International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR |Volume 10 | Issue 1 | Jan - Mar - 2022
www.ijamscr.com

Research article *Medical research*

Salam Leaf Nanoparticles Against Hemoglobin, Erythrocyte Hematocrit Levels Adolescent Girls Anemia

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ABSTRACT

Adolescent girls are a vulnerable group who experience iron deficiency anemia. This is due to the high need for iron during growth and development physically, mentally and in daily activities.1 Bay leaves contain iron as much as 19.8 mg/100 g bay leaf extract and Vitamin C as much as 82.2 mg. /1 g salam leaf extract.The aim of the study was To determine the effect of giving salam leaf nanoparticles to increase hemoglobin, hematocrit and erythrocyte levels in adolescent girls with anemia. This type of research is True Experiment research with randomized pretest and posttest with control group design. The independent variables were salam leaf nanoparticles with a dose of 1500 mg, the dependent variables were hemoglobin, hematocrit and erythrocytes. The number of samples in this study were 30 anemic adolescent girls who were divided into 2 groups, 15 were the intervention group and 15 were the control group.The results of this study are the Salam leaf nanoparticles combined with Fe tablets given for 14 days were proven to increase hemoglobin levels (p = 0.019), hematocrit levels (p = 0.005) and erythrocyte levels (p = 0.011). Mean ±SD intervention group and control group hemoglobin 11.84±0.65 vs 11.04±0.79, hematocrit 34.71±1.74 vs 32.60±2.05 and erythrocytes 3.88±0.30 vs 3.56±0.20. The difference in increase was higher in the intervention group compared to the control group. The administration of salam leaf nanoparticles and Fe tablets can increase the hemoglobin, hematocrit and erythrocyte levels of anemic adolescent girls compared to the control group who were only given Fe tablets.

Keywords: Salam Leaf Nanoparticles, Hematology Status

INTRODUCTION

Anemia is a condition in which the number of red blood cells or hemoglobin is lower than normal, so that it can interfere with the blood's ability to carry oxygen throughout the body. Classification of blood's ability to carry oxygen throughout the body.[2]

The results of Riskesdas in 2018 showed the prevalence of anemia in adolescent girls in Indonesia was 37.1% in 2013 and in 2018 there was a fairly high increase, reaching 48.9%.[5] The results of the 2016 Family Health Survey (SKRT), the prevalence of anemia in adolescent girls aged 15-20 years is 57.1%, out of a total of 21 million girls, at least 4.8 million suffer from a deficiency of red blood cells which contain the protein hemoglobin that carries oxygen from the heart to all parts of the body.[6,7]

There are two ways to treat anemia in adolescents, namely pharmacological and non-pharmacological methods. Overcoming anemia pharmacologically is by consuming iron tablets. One of the steps taken by the government to overcome anemia in women of childbearing age and pregnant women is to take iron tablets. Each iron tablet contains 200 mg of ferrous sulfate and 0.25 mg of folic acid or equivalent to 60 mg of elemental iron and 0.25 mg of folic acid. Adolescent girls consume iron tablets with a preventive dose, namely 1 tablet per day for 10 days during menstruation and 1 tablet per week when not menstruating.[10,11]

The side effects of consuming Fe tablets are that it can cause nausea, constipation and changes in stool color after consuming them, ignorance of information about this is the cause of non-compliance in consuming Fe tablets so that many teenagers experience anemia. In addition, the ignorance of adolescents about information in the examination of hemoglobin levels in health facilities is also one of the causes of increasing the prevalence of anemia in adolescents.[12]

Non-pharmacological methods are usually carried out by consuming plant and animal sources that contain iron. Foods that contain iron include salam leaves, soybeans, long beans, green beans, long bean leaves, sesame seeds, dates, tomatoes, papaya, kale, spinach, Moringa leaves, Dutch eggplant, torbangun leaves and many other sources. other iron. With the source of iron from a variety of foods, many researchers are conducting research by consuming it directly or used as an extract.[13]

Indonesia is a tropical area that has a variety of plants, one of which is salam leaf (Syzygium Polyanthum) which is easily found and used as a cooking ingredient. Salam leaves contain iron as much as 44.10gr/100 gr.[14] Other ingredients that can increase hemoglobin levels are also found in salam leaves such as folic acid, vitamin B12, vitamin B6, vitamin C and protein. [16]

The results of previous studies stated that salam leaves did not have toxic, teratogenic and genotoxic effects on experimental animals so that it can be proven that the use of salam leaves is safe for consumption.[17] The results of previous studies stated that bay leaves did not have toxic, teratogenic and genotoxic effects on experimental animals so that it can be proven that the use of salam leaves is safe for consumption. Previous research, namely salam leaves given to rats model of iron deficiency anemia and giving salam leaf extract to anemic postpartum mothers to see the increase in hemoglobin levels. From the two research results, it was found that there was a significant increase in hemoglobin levels given the salam leaf extract treatment.[18]

Based on the above background, the purpose of this study was to determine the effect of giving salam leaf nanoparticles to increase hemoglobin, hematocrit and erythrocyte levels of anemic adolescent girls.

METHODS

The manufacture of salam leaf nanoparticles was carried out at the Diponegoro University Integrated Laboratory in February 2021. This research was carried out at 1 Junior High School Siak Hulu in March 2021. Ethical approval was obtained from the Health Research Ethics Committee of the Health Polytechnic of the Ministry of Health Semarang with No.038/EA/KEPK/ 2021.

This type of research is a True Experimental study with a randomized pretest and posttest with control group design with a sample of 30 respondents and divided into 2 groups where 15 were the intervention group and 15 were the control group. The inclusion criteria of this study were adolescent girl aged 15-18 years, adolescent girl who had anemia and were willing to be respondents, while the exclusion criteria of this study were adolescent girl who suffered from illness, adolescent girl whose menstrual cycles were more than 7 days and changing sanitary napkins for more than 7 days and changing menstrual pads more than 5 times a day.

Before being given treatment, a pretest was carried out to check hemoglobin, hematocrit and erythrocyte levels in adolescent girls. The intervention group as many as 15 respondents were given salam leaf nanoparticles at a dose of 1500 mg per day combined with 60 mg Fe tablets while the control group was only given 60 mg Fe tablets. Each group was given treatment for 14 days. After being given treatment, posttest examination of hemoglobin, hematocrit and erythrocyte levels was carried out again in adolescent girls.

RESULTS

1. Giving salam leaf nanoparticles and Fe tablets had an effect on increasing hemoglobin levels compared to only giving Fe tablets in adolescent girls with anemia.

Table 1. Changes in hemoglobin levels of respondents group and control group before and after being given treatment

Variable	Group		*p value*
	Intervention	Control	
	Mean±SD	Mean±SD	
Hemoglobin			
Pretest	10,48±0,81	10,52±0,82	0,917[a]
Posttest	11,84±0,65	11,04±0,79	0,019[a]
p value	0,001[b]	0,001[b]	
Delta	1,35±0,37	0,52±0,20	0,000[a]

a : *Mann Whitney Test;* b: *Wilcoxon Sign Ranks*

The average increase in hemoglobin levels in the intervention group and the control group both experienced an increase.

However, in the intervention group there was a higher increase compared to the control group. The increase in hemoglobin levels in the intervention group was 1.35 g/dl while in the control group it was 0.52 g/dl. Analysis of the different hemoglobin levels in the intervention group and control group obtained p value = 0.000 which means that there is a significant effect between the intervention group and the control group after being given treatment.

2. Giving bay leaf nanoparticles and Fe tablets had an effect on increasing hematocrit levels compared to only giving Fe tablets to adolescent girls with anemia.

Table 2. Changes in the respondent's hematocrit levels in the intervention group and control group before and after being given treatment

Variable	Group		*p value*
	Intervention	Control	
	Mean±SD	Mean±SD	
Hematocrit			
Pretest	33,11±1,93	32,02±1,97	0,139[a]
Posttest	34,71±1,74	32,60±2,05	0,005[a]
p value	0,000[b]	0,000[b]	
Delta	1,60±0,50	0,57±0,27	0,000[a]

a: *Independent t-test;* b: *Paired t-test*

The average increase in hematocrit levels in the intervention group and the control group both experienced an increase. However, in the intervention group there was a higher increase compared to the control group. The increase in hematocrit levels in the intervention group was 1.60% while in the control group was 0.5%. Analysis of the difference in hematocrit levels in the intervention group and control group obtained p value = 0.000 which means that there is a significant effect between the intervention group and the control group after being given treatment.

3. Giving bay leaf nanoparticles and Fe tablets have an effect in increasing erythrocyte levels compared to only giving Fe tablets to adolescent girls with anemia.

Table 3. Changes in respondent's erythrocyte levels in the intervention group and control group before and after being given treatment.

Variable	Group		*p value*
	Intervention	Control	
	Mean±SD	Mean±SD	
Erythrocyte			
Pretest	3,20±0,32	3,30±0,26	0,139[a]

Posttest	3,88±0,30	3,56±0,20	0,005[a]
p value	0,001[b]	0,000[b]	
Delta	0,67±0,09	0,26±0,12	0,000[a]

a: *Mann Whitney Test; b: Wilcoxon Sign Ranks*

The average increase in erythrocyte levels in the intervention group and control group both experienced an increase. However, in the intervention group there was a higher increase compared to the control group. The increase in erythrocyte levels in the intervention group was 0.67 million/µl while in the control group it was 0.26 million/µl. Analysis of the different test of erythrocyte levels in the intervention group and control group obtained p value = 0.000 which means that there is a significant effect between the intervention group and the control group after being given treatment.

DISCUSSION

1. Effect of Giving Salam Leaf Nanoparticles to Increase in Hemoglobin Levels

The results of this study showed that there was a significant difference in the mean of the control group and the intervention group after being given bay leaf nanoparticles in combination with Fe tablets for 14 days at a dose of 1500 mg (p = 0.019, effect size 1.10, which means strong). The intervention group experienced a greater increase in hemoglobin levels than the control group (1.35±0.37 vs 0.52±0.20).

Salam leaf nanoparticles consumed for 14 days have been shown to increase hemoglobin levels in adolescent girls with anemia at Junior High School 1 Siak Hulu, Kampar Regency. This increase in hemoglobin levels is due to the content in salam leaves, namely iron, Vitamin C, protein, folate, flavonoids and Vitamin A.[14]

In the body, iron plays a role in the formation of red blood cells. Red blood cells or hemoglobin function to transport oxygen from the lungs to the body's tissues. The most important function of iron is to increase the development of the nervous system which is needed in the process of myelination, neurotransmitter, dendrite formation and neurometabolism..[21]

Sources of iron derived from plant foods are sources of non-heme iron in the form of ferric bonds (fe3+). The ferrous iron is then reduced by gastric juice (HCl) so that it turns into ferrous (fe2+) so that it will be more easily absorbed in the intestinal mucosal cells. Through a complex process, iron is absorbed in the duodenum and upper jejunum. In the stomach, iron in the form of ferric will be dissolved by gastric acid and then bound by gastriferin to be reduced to ferrous. Furthermore, in the intestine ferrous undergoes an oxidation process to ferric which will be bound by apoferritin, then will be converted into ferritin and release ferrous into blood plasma. In the blood plasma ferrous is oxidized and binds to transferrin which will transport ferrous to the bone marrow to combine to form hemoglobin. Transferrin transports ferrous into iron stores in the liver, spleen, bone marrow and reticuloendothelial system which is then oxidized to ferric.[18]

Vitamin C can help the absorption of iron in the body by reducing ferric iron to ferrous in the small intestine so that it is easily absorbed by the body. Vitamin C can increase acidity, besides that Vitamin C can form iron ascorbate groups which remain soluble at high pH in the duodenum so that it can increase iron absorption by up to 30%.[22,23]

A previous study stated that bay leaf extract induced in iron deficiency anemia rats with a dose of 6.6 mg could increase hemoglobin levels in anemic rats by 2.65 g/dl (p=0.000).[18] Another study also stated that bay leaf nanoparticles can increase hemoglobin levels in anemic postpartum mothers with a conversion dose of 73.9 mg Salam leaf nanoparticles can increase the average hemoglobin level in anemic postpartum mothers by 1.475 gr/dl intervention for 21 days (p=0.000).[24]

2. Effect of Giving Salam Leaf Nanoparticles to Increase in Hematocrit Levels

This study showed that there was a significant difference in the mean of the control group and the intervention group after being given bay leaf nanoparticles in combination with Fe tablets for 14 days at a dose of 1500 mg (p = 0.005, effect size = 1.10, which means strong). The intervention group and the control group in this study both experienced an increase in hematocrit levels, but the increase in hematocrit levels in the intervention group was higher than the control group (1.60 ± 0.50 vs. 0.57 ± 0.27).

Hematocrit is the result of the ratio of red blood cells to blood volume, hematocrit levels will be low if adolescents are anemic. The unit of hematocrit value uses %, which means that if the hematocrit value is 40%, it means that there are 40 ml of red blood cells in 100 ml of blood. In conditions of anemia, bleeding and malnutrition or malnutrition, the hematocrit level will decrease.

Increased hematocrit levels are caused by the formation of too many red blood cells or erythrocytosis. While the decrease in hematocrit levels occurs due to the condition of the body experiencing anemia, malnutrition and kidney failure. Previous research on extracts used to increase hematocrit levels, namely the provision of long bean leaf extract which was studied by Nurjannah in 2020 where long bean leaf extract could increase the hematocrit levels of adolescent girls who have anemia.[25]

3. The Effect of Giving Bay Leaf Nanoparticles To Increase Erythrocyte Levels

The results of this study indicate that there is a significant difference in the mean in the control group and the intervention group after being given bay leaf nanoparticles in combination with Fe tablets for 14 days at a dose of 1500 mg ($p = 0.011$, effect size = 1.25 which means strong). The intervention group experienced a higher increase than the control group (0.67±0.09 vs 0.26±0.12).

Erythrocytes are the most abundant cells in the blood that contain protein compounds, namely globin which is conjugated with the heme pigment and forms hemoglobin. One of the functions of erythrocytes is to transport oxygen to body tissues. Erythrocytes are composed of a membrane that surrounds hemoglobin. The erythrocyte membrane is surrounded by plasmalemma which is composed of carbohydrates, proteins, oligosaccharides and lipids. Erythrocytes are limited by a selectively permeable membrane that causes the exchange of certain substances from the inside out and vice versa.[26]

Erythrocytes developing in the marrow have a nucleus that is expelled before the erythrocytes are released into the circulation. While young erythrocytes that do not have a nucleus are called reticulocytes that retain RNA. Dietary iron enters intestinal cells through specific transport means then iron is used by cells to be stored as ferritin or transferred to plasma. Then plasma transfers iron from erythrocytes to a transport protein called apotransferrin via ferroportin which is facilitated by hepaestin. Apotransferrin binds to iron called transferrin so that iron is not free in circulation.[27]

CONCLUSION

1. Giving salam leaf nanoparticles 1500 mg in combination with 60 mg Fe tablets given to anemic adolescent girls every day for 14 days can significantly increase hemoglobin levels.
2. Giving bay leaf nanoparticles 1500 mg in combination with 60 mg Fe tablets given to anemic adolescent girls every day for 14 days can significantly increase hemoglobin levels
3. Giving bay leaf nanoparticles 1500 mg in combination with 60 mg Fe tablets given to anemic adolescent girls every day for 14 days can significantly increase erythrocyte levels.

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How to cite this article: Diana Rifka Yulia wahyuni, Runjati, Aris Santjaka, Mardiyono. Salam Leaf Nanoparticles Against Hemoglobin, Erythrocyte Hematocrit Levels Adolescent Girls Anemia. Int J of Allied Med Sci and Clin Res 2022; 10(1): 21-26.

Source of Support: Nil. **Conflict of Interest:** None declared.