BENEFIT OF MUNG BEANS (Vigna radiata L.) AND RED BEANS (Phaseolus vulgaris, L.) TO INCREASE HEMOGLOBIN LEVELS IN ADOLESCENT GIRLS WITH ANEMIA

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ABSTRACT

One non-pharmacological therapy for anemia is to consume mung beans or red beans. This study was to determine the effectiveness of giving red bean extract and mung bean extract to increase HB levels in adolescents. The type of research used in this study was quasi-experimental with two groups pre-test and post-test. The sample was divided into 2 groups, with each group consisting of 18 respondents who were selected using purposive techniques. The results of the Paired Sample T-Test showed that there was a significant difference between the Hb levels of respondents before and after consuming mung bean extract (p-value = 0.000). The results of the Wilcoxon Test showed that there was a significant difference between the Hb levels of respondents before and after consuming red bean extract (p-value = 0.000). The results of the Mann-Whitney Test showed that there was a significant difference between the increase in Hb levels of respondents in group 1 and group 2 (p-value = 0.011). Mung bean extract and red bean extract can be recommended as effective foods or drinks to increase Hb levels for adolescent girls with anemia, where mung bean extract is preferred.

Keywords: Anemia, Hemoglobin, Mung Bean, Red Bean

INTRODUCTION

Adolescence is a transition period from childhood to adulthood, where rapid development occurs including regenerative abilities that influence changes in development, physical, mental, and social roles (Gita Ayuningtyas, 2020). Adolescence is a period of change between children and adults. In clinical sciences (such as science and physiology), adolescence is known as the phase of actual improvement when the human person reaches development. This means that physically, the private parts and various organs of the body will get an ideal shape. Usually marked by the emergence of the menstrual cycle in women, and wet dreams in men (Ahyani LN, Kudus UM, 2018).

The menstrual cycle causes women to lose a certain amount of blood periodically. Blood loss will result in iron loss. Iron loss during menstruation is mainly the cause of increased iron requirements. In addition, adolescents are more concerned about changes in body size and appearance, which often leads them to engage in unhealthy behaviors such as limiting food intake, especially animal products, which are sometimes considered high-fat foods and are associated with obesity (Agustina, 2017). This is what makes young women more susceptible to suffering from anemia than young men.

Adolescent girls are at high risk of suffering from anemia because during this period there is an increase in iron requirements due to growth and menstruation. High school, lectures, and various organizational and extracurricular activities will have an impact on irregular eating patterns, in addition to the habit of consuming drinks that inhibit iron absorption, such as fizzy drinks, a variety of drinks made...
Anemia is a condition where the hemoglobin (Hb) level in the body is below normal values, according to certain groups. Anemia in adolescent girls is a very important topic to research because of the negative impacts that may arise, both short-term and long-term impacts. The short-term adverse effects of anemia in young women include a decrease in the immune system, which causes disease germs to enter the body and cause infections. Apart from that, anemia in young women can also reduce fitness levels and thinking agility, which results in decreased learning achievement and productivity. The long-term adverse impact of anemia in adolescent girls is an increased risk of pregnancy anemia. If anemia occurs during pregnancy, it will interfere with the growth and development of the fetus in the womb. Apart from that, anemia in pregnancy can also trigger complications, both during pregnancy and childbirth, and ultimately increase the risk of death for the mother and baby. Apart from that, young women who suffer from anemia when they become pregnant mothers are at risk of giving birth to Low Birth Weight (LBW) Babies and Stunting (Kemenkes, 2018).

Another reason that makes it urgent to research the topic of anemia in adolescent girls is the high incidence rate. Anemia in adolescents is a disease that still has a high prevalence in Indonesia. In 2018, 32% of teenagers in Indonesia experienced anemia. This means that there are approximately 7.5 million Indonesian teenagers who are at risk of experiencing obstacles in their growth development, and cognitive abilities and are susceptible to infectious diseases. namely 22.7% for teenagers aged 15-24 years (Hermiaty & Dkk, 2021).

Hemoglobin is a dye found in blood, which is useful for transporting oxygen and CO2 in the body. Hemoglobin is a bond between proteins, iron salts, and dyes (M. A. Dkk, 2016). Hemoglobin, which is an index of the oxygen-carrying capacity of the body, can be measured in grams/dl (I. Supariasa, dkk., 2016). Hemoglobin is a parameter that is widely used to determine anemia status on a broad scale. The normal limit for hemoglobin levels in adolescent girls is ≥ 12 g/dl. Iron requirements for adolescent girls are higher, namely 14.8 mg/day to cover the loss of iron in the blood related to menstruation. Achieving adequate iron stores becomes important for girls as menstrual periods become more regular and heavier as they mature (Moore Keith L., dkk., 2014). If iron reserves in girls are inadequate, it will cause anemia. Low hemoglobin content is indicated by a pale face (Efri & Dkk, 2022).

One effort to reduce the prevalence of anemia in adolescents is iron and folic acid supplementation through administering blood supplement tablets (TTD). In 2018, there were 76.2% of young women who received blood supplement tablets in the last 12 months. However, only 2.13% of them took TTD as recommended (≥52 pills in one year). This non-compliance is one of the factors causing anemia in young women (Hermiaty & Dkk, 2021). According to the survey results, young women do not comply with taking TTD because of the side effects, namely they feel nauseous, vomiting, stomach cramps, heartburn and constipation, and sometimes diarrhea, which makes them uncomfortable (Kemenkes, 2018).

Another effort to prevent or treat anemia is to consume foods that contain lots of iron. Foodstuffs that contain a lot of iron include various fruits, dark mung vegetables, and nuts. Apart from that, to increase iron absorption, vitamin C is needed which is also found in these foods (Waryono, 2010)(Retnorini, 2017).

One type of legume with a high iron content is mung beans which have 6.70 mg of iron per 100 grams. Due to the phytochemical content that helps the hematopoiesis process, as well as other nutrients such as starch, iron, fatty oils, manganese, magnesium, and niacin, the nutritional content of mung beans is very beneficial for teenagers in the formation of red blood cells and preventing anemia. Additionally, the following can be said about the nutritional value of mung beans: Calories: 345.00; protein: 22.00; fat: 1.20; carbohydrates: 62.90; calcium:
125.00; phosphorus: 320.00; iron: 6.70; vitamin A: 157.00 SI; vitamin B10: 157.00 SI; 6.00 mg vitamin C, 64 mg (Padmi, 2018).

Apart from mung beans, other beans that contain lots of iron are red beans. Red beans contain minerals such as iron, zinc, and copper which help the formation of red blood cells, enzymes, and bones. 100 grams of red beans contain 2.2 mg niacin, 260 mg calcium, 410 mg phosphorus, 5.8 mg iron, 194 mg manganese, 0.95 mg copper, and 15 mg sodium. As an oxygen-carrying component in muscles, iron helps produce hemoglobin, the building block of red blood cells that allows red blood cells to carry oxygen, as well as myoglobin (Kasrida, 2018)(Silvi Zaimy, 2018).

The results of the study proved that hemoglobin levels in young women with mild anemia became normal after being given mung bean drink and young women with severe anemia became moderately anaemic. There is an effect of drinking mung bean extract on increasing hemoglobin in adolescent girls (Efri & Dkk, 2022).

Data for 2021 at the Karangmalang Community Health Center, Semarang City, there were 458 young women and 96 (20.9%) of them experienced anemia. Meanwhile, in 2022 it will increase to 48.6%. The age of the teenage girls is 12-19 years. Teenagers who come to the Karangmalang Community Health Center are usually only given TTD therapy to increase Hb levels.

METHOD

This research was carried out in January-March 2023 in the Karangmalang Semarang Health Center Work Area. The type of research is Quasi-Experimental with a Two-group pre-test and post-test design. The population in this study was 72 adolescent girls at the Karangmalang Community Health Center. There were 2 groups in this study. Group 1 was given 250 ml mung bean extract intervention containing 100 grams of mung beans which was consumed once a day for 7 days. Group 2 was given 250 ml red bean extract intervention containing 100 grams of red beans which was consumed once a day for 7 days. The hemoglobin levels of adolescent girls respondents were measured before and after the intervention. This research uses soft instruments and hard instruments. The soft instruments used were Hb level observation sheets, monitoring sheets for consumption of mung bean extract and red bean extract, and SOPs (Standard Operating Procedures) for checking Hb levels. The hard instruments used are instruments to check Hb levels, namely a Hemoglobin meter, Hb stick, auto click, lancet, alcohol swab, hand scoop, and tissue.

The sample in this study was 36 respondents with anemia in the Karangmalang Community Health Center area, Semarang City, who were taken using a purposive sampling technique. The samples taken were by the established criteria, namely age 12 – 19, years with mild anemia (Hb levels 11.0 – 11.9 gr/dl) or with moderate anemia (Hb levels 8.0 – 10.9 gr/dl), had menstruated, did not menstruate during the intervention period, had no history of mung bean allergy for group 1, and red bean allergy for group 2, and had never had a history of diseases that affect hemoglobin levels, such as cancer, kidney failure, and/or abnormalities blood. Data on hemoglobin levels before and after the intervention were processed and analyzed using statistical tests. Before determining the statistical test, a data normality test was first carried out using Shapiro-Wilk to determine the statistical test. Based on the results of the Shapiro-Wilk test, the statistical tests used in this research were the Paired Sample T-test, Wilcoxon Test, and Mann-Whitney Test. This research has received ethical clearance from the Research Ethics Committee (KEP) Karya Husada University Semarang through a Certificate of Passing the Ethical Review Test No. 134/KEP/UNKAHA/SLE/I/2023. This research was conducted in compliance with approved ethical protocols. Informed consent for all respondents was carried out in writing and recorded in this study.
RESULTS

Based on Table 1, it can be seen that the average (mean) Hb level of respondents in group 1 before consuming mung bean extract was 10.3 g/dL in the moderate anemia category and the median value was 10.2 g/dL in the moderate anemia category. The Hb level after consuming mung bean extract was an average of 10.8 g/dL in the moderate anemia category and the median value was 10.8 g/dL in the moderate anemia category. The results of the study based on the mean and median showed an increase in Hb levels in respondents after consuming mung bean extract even though there was no improvement in the anemia category. The results of the Paired Sample T-Test showed that the p-value was 0.000 ($\alpha < 0.05$), which means there was a significant difference between the respondents' Hb levels before and after consuming mung bean extract. Based on these results, it can be concluded that mung bean extract has a significant effect on increasing respondents' Hb levels.

<table>
<thead>
<tr>
<th>Hb Level</th>
<th>Mean ± SD</th>
<th>Median (Min-Max)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>10.3 ± 0.35</td>
<td>10.2 (9.8 – 10.9)</td>
<td>0.000</td>
</tr>
<tr>
<td>After</td>
<td>10.8 ± 0.45</td>
<td>10.8 (10.1 – 11.9)</td>
<td></td>
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</table>

*Paired Sample T-Test

Based on Table 2, it can be seen that the average (mean) Hb level of respondents in group 2 before consuming red bean extract was 10.3 g/dL in the moderate anemia category and the median value was 10.2 g/dL in the moderate anemia category. The Hb level after consuming red bean extract was an average (mean) of 10.6 g/dL in the moderate anemia category and a median value of 10.5 g/dL in the moderate anemia category. The results of the study based on the mean and median showed that the increase in Hb levels in group 1 was higher than the increase in Hb levels in group 2. The results of the Mann-Whitney Test showed that the p-value was 0.011 ($\alpha < 0.05$), which means that there was a significant difference between the increase in Hb levels of respondents in group 1 and group 2. Based on these results it can be concluded that mung bean extract is more effective in increasing respondents' Hb levels.

<table>
<thead>
<tr>
<th>Hb Level</th>
<th>Mean ± SD</th>
<th>Median (Min-Max)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>10.3 ± 0.46</td>
<td>10.2 (9.0 – 10.9)</td>
<td>0.000</td>
</tr>
<tr>
<td>After</td>
<td>10.6 ± 0.49</td>
<td>10.5 (9.5 – 11.3)</td>
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</table>

*Wilcoxon Test

Based on Table 3, it can be seen that the increase in Hb levels in group 1 had an average (mean) of 0.5 g/dL and a median value of 0.4 g/dL. Meanwhile, the increase in Hb levels in group 2 had an average (mean) of 0.3 g/dL and a median value of 0.2 g/dL. The results of the study based on the mean and median showed that the increase in Hb levels in group 1 was higher than the increase in Hb levels in group 2. The results of the Mann-Whitney Test showed that the p-value was 0.011 ($\alpha < 0.05$), which means that there was a significant difference between the increase in Hb levels of respondents in group 1 and group 2. Based on these results it can be concluded that mung bean extract is more effective in increasing levels. Respondent's Hb, rather than red bean extract.

<table>
<thead>
<tr>
<th>Difference in Hb Levels</th>
<th>Mean ± SD</th>
<th>Median (Min-Max)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>0.5 ± 0.3</td>
<td>0.4 (0.2 – 1.2)</td>
<td>0.011</td>
</tr>
<tr>
<td>Group 2</td>
<td>0.3 ± 0.1</td>
<td>0.2 (0.1 – 0.5)</td>
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*Mann Whitney Test

DISCUSSION

This research was conducted in the
Karangmalang Community Health Center Area, Semarang City. Samples were taken at MTs Al-Hikmah Karangmalang and MA Al-Hikmah Karangmalang. Data collection begins with selecting potential respondents according to predetermined criteria by conducting interviews and checking hemoglobin levels. From the selection process, 36 respondents were selected who met the established criteria and were willing to become respondents. Overall, respondents had almost the same characteristics, namely thin (BMI = 17.5), with an average body weight of 42 kg and height of 156 cm. Respondents were divided into 2 groups based on the respondents' interests. Both groups were given intervention for 7 days according to the intervention provisions of each group. Group 1 was given 250 ml mung bean extract which was consumed once a day, and group 2 was given 250 ml red bean extract which was consumed once a day. On the 8th day, all respondents had their Hb levels checked again. Data on Hb levels before and after the intervention were processed and analyzed using statistical tests.

Effect of Mung Bean Extract on Increasing Hemoglobin Levels

Based on Table 1, the results of this study prove that in group 1 the average respondent experienced an increase in hemoglobin levels of 0.5 gr/dL after consuming 250 mL of mung bean extract once a day for 7 days, although the average respondent still experienced moderate anemia. This can be seen from the data that the average Hb level before the intervention was given was 10.3 gr/dL (moderate anemia category), and after the intervention was given the average value was 10.8 gr/dL (moderate anemia category). The results of the Paired Sample T-Test showed that there was a significant difference between Hb levels before and after being given mung bean extract with p value = 0.000 (<0.05). So it can be concluded that mung bean extract can increase Hb levels significantly.

This research is in line with the results of research from Silvi Zaimy, et al (2018) where it was found that there was a significant difference in hemoglobin levels before and after giving mung bean extract and it was concluded that there was an effect of giving mung bean extract on blood hemoglobin levels, according to the results of the Independent Sample T-Test. where the p value is 0.000 (< p 0.05). 8 Other research that is in line with this research is Efri Leny Rauf's research, 2020 which also shows that mung bean extract can increase the Hb levels of young women in the Paguyaman Health Center Working Area (p= 0.000 < 0.05).

People are familiar with the mung bean food plant (vigna radiata). Mung beans are included in the legume family and are processed into various foods and drinks because of their abundant health benefits. One of the typical tropical plants, mung peas is easy to find in Indonesia. Mung beans are plants with short, straight branches. The flowers are pale or mungish yellow. The flowers produce pods containing 10 to 15 mung bean seeds. A type of legume known as mung beans contains a lot of iron, especially in the embryo and seed coat (Umi Faridah, 2017).

Mung beans contain 22.2% protein, 9 IU of vitamin A, 150-400 IU of vitamin B1, and the minerals calcium, sulfur, manganese, and iron. Hemagglutinin and phytic acid are two additional nutrients. Toxic hemagglutinin can clot red blood cells. Phytic acid can form a complex with Fe or mineral elements, especially Zn, Mg, and Ca, into an insoluble form that is difficult for the body to absorb, thereby reducing its availability in the body because it becomes very difficult to digest. Heating at 100 °C can eliminate the toxicity of hemagglutinin. The fermentation process can make more iron available to the body. To avoid iron deficiency anemia, this is very important (Dewi LR, Widatiningsih Sri, 2017).

Mung beans contain 6.7 milligrams of iron per 100 grams. Vitamin C in mung beans can increase the absorption of non-heme iron up to four times. The complex iron ascorbate compound in vitamin C with iron is soluble and easily absorbed. Vitamin C plays a role in the iron absorption process by converting ferric iron
(Fe3+) into ferrous iron (Fe2+) in the small intestine. This conversion process makes it easier to absorb iron, and if the stomach pH is increased it can increase iron absorption by up to 30%. Hemosiderin, which is difficult to mobilize to release iron when needed, is prevented from forming by vitamin C (Dewi LR, Widatiningsih Sri, 2017)(SL, 2018).

Mung beans contain a variety of amino acids, including the essential isoleucine, leucine, lysine, methionine, phenylalanine, threonine, and valine amino acids as well as non-essential alanine, arginine, aspartic acid, glutamic acid, glycine, tryptophan, and tyrosine amino acids. Hemoglobin synthesis is assisted by the presence of protein, carbohydrates, and fat in mung beans. Succinyl-CoA is produced by carbohydrates and fats, which, when combined with glycine, undergo a series of porphyrinogenic processes to produce protoporphyrins. Hemoglobin is made by combining protoporphyrin, globin protein, and heme molecules to form hemoglobin. Mung beans are not only a building block for heme synthesis, but also contain glycine, which accounts for 0.9% of the 22% of total amino acids in mung beans. It is believed that this form protects iron from interactions in the small intestine and iron-inhibiting factors. Glycine also makes the antioxidant glutathione, which can preserve the iron in its ferro. A complex process of iron absorption occurs in the duodenum and upper jejunum (SL, 2018).

Effect of Red Bean Extract on Increasing Hemoglobin Levels

Based on table 2, the results of this study prove that in group 2 the average respondent experienced an increase in hemoglobin levels of 0.3 gr/dL after consuming 250 mL of red bean extract once a day for 7 days, even though the average respondent still experienced moderate anemia. This can be seen from the data that the average Hb level before the intervention was given was 10.3 gr/dL (moderate anemia category), and after the intervention was given the average value was 10.6 gr/dL (moderate anemia category). The Wilcoxon Test results showed that there was a significant difference between Hb levels before and after being given red bean extract with p value = 0.000 (<0.05). So it can be concluded that red bean extract can increase Hb levels significantly.

This research is in line with the results of research by Umrah Adit, 2018. The results of this research show that there is an effect of consuming red beans on the treatment of anemia in pregnant women at the Sendana Community Health Center, Palopo City (ρ = 0.002), with the average Hb level before treatment being 9.7 ± 0.9, and the Hb level after treatment was 12.5 ± 1.1. So it can be concluded that red beans can be used as a traditional medicine to increase Hb levels during pregnancy.

Leguminosae, also known as legumes, is a family that includes kidney beans (Phaseolus vulgaris, L). Mung beans, cowpeas, and soybeans belong to the same family. Because they are grown in all provinces in Indonesia, red beans are easily one of the foods that contain lots of fiber, namely red beans. Red beans contain minerals such as iron, zinc, and copper which help in the formation of red blood cells, enzymes, and bones. Consuming red beans can relieve anemia complaints. Apart from that, the Omega 3 and 6 content of red beans is beneficial for fetal brain development (Asti Elfrida Bakara, 2022).

Minerals can be found in abundance in kidney beans. 100 grams of red beans contain 2.2 mg niacin, 260 mg calcium, 410 mg phosphorus, 5.8 mg iron, 194 mg manganese, 0.95 mg copper, and 15 mg sodium. As an oxygen-carrying component in muscles, iron helps produce hemoglobin, the building block of red blood cells that allows red blood cells to carry oxygen, as well as myoglobin (Kasrida, 2018). The iron in red beans undergoes a complicated process in the upper jejunum and duodenum to absorb the iron which is then used as raw material to make hemoglobin (Retnorini, 2017)(S, 2011).

Comparison of the Effectiveness of Mung Bean Extract and Red Bean Extract on Increasing Hemoglobin Levels
Based on Tables 1 and 2, it can be seen that mung beans and red beans can both increase Hb levels significantly. However, based on Table 3, it can be seen that Group 1 had an increase in Hb levels of 0.2 g/dL higher than Group 2, which can be seen from the data. The average increase in Hb levels in group 1 was 0.5 g/dL, while the average -Average increase in Hb levels in group 2 was 0.3 g/dL. This shows that mung bean extract can increase respondents' Hb levels higher than red bean extract. The results of the Mann-Whitney Test showed that there was a significant difference between the difference in Hb levels in groups 1 and 2 with p value = 0.011 (<0.05). So it can be concluded that mung bean extract is more effective in increasing respondents' Hb levels than red bean extract.

The results of researchers' observations in groups 1 and 2 found that before providing the intervention, the average respondent looked pale and complained of symptoms of fatigue, dizziness, and body weakness, which are signs of anemia. After the intervention was carried out in groups 1 and 2 for 7 days, it was found that the hemoglobin levels of all respondents had increased and the signs and symptoms of anemia such as paleness, dizziness, weakness, and fatigue had decreased.

Anemia occurs when the level of hemoglobin contained in the blood is not enough to carry oxygen or red blood cells to meet the body's physiological needs. Anemia is a condition in which a person's blood hemoglobin (Hb) level is lower than the normal value. age and gender (Anggraeni, 2021). Nutritional anemia is a condition where the tissue that forms red blood cells is unable to maintain normal hemoglobin levels during production, resulting in blood hemoglobin levels being lower than normal. Anemia caused by iron deficiency disrupts the formation of red blood cells and other body functions and is called iron nutritional anemia (Publikasi J, Skala P, Disminore N, Remaja P, Pku Muhammadiyah Surakarta, 2019)(Anggraeni, 2021).

One way to overcome this is to consume TTD. However, it turns out that the TTD provided by the health center is not routinely consumed due to nausea, vomiting, and sometimes diarrhea or constipation. Another way that can be done is to consume vegetables or nuts which contain high levels of iron. One types of legume that is high in iron is mung beans and red beans.
The results of this study prove that both mung beans and red beans can significantly increase Hb levels in young women. However, there is a difference in effectiveness between mung beans and red beans in increasing Hb levels in young women, where mung beans are more effective than mung beans. This is because mung beans contain higher levels of iron than red beans. Mung beans contain 6.7 milligrams of iron per 100 grams (Purwono, M. S., Hartono, 2012) (Padmi, 2018). Meanwhile, 100 grams of red beans contain 5.8 mg of iron (Kasrida, 2018).

Iron in food, either as Fe3+ or Fe2+, goes through a digestive process first. Fe3+ dissolves in gastric acid, is bound by gastroferrin, and is reduced to Fe2+ (Ferro) when ascorbic acid (vitamin C) is present. Fe2+ is oxidized to Fe3+ in the intestine, where it binds to apoferritin and is converted to ferritin, releasing Fe2+ into the blood plasma. Fe2+ is oxidized to Fe3+ in plasma, where it binds transferrin. Hemoglobin is produced when Fe2+ and transferrin combine in the bone marrow. Transferritin moves Fe2+ to iron storage sites in the body (liver, spleen, reticuloendothelial system, and bone marrow) where Fe2+ will be oxidized to Fe3+. Ferritin is produced when this Fe3+ combines with apoferritin and is stored (Dewi LR, Widatiningsih Sri, 2017) (Notoadmojo, 2010).

CONCLUSION

Mung bean extract and red bean extract both affect increasing Hb levels (P value = 0.000), where mung bean extract is more effective than red bean extract in increasing respondents’ Hb levels (P value = 0.011). Mung bean extract and red bean extract can be recommended as effective foods or drinks to increase Hb levels for young women who suffer from anemia, where mung bean extract is preferred.

In this study, other foods and drinks consumed by respondents apart from mung bean extract or red bean extract, which might affect the respondent's Hb levels, were not monitored or recorded. Therefore, it is recommended that future researchers who are interested in research with a similar theme be advised to control food or drink factors that can influence Hb levels, apart from the intervention provided.

REFERENCE


