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The effect of soy milk on increasing hemoglobin levels in adolescent girls with anemia

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Abstract

Background: Anemia is a common health problem among adolescent girls, primarily due to blood loss during menstruation. This condition can interfere with learning concentration and daily activities. At Waskita Bekri Junior High School (SMP Waskita Bekri), 34 out of 52 female students were identified with mild to moderate anemia a relatively high prevalence, partly caused by a one-year delay in the distribution of iron supplementation tablets. Anemia prevention can be carried out through both pharmacological and non- pharmacological approaches, one of which is the consumption of soy milk.

Purpose: To determine the effect of soy milk consumption on increasing hemoglobin levels in adolescent girls with anemia at Waskita Bekri Junior High School, Central Lampung Regency.

Method: The study was conducted in May 2025 using a quantitative analytical experimental method with a one-group pretest–posttest design. The sample consisted of 34 female students selected through purposive sampling, based on hemoglobin levels measured using the Easy Touch device, who were identified as having mild to moderate anemia. Data were analyzed using univariate and bivariate methods, with the paired t-test applied for statistical testing.

Results: The results showed that the average hemoglobin level before the intervention was 11.12 g/dL, which increased to 12.20 g/dL after soy milk consumption. The mean difference of 1.08 g/dL indicates an improvement in hemoglobin levels following the intervention.

Conclusion: The paired t-test yielded a p-value of 0.000 (< 0.05), confirming a significant effect of soy milk consumption on increasing hemoglobin levels in adolescent girls with mild to moderate anemia.

Suggestion: It is recommended that adolescent girls at Waskita Bekri Junior High School maintain a balanced diet and regularly consume iron supplements as advised to prevent anemia.

Keywords: Adolescent Girls; Anemia; Soy Milk.

INTRODUCTION

Anemia is a condition in which there is a decrease in the number of erythrocytes followed by a decrease in hemoglobin (Hb) levels, hematocrit, and erythrocyte count (Azzahroh & Rozalia, 2018). Anemia is classified as mild anemia, moderate anemia, and severe anemia (Podungge, Nurlaily, & Mile, 2022).

Lifestyle changes and insufficient consumption of iron-rich foods can trigger anemia, which can have negative effects on sufferers. The negative effects

include low productivity, decreased learning ability and immunity, and stunted growth, which can lead to high morbidity rates (Astapani, Harahap, & Apriyanti, 2020).

The group currently at high risk of anemia is adolescent girls aged 14-15 years compared to adolescent boys. This is because iron absorption in adolescent girls increases at this age, and they also experience physical growth, hormonal changes, and menstruation every month (Silalahi, Aritonang, &

Ashar, 2016; Basith, Agustina, & Diani, 2017). Therefore, adolescent girls are considered a strategic target group in breaking the cycle of nutritional problems (Fajriyah & Fitriyanto 2016).

The prevalence of anemia in adolescent girls reaches 30% based on WHO data, while in Indonesia it reaches 32%. In 2018, the proportion of anemia in adolescent girls in Indonesia in the 12-18 age group increased by 59.7% (Ministry of Health of the Republic of Indonesia, 2019). The above results show that anemia in adolescent girls is a problem that must be resolved immediately. This also indicates that alternative efforts are needed to prevent it effectively because they are prospective mothers who will give birth to the next generation and play a key role in parenting (El Shara, Wahid, & Semiarti, 2017).

Sufficient iron and protein in the body are essential for Hb synthesis. Hb is a molecule consisting of globin protein, porphyrin, and iron heme. If any of these three elements are insufficient, Hb synthesis will be inhibited. Protein and iron are the components most commonly deficient in the body (Suantara, Kusumajaya, & Kayanaya, 2013). Protein plays a role in transporting iron to the bone marrow to form new Hb molecules (Kulsum & Astuti, 2020).

Adolescent girls need 8-15 mg of iron daily (Ministry of Health of the Republic of Indonesia, 2019). Iron for Hb synthesis is obtained from transferrin. Low transferrin levels in the blood can be caused by low iron intake from food, ineffective absorption in the intestines, or increased demand. The absorption of dietary iron ranges from 10-15%, depending on the source of iron (Suantara et al. 2013).

Anemia can be prevented pharmacologically and non-pharmacologically, one of which is with soy milk. Anemia can be prevented by increasing the iron content and bioavailability in food, meeting the body's iron requirements, and improving the consumption of foods containing animal and vegetable proteins, one of which is soy milk.

Soy milk is a highly nutritious beverage extracted from ground soybeans and water in a specific ratio to produce a white, milky liquid with a distinctive aroma. Soybeans, the basic ingredient in soy milk, are a functional food containing high levels of protein, fat, carbohydrates, calcium, phosphorus, iron, provitamin A, vitamin B complex (except B12), and water. Consuming soy milk can meet iron requirements that

cannot be adequately fulfilled through daily food intake. The iron in soy milk is beneficial for increasing red blood cells in adolescent girls with anemia (Otemusu, 2016).

RESEARCH METHOD

This research method is quantitative with a pre-experimental analytical approach using a one-group pretest-posttest design without a control group. In this design, adolescent girls were assessed based on their results before and after being given soy milk to increase their Hb levels. The research was conducted at Waskita Bekri Junior High School in Central Lampung Regency in May 2025.

The population in this study consisted of all 52 female adolescents at SMP Waskita Bekri. The sampling technique used in this study was purposive sampling. The sample was determined using inclusion and exclusion criteria. The inclusion criteria in this study were female adolescents at SMP Waskita Bekri who were willing to be respondents and had mild to moderate anemia, were willing to drink soy milk, while the exclusion criteria were adolescents who had severe anemia and were allergic to soy milk. The number of samples studied was 34 people.

The data collection technique used primary data sourced from direct data collection through measuring the Hb levels of adolescent girls at Waskita Bekri Junior High School who had mild and moderate anemia, before and after being given 200 ml of soy milk once a day for 7 days. The instrument used in this study was an observation sheet for soy milk administration. The Hb levels of the samples were measured using a haemometer. The Hb levels were grouped into two categories, namely mild anemia (11-11.9 g/dL) and moderate anemia (8-10.9 g/dL).

The data analysis used consisted of univariate and bivariate analyses. Univariate analysis was performed on each variable studied to identify the frequency distribution and percentage of Hb levels in subjects given soy milk. Bivariate analysis was performed on two variables that were thought to have an effect, namely the independent variable of soy milk consumption on the dependent variable of increased Hb levels. The results of the study were analyzed using a dependent T-test with a 95% confidence interval.

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RESEARCH RESULTS

Table 1. Distribution of Average Hemoglobin Levels in Adolescent Girls Before and After Being Given Soy Milk (N=34)

Variable	Mean	Median	Min	Max	SD	CI:
Hb Levels (Pre-Test)	11.1	11.4	9.70	11.8	0.65	11.9-12.4
Hb Levels (Post-Test)	12.20	12.55	9.80	13.0	0.83	11.9-12.4

Based on the table 1. above, it can be explained that before being given soy milk (Pre-test), the average hemoglobin level of teenage girls was 11.1 g / dl with a standard deviation of 0.65. The smallest value was 9.70 g / dl and the maximum value was 11.8 g / dl. From the results of the interval estimation, it can be concluded that 95% believed that the average hemoglobin level before being given soy milk was between 11.91 g / dl to 12.49 g / dl. And the average distribution can be explained that after being given soy milk (post-test), the average hemoglobin level of teenage girls was 12.20 g / dl with a standard deviation of 0.83, the smallest value was 9.80 g / dl. And the maximum value was 13.00 g / dl. From the results of the interval estimation, it can be concluded that 95% believed that the average hemoglobin level of teenage girls after being given soy milk was between 11.91 g / dl to 12.49 g / dl.

Table 2. Effect of Soy Milk on Hemoglobin Levels in Adolescent Girls with Anemia

Variable	Mean	SD	SE	Average Difference	P-Value
Level Hb	Before	11.12	0.65	1.08	0.000
	After	12.20	0.83	0.14	

Table 2. shows that the average Hb level in the study subjects before being given soy milk was 11.1 g/dL, while the average Hb level in the study subjects after being given soy milk was 12.2 g/dL. The difference between the difference in Hb level changes was 1.08 g/dL, so it can be concluded that there was an increase in Hb levels in the subjects before and after being given soy milk.

DISCUSSION

The statistical test results obtained a p-value of 0.000, or <0.05 , indicating that soy milk upplementation has an effect on hemoglobin levels in adolescent girls with anemia. The hemoglobin levels before soy milk supplementation were significantly lower than after soy milk supplementation.

Anemia is a condition in which Hb levels are below normal. Normal Hb levels in adolescent girls are >12 g/dL. Anemic girls are considered anemic if their Hb

levels are <12 g/dL, and most are unaware of their anemia, even when they do, it is still considered normal (Kaimudin, Lestari, & Afa, 2017). Therefore, the incidence of anemia in adolescent girls requires serious attention.

The impact of anemia on adolescent girls includes stunted growth, increased susceptibility to infection during growth, reduced fitness, and decreased academic performance. Anemia in adolescent girls can reduce their concentration during learning.

Iron deficiency in adolescent girls is due to blood loss due to menstruation and the rapid growth phase, which requires three times the iron intake compared to adolescent boys. In cases of excessive or normal menstrual bleeding, iron loss must be replaced. Since menstruation produces an average of 60 ml of blood per month, which equates to 30 mg of iron, women require an extra milligram per day to maintain iron absorption (Giyanti & Wahtini, 2016).

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Factors that generally cause anemia in adolescent girls include knowledge of anemia, consumption patterns, socioeconomic status, health status, physical activity, and menstrual patterns. Women's iron expenditure is higher than men's. In addition to basal iron loss, adult women menstruate every month, excreting an average of 28 mg of iron per period (Podungge et al., 2021). Since menstruation occurs once a month, the average daily iron excretion is 28 mg divided by 30, which equals 1 mg/day. Therefore, women excrete almost twice as much iron as adult men. This increased iron requirement, combined with insufficient iron intake, can make adolescent girls susceptible to iron deficiency anemia (Syatriani & Aryani, 2010).

According to previous researchers, efforts to prevent and manage anemia in adolescent girls include increasing the intake of iron-rich foods, fortifying foods with iron, iron supplementation, and consulting a doctor. If you experience signs and symptoms of anemia, consult a doctor immediately to determine the cause and receive treatment (Estuti & Wiwit, 2023).

Anemia prevention can be achieved through pharmacological and non-pharmacological approaches, including consuming soy milk. Soy milk is highly effective in preventing anemia due to its high nutritional content, including fat, carbohydrates, calcium, phosphorus, iron, provitamin A, B-complex vitamins (except B12), and water. Subjects given 200 mL of soy milk once for 7 consecutive days experienced an increase in Hb levels of 1.09 g/dL.

This is because 100 mL of soy milk contains 0.70 mg of iron. Providing soy milk can meet iron needs that cannot be met adequately through daily diet. The iron in soy milk is beneficial for increasing red blood cells in adolescent girls. If iron intake is insufficient, it will affect the absorption of iron from food, mobilize iron stores in the body and reduce iron transport to the bone marrow, and lower Hb levels, resulting in anemia (Gibney, Forde, Mullally, & Gibney, 2017).

Other benefits of soy milk include its cholesterol-free content, phytochemicals such as oleate, linoleate, and linolenate, and its ease of digestion (Valentina, Yusran, & Meliahsari, 2020). Soy milk, in addition to containing iron, also contains protein, which can increase hemoglobin levels. The protein in soy milk forms globin, which then binds with heme to form hemoglobin.

The increase in Hb levels in subjects given soy milk is because soy milk contains 35-40% protein, 90% of which is stored in 2 forms of globulin protein, namely 11S glycinin and 7S β -conglycinin. Glycinin has an A (acidic) subunit and a B (basic) subunit, while β -conglycinin has α and β subunits. This protein contains all essential amino acids so that soy products are almost similar to animal foods in terms of protein quality, but with lower levels of saturated fat and no cholesterol. The results of the study showed that the mean value before giving soy milk was 11.1 g / dL and the mean after giving soy milk was 12 g / dL. The difference between the difference in changes in Hb levels was 0.9 g / dL, so it can be concluded that there was an increase in Hb levels in subjects before and after giving soy milk (Rizki, Wiji, Rismawati, & Harianti, 2022).

CONCLUSION

From this study, it can be concluded that soy milk has an effect on increasing hemoglobin levels in adolescent girls with anemia.

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