THE EFFECT OF GIVING MORINGA LEAF PUDDING (MORINGA OLEIFERA) ON HEMOGLOBIN (HB) LEVELS IN ADOLESCENT GIRLS AT JUNIOR 2 PUBLIC MIDDLE SCHOOL

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Abstract. The food consumption pattern of female adolescents is one of the causes of deficiency of Fe intake, because female adolescents tend to want to maintain their body shape, thereby limiting food consumption which causes a lack of nutrient intake. As a result of this which occurs in the long term, it will cause Hb levels to continue to decrease and cause other nutritional problems such as iron nutritional anemia. This study aims to determine the effect of giving Moringa leaf pudding on hemoglobin (Hb) levels in female adolescents. This research method is a quasi-experimental study on 34 samples. How to take samples with random sampling method. Data collection was obtained from the results of 24-hour recall measurements, organoleptic tests, and hemoglobin levels before and after the intervention. Statistical analysis using the Paired Sample t-Test. The results of the study mean hemoglobin levels before the intervention (giving Moringa leaf pudding) was 13.68 g/dL, and after the intervention was 14.20 g/dL. The highest increase in Hb levels is 0.3-0.9 g/dL. There was a significant effect or difference in the hemoglobin level of female adolescents after consuming Moringa leaf pudding ($p < 0.05$).

Keywords: Moringa leaves, hemoglobin levels, young women, iron.

1 INTRODUCTION

The food consumption pattern of adolescents girls is one of the causes of a deficiency in Fe element intake, because female adolescents tend to want to maintain their body shape, thus limiting food consumption which causes a lack of nutrient intake (Djannah & Wisudawati, 2023). Inadequate food intake can cause iron reserves in the body to be imbalanced with the need for iron for the synthesis process of forming hemoglobin (Hb). As a result of this which occurs in the long term will cause Hb levels to continue to decrease and cause other nutritional problems, for example iron nutritional anemia (Ayuningtyas et al, 2020) (Tarini et al., 2020).

Based on Riskesdas data (2018), female adolescents are a group that is prone to anemia. Based on age group, anemia sufferers aged 5-14 years were 26.4% and 18.4% in the age group 15-24 years. Of all these age groups, women have the highest risk of suffering from anemia, especially young women (Badan Penelitian dan Pengembangan Kesehatan, 2018). According to the 2018 National Riskesdas Report, for the province of North Sulawesi, the provision of iron supplements to adolescent girls aged 9-10 years who were obtained in the last 12 months from health facilities was around 23.5%. As for the City of Manado, for young women aged 10-19 years, around 2.38% had received iron supplements from health facilities (Badan Penelitian dan Pengembangan Kesehatan, 2018).

Iron deficiency is considered the most common cause of anemia worldwide, although deficiencies of folic acid, vitamin B12 and vitamin A, and congenital abnormalities can all cause anemia (Kumar et al., 2022). Anemia is a condition in which the number of erythrocytes or oxygen-carrying capacity is insufficient to meet physiological needs so that it will interfere with the formation of erythrocytes (Hussien et al., 2023) (Sivakami & Seth, 2020). Disruption of the formation of erythrocytes can be due to a lack of consuming foods that contain nutrients, especially important nutrients such as iron, folic acid, vitamin C, and other important nutrients (Putri et al, 2022) (Shubham et al., 2020).

Moringa leaves are one of the local plants that have been known for centuries as a versatile plant, rich in nutrients and medicinal properties (Bustomi et al., 2023) (Boopathi & Raveendran, 2021) (Vani et al., 2021). The results of the study stated that Moringa leaves contain a lot of vitamin A, vitamin B, vitamin C, calcium, potassium, iron and protein in very high amounts where these substances are easily digested by the human body (Hastuty et al, 2022) (Vani et al., 2021).

According to the results of a study entitled the effect of consuming moringa oleifera on the incidence of anemia in pregnant women at the Mojorejo Ponkesdes, Kedungadem District, Bojonegoro Regency, the results of the study showed that before consumption of Moringa oleifera, most pregnant women experienced mild anemia. Meanwhile, after consuming Moringa Oleifera, most of them did not experience anemia. By consuming Moringa Oleifera regularly every day, it can increase the Hb level of pregnant women by 0.34 g/dL in the first week and increase the Hb level of pregnant women up to 0.96 g/dL in 14 days or 2 weeks after consuming Moringa Oleifera (Ajeng et al, 2022). The purpose of this study was to determine the effect of giving Moringa leaf pudding (Moringa Oleifera)) on hemoglobin (Hb) levels in young women at Junior 2 Public Middle School.

2 METHOD

This research is a quasi-experimental study with a pretest-posttest design with no control group (comparison). The implementation time was carried out during May 2023. The research location was carried out at Manado 2 Public Middle School. Provision of Moringa leaf pudding was given 2 cups of pudding for 2 weeks for 6 times administration. And for examination of hemoglobin levels carried out on young women aged 12-14 years. The population in the study were 34 young girls at Manado 2 Public Middle School, North Sulawesi.

2.1 Operational Definition

Moringa Leaf Pudding is the Moringa leaves used in this study originating from Manado. Moringa leaf pudding is a modified pudding made from the basic ingredients of nutrijel added with moringa leaves, citrus fruit, sugar and water. Moringa leaves are given every 1x gift, namely 150 grams of Moringa leaves, 160 grams of citrus fruit, 15 grams of nutrijel and 100 grams of sugar. Giving 2 cups of Moringa leaf pudding for 2 weeks with 6 times giving at 09.00 before studying and at 10.30 during recess. Eating Protein and Iron (Fe) intake is the activity of consuming food from 07.00 in the morning until waking up again at 07.00 in the morning the next day. The embodiment of the nutritional needs of protein and iron (Fe). How to measure the food intake of female adolescents using the 24-hour recall form. Hemoglobin (Hb) levels are those obtained by measuring blood samples carried out by professionals (health analysts who have worked in hospitals) using Easy Touch GCHB, namely by taking capillary blood samples and expressed in g/dL. Adolescent girls are someone who is female aged 12-14 years who attends

2.2 Recipe for Pudding Moringa Leaves

Pudding Ingredients:

Layer 1 : 150 gr moringa leaves, 15 gr nuttrijel, 80 gr sugar, 20 gr sweetened condensed milk, 800 ml water.
Layer 2 : 160 gr citrus fruit, 15 gr nutrijel, 100 gr sugar, 650 ml water.
How to Make Moringa Leaves Pudding
Layer 1:

Prepare tools (pots, knives, pans, stoves, baking sheets, blenders, filters, spoons, spatulas, cups). Clean the Moringa leaves, Wash the Moringa leaves, Bleancing for about 5 minutes, Blend the Moringa leaves. Strain using a sieve, by adding boiled water until. Then pour into the pot. Pour the powdered nutrijel, then add the granulated sugar, stir until smooth and powdered sugar. Cook over medium heat until boiling. Also add liquid milk. Cook for about an hour, until the pudding mixture thickens. Remove, pour into a cup container pudding mold. Let stand until not hot, while waiting for the second layer.

Layer 2 :

Peel the orange peel. Clean the oranges, Blend the oranges. Strain the orange juice using a strainer. Then pour it into the pan, then add the nutrijel powder. Cook over medium heat, keep stirring until it boils. Cook for about 1 hour, until the pudding mixture thickens. Remove, and pour into the cup of the pudding mold that already has the first layer. Then chill Then ready to serve. Value of Nutritional Content Per One Moringa Leaf Pudding RecipeTotal Nutrients : Energy 1057.8 kcal, Protein 29.0 gr, Fat 8.3 gr, Carbohydrates 230.4 gr, Iron (Fe) 82.1 mg. Source: Nutri Survey 2007. The product above produces 7 cups of Moringa leaf pudding with nutritional content: Energy : 151.1 kcal, Protein : 4.14 gr, Fat: 1.18 gr, Carbohydrates: 33.1 gr, Iron (Fe) : 11.7 mg. Once given as much as 2 cups of pudding has nutritional content: Energy : 43.2 kcal, Protein : 1.1 gr, Fat : 0.3 gr, Carbohydrates: 9.4 gr, Besi (Fe) : 3,4 mg
Data analysis on the dependent variable is used to determine the effect of the independent variable using the Paired t test.

3 RESULTS

3.1 Organoleptic Test

Organoleptic Test and Analysis of Differences in Formula 1 and Formula 2

The organoleptic test will describe the consumer's assessment of the taste, color, aroma, and texture of the Moringa leaf pudding product given to the respondent. Respondents' assessment of the taste of Moringa leaf pudding on taste, color, aroma, and texture showed that the most preferred Moringa leaf pudding flavor was the taste of Moringa leaf pudding mixed with 150 grams of Moringa leaves and 160 grams of citrus fruit.

3.2 Hemoglobin (Hb) Level

Hemoglobin levels can describe the levels of red blood cells in the human body. By giving Moringa leaf pudding with the addition of citrus fruit, it will show a comparison before and after giving this product. The distribution of hemoglobin levels before and after the intervention can be shown in table 1 below.

Table 1. Distribution of Subjects According to the Status of Hemoglobin (Hb) Levels Before and After Intervention in Adolescent Girls

Clasification	Hemoglobin	Before		After	
Hemoglobin Level	(g/dL)	n	%	N	%
Normal	>12	31	92	34	100
Mild Anemia	10-11,9	3	8	0	0
Moderate Anemia	8-9,9	0	0	0	0
Severe Anemia	<8	0	0	0	0

The table above shows that the treatment group before the intervention as many as 3 people (8%) had mild anemia and after the intervention no one had anemia.

The status of other hemoglobin levels is normal. Effect of Formula 1 on Hb Levels Before and After Giving Analysis of the difference in hemoglobin levels before and after the intervention can be showed an increase that occurred during the intervention. There is a significant difference in hemoglobin levels in respondents with a Sig.(2-tailed) value of 0.000 <0.005. The results of measuring hemoglobin levels showed that there was an increase in terms of the average hemoglobin, which was 13.68 g/dL at the initial measurement and 14.20 g/dL at the last measurement.

3.3 Intake of Iron

Food intake is the main factor for meeting nutritional needs as a source of energy to maintain body resistance against disease and for growth. Intake of nutrients can be categorized according to the fulfillment or adequacy of nutrition. Adequacy of Iron (Fe) Intake From Recall 24 Hours Before and After Intervention, it can be seen that the results of the 24-hour recall before the intervention and after the intervention for 34 respondents showed a difference where before the intervention there were 26 people (76%) respondents who had iron adequacy in the severe deficit category, after the intervention there were 10 people (29%) had iron adequacy in the severe deficit category Effect of Formula 1 on Iron (Fe) Intake Before and After Intervention. There is a significant difference in iron (Fe) intake in response to the Sig. (2-tailed) of 0.000 ($p < 0.05$). Results Recall 24 hours of iron intake before and after the intervention without that there was an increase seen from the average iron intake, namely 4,085 mg at the initial recall and 7,361 mg at the last recall.

Adequacy of intake of iron (Fe) from the formula 1 time administration contains 3.4 mg of the substance. Meanwhile, the need for iron (Fe) for female adolescents aged 12-14 years is 15 mg/day. When compared to intake by giving 2 cups of pudding for 6 times administration, the percentage of Fe sufficiency is 22%.

3.4 Protein Intake

Adequacy of Protein Intake From Recall 24 Hours Before and After Intervention. Results Recall 24 hours of protein intake before and after the intervention without that there was an increase seen from the average protein intake, namely47,429 g in the initial recall and 101,602 g in the last recall.

Adequacy of protein intake from the formula 1 time administration contains 1.1

grams of substance. Meanwhile, the protein requirement for female adolescents aged 12-14 years is 65 gr/day. When compared to intake by giving 2 cups of pudding for 6 times administration, the percentage of protein sufficiency is 1.69%.

4 DISCUSSION

The characteristics possessed by Moringa leaf pudding are different from other puddings because the raw materials used in pudding products are made from Moringa leaves and citrus fruits so that they have a more dominant orange flavor so that the taste of Moringa leaves is not too pronounced because before it is mixed into agar-agar So that the Moringa leaves are blanched first and the Moringa leaf pudding has a dark green color because it uses a mixture of Moringa leaves. However, when served, the Moringa leaf pudding is coated with pudding, which is added with citrus fruit until it hardens. for the texture of the pudding that is owned is more chewy because it uses plain nutrijel. So that the Moringa leaf pudding with the addition of citrus fruit produced is preferred by the panelists, namely formula 1.

4.1 Increased Hemoglobin Levels

Young women who were the subjects of this study were aged 12-14 years and were included in the adolescent age group. Women are at higher risk of experiencing anemia, especially in young women (Dziembowska et al., 2019). Symptoms of anemia are iron deficiency which results in the transport of oxygen in the blood which is characterized by fatigue, weakness, lethargy, pale face, lack of appetite, nails breaking easily, not concentrating on studying and slowing comprehension in school-age children (Mathias et al., 2020) (Cia et al, 2021).

In the pre-test hemoglobin level examination, the minimum value was 11.2g/dL and the maximum value was 15.6g/dL. Then after giving Moringa leaf pudding there was an increase in hemoglobin levels with a minimum value of 12g/dL and a maximum value of 15.7g/dL. From the pre-test conducted, there was still a lot of anemia that occurred in young women at 2 Public Middle School.

From the intervention given, there were 29 people who experienced an increase in hemoglobin levels after administration of the product. However, there are 3 people who have a fixed hemoglobin level and 2 people who experience a decrease in Hb due to irregular eating patterns and sleeping patterns while at home so that adequate intake of

iron is in the severe deficit category and for protein in the moderate deficit category. They consume more instant noodles such as pop noodles, supermie, almost every day compared to rice, and also rarely consume food sources of iron and protein such as tofu, tempeh, vegetables and fish and lack awareness for breakfast every morning. Of the 29 people who experienced an increase proves that consumption of moringa leaf pudding with the addition of 2 cups of citrus fruit can increase good hemoglobin levels in young women, especially those who experience anemia.

4.2 Increased Intake of Iron

Iron is one of the important minerals needed by the human body (Dasa & Abera, 2018). The function of iron is to transport oxygen from the lungs throughout the body. Iron combines with oxygen in the lungs and releases oxygen in the blood where it is needed. Iron is used in the manufacture of hemoglobin and plays an important role in the normal functioning of the immune system (Vogt et al., 2021) (Yiannikourides & Latunde-Dada, 2019).

In this study, a 24-hour recall was carried out for 34 respondents, many of whom did not consume enough sources of iron, due to a lack of intake of legumes, vegetables, meat and fish. So that in this study the distribution of iron was 3.4 mg and in 1 day it was given 2 times, the administration was carried out at 09.00 during the first hour of study was given 1 cup and at 10.00 hours a break was given 1 cup. So that in one day the distribution given from Moringa leaf pudding products is as much as 3.4 mg or 22% of the daily requirement.

There is a significant difference in iron intake in respondents with a Sig. (2-tailed) of 0.000 > 0.005. The results of a 24-hour recall of iron intake before and after the intervention showed that there was an increase seen from the average intake of 4,085 mg at the initial recall and 7,361 mg at the end of the recall

4.3 Increased Protein Intake

Protein plays an important role in the transportation of iron in the body (Yiannikourides & Latunde-Dada, 2019) (Kobayashi et al., 2019). if there is not enough protein available then the iron intake cannot be distributed with the organs. The protein that functions to transport iron, namely transferrin (Campos-Escamilla, 2021). Protein also plays a central role, especially in the body's iron metabolism, because transferrin transports iron in circulation to places that need iron, such as from

the intestine to the bone marrow to form new hemoglobin (Sari et al, 2019) (Putri and Dary, 2020)(Ravingerová et al., 2020) (Masaldan et al., 2019). From the results of a 24-hour recall before the intervention and after the intervention in 34 respondents, protein intake was still insufficient due to a lack of good protein intake. So this research is the distribution of protein in one cup of Moringa leaf pudding with a mixture of 150 grams of Moringa leaves and 150 grams of citrus fruit. In 1 day 1 time giving as much as 2 cups with a content of 1.1 gr, giving is carried out at 09.30 in the morning during breaks. So that in one day the distribution is given from Moringa leaf pudding products with the addition of citrus fruit as much as 1.1 gr or 1.69% of the daily requirement. There is a significant difference in protein intake in respondents with a Sig. (2-tailed) of 0.000 ($p > 0.05$. The results of a 24-hour recall of protein intake before and after the intervention showed that there was an increase seen from the average intake, namely 47,429 g at the initial recall and 101,602 g at the end of the recall.

5 CONCLUSION

Treatment in the form of giving Moringa leaf pudding can increase hemoglobin levels in young women. Hemoglobin levels in respondents who consumed Moringa leaf pudding experienced a significant increase. There were differences in hemoglobin (Hb) levels before and after giving nutritional interventions in processed Moringa leaf pudding, Treatment in the form of giving Moringa leaf pudding products can increase iron and protein intake in young women.

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