has received approval from the Health Polytechnic Ethics Commission of the Ministry of Health Manado Number: KEPK /01/ 03/060/2023. June 05, 2023

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