



Potential of Kidney Bean Extract (*Phaseolus Vulgaris L*) in the Management of Anemia in Pregnant Women

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ABSTRACT

Background: Anemia occurs when there is a decrease in the volume of blood cells, thereby reducing the level of oxygen available to vital organs. In anemia, the hemoglobin level in the body is below 11 gr/dl. It is estimated that 42.8% of mothers in this country suffer from anemia during pregnancy, according to WHO. The plasma volume is higher and the number of red blood cells (erythrocytes) is higher, causing the blood to thin and the concentration of hemoglobin (Hb) to decrease.

Research objectives: To analyze differences in hemoglobin levels and the number of erythrocytes in pregnant women with anemia before and after administration of red bean extract (*phaseolus vulgaris l*) compared to the control group (fe tablets).

Method: Quasy experiment with pretest-posttest design with control group design. The sample consisted of 40 pregnant women with anemia which were divided into 2 groups, namely 20 intervention groups and 20 control groups.

Results: The analysis showed red bean extract combined with Fe given to pregnant women every day for 14 days can significantly increase hemoglobin levels with an average increase in the intervention group increasing 11.515 gr/dl while in the control group increasing 11.960 gr/dl. While the results of the analysis The number of erythrocytes in the intervention group increased 4.3200 million/cell and in the control group increased 3.9640 million/cell.

Conclusion: Red bean extract (*phaseolus vulgaris l*) has the potential to increase hemoglobin levels and erythrocyte counts in anemic pregnant women compared to the control group.

Keywords: red bean extract; Pregnant mother; anemia (Hb levels, red blood cells)

INTRODUCTION

Pregnant women are especially sensitive to iron deficiency because they need more oxygen during pregnancy, which increases the production of erythropoietin. The result is an increase in plasma volume which is higher and the number of red blood cells (erythrocytes) is higher, causing the blood to thin and the concentration of hemoglobin (hb) to decrease. Gestational anemia is a condition where the mother's Hb level is below 11gr/dl in TM I and III of pregnancy and below 10.5gr/dl in TM II.¹

Anemia is the 2nd problem globally and is also the most dangerous public health case in the world. Anemia during pregnancy ranks at the top of the WHO program in the 2025 Global Nutrition Goals, with a global prevalence of anemia in pregnant women of 38%.² Up to 56% of cases of anemia in pregnant women occur, especially in those whose income is below standard. The highest anemia rate among pregnant

women is in Sub-Saharan Africa (57.1%), Southeast Asia (48.2%), Europe (25.2%), and South America (24.1%).³ Anemia during pregnancy is a major cause of maternal death worldwide.⁴

The most common pregnancy complication is anemia, which ranges from 20 to 89% with a baseline hemoglobin value of 11 g/dl. The prevalence of anemia in pregnant women is 37.2% and in women of childbearing age is 32.6% (RI Ministry of Health, 2019). According to the 2019 Indonesia Health Profile, Southeast Sulawesi has 5,256,483 pregnant women and 68,823.⁶

The prevalence of anemia pregnant women in Kendari City in 2017-2019 shows an increase. In 2017, 2194 pregnant women were found to be anemic with Hb levels of 8-11g/dl and 60 anemic pregnant women with Hb <8g/dl out of a total of 6,550 pregnant women who had their hemoglobin checked. Whereas in 2018, 2,667 pregnant women were found to have anemia with Hb levels of 8-11g/dl and 172 with Hb <8g/dl

out of a total of 7,373 pregnant women.⁷

Based on data in Kendari City, at the Lepo-lepo Health Center in 2019 396 (61.49%) pregnant women were registered with anemia out of a total of 644 pregnant women, in 2020 there were 522 (78.49%) pregnant women with anemia with a total of 662 mothers pregnant and in 2021 there will be 513 (87.69%) pregnant women with anemia out of a total of 585 pregnant women. Based on these data it can be seen that the number of anemic pregnant women is increasing from year to year and is a puskesmas with the highest number of anemic pregnant women compared to other puskesmas in Kendari City.⁸

According to Riskesdas data for 2018, 73.2% of pregnant women were given Fe tablets and the remaining 26.8% did not receive Fe tablets. Overall 61.9% of pregnant women had consumed 90 tablets of Fe tablets and as many as 38.1% of pregnant women who had consumed Fe tablets had 90 tablets⁹. Based on data from the Lepo-lepo Health Center in 2019, 644 pregnant women (100%) received iron supplement tablets, in 2020 650 (98.18%) pregnant women received Fe tablets out of a total of 662 pregnant women, while in 2021 who received Fe tablets were 561 (95.89%) of the total 585 pregnant women. However, iron tablets have side effects such as nausea, vomiting, diarrhea, and constipation if consumed by pregnant women.^{10,11,12}

Anemia during pregnancy has a negative impact on the mother and fetus. Pregnant women with anemia are at increased risk of morbidity and mortality, especially if postpartum hemorrhage occurs, while exposure to the fetus increases the risk of preterm birth, low birth weight, and low Apgar scores. It also influences the incidence of infections, prolonged or obstructed labour, unsafe abortions and postpartum complications.¹³

The Indonesian government is trying to overcome the problem of anemia in Indonesia by distributing Fe tablets to health services so that they are distributed free of charge to all pregnant women. However, even though the prevention of anemia has been going on for a long time, the prevalence of anemia is still quite high¹⁴.

The use of herbal medicines is usually safer than the use of synthetic drugs in the treatment of non-pharmacological anemia because when used properly, the side effects are relatively few. In Indonesia, many medicinal plants, including kidney beans, have been used for centuries to treat various ailments.¹⁵

Red beans contain chemical compounds, namely flavonoids, saponins, and tannins. When combined with iron, flavonoids used to treat anemia fight free radicals such as hydroxyl and superoxide, protect lipid membranes, reduce cell damage, and maintain red blood cells.¹⁶ Red bean is a food with g=functional properties that may be effective against anemia, and its iron-fortified content is a promising alternative therapy that covers daily intake, including important body parts.¹⁵

In this study the dosage form used was in the form of extract capsules. Administration in capsule form is considered because the capsule formulation offers the following advantages; the shape is attractive and comfortable, bland which can cover the taste and smell of the unpleasant medicine, easy to swallow, quickly destroyed in the stomach so that it is absorbed in the intestines. Mothers who don't like red beans are easy to consume.¹⁷

This study aims to analyzedifferences in hemoglobin and

erythrocyte levels in pregnant women with anemia before and after administration of red bean extract (*phaseolus vulgaris* l) compared to the control group (fe tablets).

METHODS

This research was conducted in May-June 2022. This type of research is quantitative by design *quasy experiment* with pretest-posttest with control group design. The study population is all pregnant women who experience anemia at the Lepo-lepo Health Center. This research was approved by the Health Research Ethics Commission of the Poltekkes Kemenkes Semarang on May 19, 2022 with No. 0407/EA/KEPK/2022.

The sample in this study were anemic pregnant women who met the inclusion criteria. The inclusion criteria for this study sample were: TM II pregnant women who were willing to be respondents, TM II pregnant women aged 20-35 years, TM II pregnant women with primigravida and multigravida parities, TM II pregnant women with lila ≥ 23.5 , mothers TM II pregnant with gestational age ≥ 2 years, TM II pregnant women who experience mild anemia with Hb values of 9-10 gr/dl. The research location is the Lepo-lepo Health Center, Kendari City, Southeast Sulawesi. The sampling method used purposive sampling and based on the sample calculation formula, a minimum sample size of 40 respondents was obtained, of which 20 were for the intervention group and 20 for the control group.

Instruments in this study: observation sheets (noting the characteristics of the respondents, data on examination of hemoglobin and erythrocyte levels, observation sheets of daily consumption of Fe tablets and administration of red bean extract every day for 14 days (intervention group) and control group, blood sampling equipment, and Processing extracted bean, manufacture of red bean extract in the Laboratory Center of Nanoresearch for Humanity (CNH) Semarang.

Data analysis used in this study consisted of univariate analysis (frequency distribution of sample characteristics, standard deviation, mean, Hb levels and erythrocytes maximum, minimum) and bivariate analysis (normality test with Shapiro-Wilk, homogeneity test using Leven's test, and hypothesis testing using independent t-test). This research was conducted in 2 groups, namely the intervention group (given Fe tablets and administration of red bean extract every day for 14 days) and the control group (administration of Fe tablets only every day for 14 days) prior to intervention on the first day a venous blood sample (3cc) was taken to check hemoglobin levels and erythrocytes, then pregnant women are given red bean extract and Fe tablets regularly at a dose of 400 mg per day taken at night for 14 days as the intervention group while in the control group given Fe tablet supplementation for 14 days at a dose of 60 mg/day taken at night. Then on the 15th day a repeat blood draw was carried out to examine the increase in the mother's hemoglobin level and erythrocytes.

RESULTS AND DISCUSSION

Based on the data obtained, the characteristics of the respondents in this study included age and parity, nutritional status, education and employment which can be seen in table 1 below.

Table 1: Distribution of the characteristics of the respondents in the intervention group and the control group.

Characteristics	Group				p-values
	Intervention (n=20)		Control (n=20)		
	n	%	n	%	
Age					
20-27	5	25.0	6	30.0	0.493
28-35	15	75.0	14	70.0	
Parity					
Primigravida	5	25.0	4	20.0	0.463
Multigravida	15	75.0	16	80.0	
Nutritional status					
SEZ <23.5	6	30.0	5	25.0	0.493
No SEZ > 23.5	14	70.0	15	75.0	
Education					
Elementary-Junior High School	6	30.0	5	25.0	
SENIOR HIGH SCHOOL	10	50.0	11	55.0	0.665
College	4	20.0	4	20.0	
Profession					
Working	3	15.0	5	25.0	0.122
Not Working	17	85.0	15	75.0	

*Levene test

The results of the statistical homogeneity test showed that there were no differences that had an impact on the characteristics of age, parity, nutritional status, education, and employment between the intervention group and the control group (p-value > 0.05). This indicates that the researcher was

unable to identify the characteristics of age and parity as confounding variables so as not to cause a bias effect on the analysis results.

The results of the data normality test can be seen in table 2 below:

Table 2: Results of the normality test for hemoglobin and erythrocyte levels before and after treatment in the intervention group and the control group

Variables	Normality test		Homogeneity Test
	Intervention	Control	
	p-values	p-values	
Hemoglobin			
Pretest	0.189*	0.203*	0.803**
Posttest	0.824*	0.501*	
Erythrocyte			
Pretest	0.136*	0.195*	0.625**
Posttest	0.176*	0.052*	

*Shapiro-Wilk, **Levene test

The results of the normality test showed that the hemoglobin level in the treatment group and control group before and after the intervention had a significant value (>0.05), this indicated that the data were normally distributed. The test results using

the Levene test obtained a p-value > 0.05 which indicated that there was no difference or homogeneity between hemoglobin and erythrocyte levels before and after treatment.

Table 3: Differences in Hemoglobin Levels Before and After Treatment in the Intervention and Control Groups

Variable	Group		p-values
	Intervention	Control	
	Mean±SD	Mean±SD	
Hemoglobin			
Pretest	10.300 ±0.288	10.080 ±0.256	0.015*
Posttest	11.515 ±0.275	10.960 ±0.237	0.000*
p-values	0.000**	0.000**	
Δ	1.215±0.275	0.880±0.237	0.001*

* independent t-test test

** paired t-test

Based on the results of statistical tests that were carried out to see differences in hemoglobin levels between the intervention group that consumed Fe tablets combined with red bean extract (*phaseolus vulgaris*) and the control group that consumed only Fe tablets, it showed that there were significant differences in hemoglobin levels in the two groups.

Pregnant women are strongly advised to take iron tablets every day to prevent depletion of iron stores in the body. Response to treatment is monitored by increasing hemoglobin, increasing at least 0.3 g/dl every week. During pregnancy, the physiological blood volume is such that the mother's blood volume increases in early pregnancy, increases more rapidly in late pregnancy, increases much more slowly in late pregnancy, and decreases during the last week of pregnancy. There are academic changes. This hematological change is called hemodilution. Physiologically, an increase in blood cells compared with an increase in plasma causes hemodilution, thinning the blood.^{18,19}

Based on the results of the independent t-test, it was obtained that the p-value = 0.000 < 0.05, it can be concluded that giving red bean extract (*phaseolus vulgaris*) and Fe tablets for 14 days can increase hemoglobin levels. Based on statistical tests after the intervention was carried out by consuming Fe tablets regularly for 14 days, the average hemoglobin level in the control group experienced an average increase of 10.96, while the average hemoglobin in the treatment group that consumed red bean extract and Fe tablets regularly for 14 days, increased to 11.51 gr/dl. The increase in hemoglobin levels

was due to red bean extract containing a high enough source of iron, namely 11.54 mg/100 grams. The iron contained in red bean extract is non-heme iron. where non-heme iron can be absorbed optimally by the body. So the body gets an adequate supply of iron for the formation of hemoglobin.²⁰

The content of other red bean extracts is 22.3 mg of protein per 100 grams. Energy from protein helps the body to metabolize and keeps the body in optimal condition. Protein is also a carrier of iron, carrying iron to places that need iron, such as bone marrow to form new hemoglobin, red bean extract also contains flavonoid compounds 3.37mg/100 grams. Flavonoids for protection against anemia interact with iron to protect membrane lipids from free radicals in the form of hydroxy and peroxide, prevent cell damage and protect blood cells. The carbonyl group in flavonoids can chelate iron, and can also form complexes with -OH metal ions. In the bone marrow, transferrin binds to receptors on the red blood cell membrane and is then made into heme in the mitochondria.^{21,22}

Iron is converted to iron in the intestine is absorbed, converted to iron in the intestine, plasma is formed ((Fe²⁺ apotransferrin), Fe²⁺ is transported to the spinal cord, and iron is used and increased by red blood cells. absorbed by the body, can increase hemoglobin levels.²³

Previous research stated that after giving soya red beans to young women, they showed significant results with a pvalue < 0.05 which had an effect on increasing hemoglobin levels.²⁴ Other studies also showed significant results on giving red bean juice with a p-value = 0.001.²⁵

Table 4. Differences in the number of erythrocytes before and after treatment in the intervention and control groups

Variable	Group		p-values
	Intervention	Control	
	n Mean±SD	Mean±SD	
Erythrocyte			
Pretest	3.948±0.207	3.863 ±0.255	0.222 *
Posttest	4.320±0.155	3.964±0.197	0.000 *
p-values	0.000**	0.000**	
Δ	0.372±0.214	0.101±0.100	0.000 *

* independent t-test test

** paired t-test

The results of a statistical test conducted to determine the difference in the number of erythrocytes between the intervention group which consumed Fe tablets combined with red bean extract per day for 14 days and the control group which only consumed Fe tablets per day for 14 days showed that there was a significant difference in the levels of erythrocytes in both groups. The average value of the number of erythrocytes. The average value of the number of erythrocytes in the control group which only consumed Fe tablets was lower than the average number of erythrocytes in the intervention group which consumed Fe tablets and red bean extract for 14 days. Statistical tests carried out in the control group experienced an average increase in erythrocyte levels of 0.101 while in the intervention group experienced an average increase of 0.372 with a p-value of 0.

Hemoglobin which carries oxygen from the lungs to the tissues, is carried by red blood cells, also known as erythrocytes. The number of red blood cells in all military blood is 5 billion, or 5 million blood cells per cubic milliliter (mm³), and red blood cells are affected by the concentration of hematocrit and hemoglobin. Hemoglobin and hematocrit levels change dramatically when the erythrocyte count is high. Erythrocytes are produced during the process of erythropoiesis, which takes place in the red bone marrow (medulla asseum rubrum), which is present in a number of long bones. Erythrocytes are made during the production of red blood cells in the flat bone marrow, and the process begins with immature erythrocytes that are still capable of producing hemoglobin.^{26,27}

Red bean extract contains protein, fat, carbohydrates, iron, vitamins A and B, people believe that red beans can lose weight, good for digestion, and for diabetics. In addition, red beans contain flavonoid compounds that function against the effects of free radicals. Free radicals cause lipid peroxidation

in cell membranes and tissue damage. Peroxidation of cell membrane lipids promotes hemolysis of red blood cells, thereby releasing hemoglobin and breaking down hemoglobin.^{15,28}

Based on previous studies consuming red beans can increase the number of erythrocytes, one of the benefits of red beans itself is to prevent anemia because they contain high iron which can help prevent anemia.^{28,29} Previous research stated that red bean extract in rats provided an increase in hematologic.³⁰

CONCLUSIONS AND RECOMMENDATION

Kidney bean extract (*phaseolus vulgaris* l) 400 mg combination of Fe tablets given daily for 14 days to anemic pregnant women significantly increased hemoglobin levels, the average increase was 1.215 gr/dl compared to those only given Fe tablets which was as much as 0.880 gr/dl etc.

The combination of 400 mg of red bean extract and Fe tablets given daily to anemic pregnant women for 14 days significantly increased the number of erythrocytes with an average increase of 0.372 million/cell compared to women who were given only Fe tablets, which was 0.101 million/cell. Health workers can socialize to all service personnel, especially maternal and child health (MCH) in cases of anemia and utilize red bean extract therapy (*phaseolus vulgaris* l) as a companion to iron supplements in treating anemia in pregnant women with anemia.

In order to improve the quality of midwifery care, especially in the service of pregnant women, this study identified evidence based on alternative materials to increase hemoglobin levels in women with anemia. This evidence can be used as a reference and to advance obstetrics.

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