Impact of Nutritional Intervention Using Mung Bean Juice and Soy Milk on Hemoglobin Levels in Adolescent Girls

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Abstract

Objective: To evaluate the clinical characteristics of patients with Pelvic Organ Prolapse (POP) in national referral hospitals and Objective: To evaluate the effectiveness of mung bean juice and soy milk in improving haemoglobin levels among young women.

Methods: A quasi-experimental design employing a pre-test–post-test control group approach was used. Participants were assigned to three intervention groups and one control group, receiving either mung bean juice or soy milk for a 14-day period. Data analysis was performed using one-way ANOVA.

Results: Hemoglobin levels across the intervention and control groups ranged from 7.7 g/dL at baseline to 11.9 g/dL after treatment. The mung bean juice group demonstrated an increase in mean haemoglobin from 9.30 g/dL before treatment to 14.82 g/dL after treatment, yielding a 5.52 g/dL improvement (p = 0.000). In the soy milk group, haemoglobin values ranged from 7.5 g/dL to 11.9 g/dL, with mean levels rising from 9.30 g/dL to 15.50 g/dL, an increase of 6.20 g/dL (p = 0.000). These results confirm a statistically significant enhancement in haemoglobin levels in both interventions, with soy milk showing a slightly greater effect.

Conclusion: The findings indicate that both mung bean juice and soy milk are effective in elevating hemoglobin levels in young women, with soy milk providing a comparatively higher increase.

Keywords: folic acid, hemoglobin, iron doses, vitamin C in green bean juice.

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INTRODUCTION

Hemoglobin is a part of red platelets/ erythrocytes which has the ability to bind oxygen as well as deliver it to every tissue cell in the body. Tissues in the body need oxygen to carry out their functions. Symptoms of lack of oxygen in the brain and muscles include lack of concentration and fitness in activities. Hemoglobin is a component of red blood cells and erythrocytes that binds oxygen as well as transports it to everyone. tissue cells in the body. Red blood cells or erythrocytes are composed of hemoglobin which is formed from the combination of protein and iron [1].

Anemia is characterized by a decrease in hemoglobin (Hb) below normal, the mature blood cell that carries oxygen to all tissues. A normal Hb level is 11 grams per deciliter for women and 13 grams per deciliter for men. Iron deficiency is the leading cause of anemia. According to data from the World Health Organization (WHO), anemia affects 11% of people in low-income countries and 47% of people in developing countries. With its high prevalence in both groups, anemia in adolescents in developing countries is a serious public health problem [2].

Based on 2018 *Riset Kesehatan Dasar* (Basic Health Research Survey, RISKESDAS) information, In Indonesia, anemia prevalence is 21.7%, with a percentage of 20.6% in metropolitan areas and 22.8% in 18.4% of males and 23.9% of women live in rural areas[3] Anemia sufferers aged 5 to 14 years make up 26.4% of the population, while those aged 15 to 24 years make up 18.4%.

Adolescents' perceptions of anemia can be seen in the Indonesian Nursing Diagnosis Standards and Reassessment (SDKI-R) survey. Up to 70% of female participants said they were aware of anemia. while 60% of male respondents stated, but only 14% of each group answered correctly that anemia is a condition where hemoglobin levels are low.[4]

Low hemoglobin levels are a symptom of anemia. Based on data from the Basic Health Research from 2007 to 2018, it is established that the number of adolescents with anemia is rising. In 2007, 6.90 % of teenagers had anemia; by 2013, that number had risen to 18.40 percent; and by 2018, it had risen dramatically to 22.7%. This indicates that anemia affects 22.7% of Indonesian women who are of reproductive age. anemia, vulnerability to other infectious infections, and struggle with their growth, development, and cognitive capacities [5]. In the meantime, anemia affected up to 23.9% of young women in Jambi Province in 2018. The number of young women of productive age in Jambi Province and Muaro Jambi Regency increased to 1,157,599 and 132,693 respectively in 2021, indicating a rise in the prevalence of anemia among teenagers. A total of 1,654 young women are anemic, according to the Muaro Jambi District Health Service [6].

Low hemoglobin levels in the blood can lead to anemia, a deficiency of red blood cells. Anemia is a major nutritional problem in Indonesia, with adolescents experiencing more anemia than children and adults. Common symptoms include lethargy, weakness, dizziness, blurred vision, and a pale complexion. Anemia can have various impacts on adolescents, including a lowered immune system, making them susceptible to illness, and decreased activity and academic performance due to poor concentration.[7]

Iron deficiency can be overcome through treatment and prevention of anemia by increasing food sources of Fe and taking 60–120 milligrams of iron daily. In addition, iron-rich foods like fish, meat, liver, and milk, yoghurt, nuts and green vegetables are needed to treat anemia. Green beans and soybeans are two examples of nuts with high iron content. One item that has the ingredients required for the production of blood cells is green beans, therefore they are one of the foods that can help young women overcome the effects of lowering their blood sugar levels.[8]

Iron in green beans is generally found in undeveloped organisms and a seed coat, to be precise 6.7 mg per 100 grams which can be consumed or served in the form of green bean juice, namely through soaking, boiling, and filtering the water and dregs and separating them so that Being a nutrient-dense drink can prevent iron deficiency anemia. Iron and copper are two nutrients contained in soybeans. These two nutrients are very important for producing red blood cells. Soy-based foods can meet a person's daily protein needs of 55 grams if they are unable to consume meat or other sources of animal protein.[9]

Between 2020 and 2045, Indonesia will reach a demographic bonus where people of productive age constitute the majority of its population. This period must be used to prepare quality young people, including those from the health sector. Healthy teenagers are an investment in the country's future. Therefore, national development must prioritize investment in the health of the younger generation in order to produce a healthy young generation as capital for an advanced Indonesia. However, this has an impact on lack of access, socialization and education regarding anemia prevention, so that many people, especially teenagers, do not realize the importance of preventing anemia for teenagers and continue to make wrong assumptions about food and nutrition. This is one of the reasons why many Indonesian teenagers have very high anemia rates.[10]

Need is the primary cause of most dietary deficiencies, such as iron deficiency. Children and adolescents with low economic status are more susceptible to iron deficiency due to low iron intake and low intake of bioavailable iron from food, which can be exacerbated by blood loss due to parasitic diseases and jungle fever. Other factors include digestive problems and chronic blood loss due to menstruation. Research shows that early iron deficiency can affect mechanical and mental capacity and cause behavioral problems in children that may be irreversible.[1] Weaknesses in the younger generation also have various consequences, such as weakening physical and mental development and improvement as well as reduced physical health, work limitations and school performance. Therefore, early detection and screening for iron deficiency is very important.[11]

Based on an initial survey conducted at Madrasah Aliyah (MA) Raudhatul Muhajirin, an Islamic Senior High School, a sample of 20 female students was assessed. Hemoglobin level analysis

revealed that 15 students (75%) had hemoglobin levels below the normal threshold of < 12 g/dL. Interviews with the school principal indicated that there had never been a hemoglobin screening program at the school, nor had the students received *Tablet Tambah Darah (TTD)* iron supplementation tablets from the local health center. Furthermore, interviews with the female students showed a lack of awareness regarding the benefits of green bean juice, soy milk, and *TTD* in improving hemoglobin levels. Most of them had never consumed green bean juice or soy milk, and reported infrequent use of *TTD* as a means to prevent or treat anemia.

METHODS

This study received ethical approval from the Jambi City Health Polytechnic, as stated in Ethical Review Certificate Number LB.02.06/2 1145 2024. The research employed a quasi-experimental design using a one-group pretest-posttest with control group approach to evaluate the effect of nutritional interventions on hemoglobin levels among adolescent girls. Participants were divided into three experimental groups and one control group. One group received 200 ml of mung bean juice daily, another received 200 ml of soy milk daily, while the control group was administered *TTD*. The independent variables in this study were the consumption of mung bean juice and soy milk, while the dependent variable was the hemoglobin (Hb) level of the participants.

Participants were selected from MA Raudhatul Muhajirin based on inclusion criteria, which included early adolescents aged 12–14 years, middle adolescents aged 15–17 years, and late adolescents aged 18 years and above. Prior to the intervention, hemoglobin levels were measured directly by the researchers, and informed consent was obtained from all eligible participants. Primary data consisted of hemoglobin measurements taken before and after the 14-day intervention, while secondary data were collected through structured interviews and observations to assess compliance. Compliance was defined as consuming at least 90% of the prescribed volume of mung bean juice or soy milk. Participants who met this threshold were categorized as compliant, while those who consumed less were considered non-compliant.

The mung beans (Vigna radiata L.) and soybeans (Glycine max L.) used in the intervention were sourced from the Angso Duo traditional market in Jambi City. Only high-quality beans were selected, ensuring they were peeled and free from musty or rancid odors. The drinks were prepared by specialists at the Drug Science Laboratory of STIKes Harapan Ibu Jambi, which had undergone food safety and organoleptic testing. Nutritional content including iron, folic acid, and L-ascorbic acid was analyzed using atomic absorption spectrophotometry (AAS) at the Harapan Ibu Regional Health Laboratory, under the supervision of Mr. Mukhlis Sainuddin, M.Sc.

Iron intake was assessed using two 24-hour dietary recalls. A 200 ml serving of mung bean juice or soy milk provided approximately 50% of the daily iron requirement (18 mg). Intake was categorized as adequate if it met or exceeded 77% of the Recommended Dietary Allowance (RDA) for adolescent girls, and inadequate if it fell below this threshold. The intervention was carried out over 14 consecutive days, during which participants consumed the assigned drinks under supervision. On the fifteenth day, hemoglobin levels were reassessed using Hb Quick Check. The results showed improvements in both anemic (Hb ≤10.7 g/dL) and non-anemic (Hb ≥11 g/dL) participants. Measurements were taken via capillary blood and validated using multiple methods, including HemoCue, WHO Color Scale, and the cyanmethemoglobin technique. Despite minor outliers, the mean concentration bias remained within ±7%, indicating reliable analytical performance.

Data analysis was conducted using univariate and bivariate methods, including one-way ANOVA to compare hemoglobin levels across groups. The accuracy of participants' behavior in consuming the drinks was monitored throughout the intervention, and compliance was measured by comparing the actual intake to the expected intake. This assessment also helped minimize potential side effects from excessive consumption. The study concluded with a comprehensive evaluation of hemoglobin improvements and the nutritional content of the drinks, specifically iron, folic acid, and vitamin C.

RESULTS

AAS analysis of breast milk samples were used to measure the average levels of breast milk's iron and zinc content. After 14 days of giving banana flower and Moringa leaf extracts, samples of breast milk were taken. Bosom milk

tests were acquired on day 15 for the control and intercession gatherings. Contrasts in mean degrees of zinc and iron in bosom milk were determined involving 1-way ANOVA information examination as introduced in Table 1.

Table 1. Respodent Characteristics (n=36)

Characteristics	F	%
Age		
Early 2-14	0	0
Mid 5-17	35	97.2
Late 18 and Over	1	2.8
Total	36	100
Class		
10 A and B	14	38.9
11 A and B	12	33.3
12 A and B	10	27.8
Total	36	100
Body Mass Index (BMI)		
Underweight < 17.0	8	22.2
Normal 18.0-25.0	26	72.2
Fat 25.1-27.0	2	5.6
Total	36	100
Frequency of anemia		
Anemia (Hb ≤10-7 g/dl)	36	100
Non- anemia (≥ 11 g/dl)	0	0
Total	36	100

Considering the information in table 1, it can be determined that of the 36 respondents, the total number of respondents were Middle Adolescents 15-17 years old, namely 35 respondents (97.2%) of respondents aged 18 and over, only 1 person (2.8%). Meanwhile, based on class, 14 (38.9%) respondents came from class X A and B, 12 (33.3%) respondents from class XI A and B and 10 (27.8%) respondents from class and B (MA) Raudhatul Muhajirin. For the body mass index category underweight < 17.0 there were 8 respondents (22.2%) and the normal body mass index category 18.0-25.0 there were 26 respondents (72.2%) in the obese category 25, 1-27.0 as many as 2 respondents (5.6%).

One of the factors that influences the incidence of anemia is age because during adolescence there is a growth spurt which requires a lot of iron intake. Adolescent girls need more iron than adolescent boys, because adolescent girls experience menstruation every month which results in iron loss of 0.8 mg/day during menstruation[12]. As humans get older, the physiological decline of all organ functions, including a decrease in bone marrow which produces red blood cells, increases.

From the results of the research carried out, it was obtained that the distribution of respondents based on Hb levels before being given green bean juice, soy milk and *TTD* can be seen in table 2 below.

Table 2. Pre-and Post-test Results for Hb Level

Variable	KP 1 Green Bean Juice Mean ± SD	KP 2 Soy Milk Mean ± SD	KK (TTD) Mean ± SD	Frequency
Hb level-pretest	2.190 ± 1827	2.451 ± 1833	2.543 ± 1232	36
Hb level-posttest	4.000 ± 4.000	4.000 ± 4.000	4.000 ± 4.000	
Total				36

Based on table 2 above, it can be seen that the 36 respondents before being given green bean juice, soy milk, and *TTD* had the lowest standard deviation value of 2.190 and following the administration of green bean juice, soy milk, and *TTD* has an average standard division score of 4,000. The results of statistical tests showed that there was a notable distinction between before and after the intervention of green bean juice, soy milk and blood supplement tablets in young women, so it can be seen that giving green bean juice and soy milk can increase hemoglobin levels in young women.

By increasing the knowledge of young women about nutritious food intake, young women will become more confident in consuming nutritious food which can increase hemoglobin levels. A very nutrient-dense beverage that is extracted from ground soybeans and water is added in a certain ratio to obtain a milky white liquid with a distinctive aroma. Soybeans as the basic ingredient for making soy milk are functional food ingredients with high protein content, water, calcium, phosphorus, iron, fat, carbs, provitamin A, and vitamin B complex (apart from B12). Providing soy milk can fulfill iron needs that cannot be met sufficiently through food every day. Soy milk is useful for increasing red blood cells in anemic teenage girls.[15]

Tabel 3. Pair T-Test Test for Hb Levels in the Control Group and Intervention Group

Hb Level	KP 1 Mean ± SD	KP 2 Mean ± SD	KK Mean ± SD	*P-value*
Pre-test	-1,692 ± -1.983	-1.846 ± 2.181	-1.615 ± 1.921	000
Post-test	-1.402 ± -12.702	-1.511 ± 12.000	-1.309 ± 11.502	000

The Paired Differences Pre Test values for the pretest green bean juice were found to be -1,692 -1,983, while the paired differences post-test values for the posttest green bean juice were found to be 1,402 t -12,702 with a P-value of 0.000. In the pre-test control group, *TTD* was -1,615 -1,921, in the posttest control group, *TTD* was 1,309 -11,502 with a P-value of 0.000 for the three control groups and the intervention group. This indicates that there was an effect of giving peanut juice green, soy milk, and *TTD* changes in hemoglobin levels of adolescent girls at MA.

Table 4. Average According to the Variables Under Study (n=36)

Variable	Group	Mean ± SD	*P-value*
Iron levels in hemoglobin	Control	0.037420 ± 0.0144486	
	Soy milk extract	0.026890 ± 0.0037153	0.000
	Green bean extract	0.026480 ± 0.0052958	
Folic acid levels in hemoglobin	Control	0.053020 ± 0.0101707	
	Soy milk extract	0. 072640 ± 0.0972192	
	Green bean extract	0.042340 ± 0.0055928	0.160

The control group's hemoglobin had an average level of 0.037420 folic acid, while the soy milk extract group had an average of 0.026480 for the bean extract group. 026480. In the meantime, the control group's hemoglobin averaged 0.053020, the soy milk extract group 0.072640, and the green bean extract group 0.042340 iron. The control group's variable iron levels in hemoglobin were higher than those of the soy milk extract and green bean extract groups in the 1-way ANOVA test analysis. The statistical test results have a p-value of 0.000. According to these findings, there is a notable distinction. in hemoglobin iron levels between the control group, the soy milk extract, and the green bean extract groups. Be that as it may, the degrees of folic corrosive in hemoglobin in the soy milk concentrate and green bean juice bunches were higher contrasted with the soy milk concentrate and green bean juice bunches in the benchmark group. The results of statistical tests have a p-value of 0.160. The hemoglobin iron levels of the control group, soy milk extract, and green bean extract are not significantly different from one another, as shown in this figure.

Soy milk contains 0.70 milligrams of iron in 100 milliliters of milk. Iron requirements that cannot be adequately satisfied by daily diet can be satisfied by providing soy milk. Soy milk's iron content helps to boost red blood cells in teenage girls. If iron intake is insufficient, it will affect the increase in 0.70 milligrams of iron in 100 milliliters of milk. Giving soy milk can help meet iron needs by reducing Hb levels, mobilizing iron stores in the body, reducing iron transit to the bone marrow, and facilitating iron absorption from diet. As a result, anemia can be adequately fulfilled with daily eating. Soy milk's iron content helps to boost red.[13]

CONCLUSION

People with anemia can efficiently raise their hemoglobin (Hb) levels by consuming soy milk and mung bean juice. This advantage is especially noticeable for vulnerable populations such as teenage girls.

ACKNOWLEDGEMENT

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