



## Effectiveness Combination of Torbangun Leaf and Red Guava Fruit Extract to Changes in Hemoglobin, Hematocrit, Erythrocyte and Oxygen Saturation Levels Adolescent Girls Anemia

Almas Syauqina Idzni<sup>1</sup>, Mardiyono<sup>2</sup>, Suryati Kumorowulan<sup>3</sup>

<sup>1</sup> Midwifery Student, Master Applied of Semarang Health Polytechnic, Semarang, Indonesia

<sup>2</sup> Department of Nursing, Master Applied of Semarang Health Polytechnic, Semarang, Indonesia

<sup>3</sup> Health Research and Development Center, Magelang, Indonesia

Corresponding Author : Almas Syauqina Idzni

### ABSTRACT

#### Background

Anemia is a non-communicable disease that can cause various impacts such as decreased body resistance so that it is susceptible to disease, decreased fitness in thinking, decreased learning achievement or work productivity/performance. Efforts that have been made related to anemia are by giving TTD (blood boost tablets) but the incidence of anemia is still relatively high. Therapy that can be given to overcome anemia is a complementary therapy, namely torbangun leaf extract containing 113 mg/1 gram Fe and red guava fruit containing 52 mg/L vitamin C. Torbangun leaves have the advantage that they have a high Fe content, then red guava have a high vitamin C content.

#### Purpose

Analyze the effectiveness combination of torbangun leaves extracts and red guava fruit on increasing hemoglobin, hematocrit, erythrocyte and oxygen saturation levels in adolescent girls anemia.

#### Method

The type of research is true experiment with a simple random sampling technique. The number of samples was 34 adolescent girls, 17 samples were in the control group, and 17 were in the intervention group. This study used a combination of extracts made into powder, namely torbangun leaves (1000 mg) and red guava fruit (500 mg) which were combined into one capsule with a dose of 1.5 grams given 3 x 1 for 14 days. The tool used to measure hemoglobin, hematocrit, erythrocytes with a hematology analyzer, and oxygen saturation using a pulse oximeter.

#### Results

There was a significant increase in increasing the levels of hemoglobin, hematocrit, erythrocyte and oxygen saturation. Each treatment was assessed from the average difference in the control and intervention groups. Hemoglobin ( $p=0.000$ ,  $0.51\pm 0.30$  vs  $1.12\pm 0.40$ ), hematocrit ( $p=0.001$ ,  $2.00\pm 0.93$  vs  $3.76\pm 1.64$ ), erythrocyte ( $p=0.000$ ,  $0.16\pm 0.10$  vs  $0.40\pm 0.22$ ), Oxygen Saturation ( $p=0.000$ ,  $0.82\pm 0.63$  vs  $1.94\pm 0.65$ ).

#### Conclusion

Giving a combination of torbangun leaf extract and red guava fruit 1.5 grams and Fe tablets are effective in increasing the levels of hemoglobin, hematocrit, erythrocyte and oxygen saturation

**Keywords:** Torbangun Extract, Red Guava, Adolescent Anemia, Hematological Status

## INTRODUCTION

Anemia is a condition in the body where the level of hemoglobin (Hb) in the blood is lower than normal. Hemoglobin is one of the components of red blood cells that functions to bind oxygen and deliver it to all body tissue cells. This O<sub>2</sub> is needed by the body (brain and muscles tissue) because if there is a lack of oxygen it can cause a lack of concentration.<sup>1</sup>

Erythrocyte also plays an important role in the blood, erythrocyte is made in the spinal cord which is normally biconcave in shape, has no nucleus, and contains hemoglobin. The biomolecule that contains iron and can bind oxygen is called hemoglobin. The role of hemoglobin is to transport O<sub>2</sub> in the lungs and then the O<sub>2</sub> will be released when the erythrocyte crosses the capillaries. So hemoglobin and erythrocyte have an important role in the process of transporting oxygen throughout the body.<sup>2</sup>

Hematocrit is a blood test used to determine the total volume of erythrocyte in the blood in 100 ml expressed in percent (%).<sup>3</sup> Oxygen saturation is very important to know because oxygen saturation is oxygen bound by hemoglobin in the bloodstream and is the process of distributing blood containing O<sub>2</sub> from arteries to body tissues.<sup>4</sup>

Anemia in adolescent girls can have an impact: exposure to infectious diseases because anemia has an impact on lowering the body's resistance the immune system, fitness and clarity of thought will decrease due to lack of oxygen to muscle cells and brain cells, besides that it can have an impact on decreasing learning achievement and performance.<sup>5</sup>

According to WHO 1993-2005, the prevalence of anemia is 40-88%. The incidence of anemia in adolescents according to WHO is 53.7%. The causes of anemia include menstruation, diet, and stress<sup>1</sup>. The incidence of anemia in Indonesia increased in 2018, the prevalence in women was 27.2% and in men, 20.3%, the prevalence of anemia increased when compared to the prevalence in 2013 for anemia in adolescent girls as much as 23.9% and for men 18.4%. Meanwhile, based on the age group in 2013 the prevalence of anemia at the age of 5 years-14 years (26.4%) and the age of 15 years-24 years (18.4%) but in 2018 the prevalence of anemia increased in the age of 5 years-14 years (26, 8%) and at the age of 15 years-24 years (32%). Then in Central Java

Province the prevalence of iron nutritional anemia in women was 26.5%. In Pemalang Regency the incidence of adolescent anemia in 2010 was 32.28%, 2012 was 10.96%, 2014 was 20.46%, and in 2017 research conducted by Aulia et al. 48.2%.<sup>6 7</sup>

Efforts to improve adolescent health require an intervention to improve hemoglobin, hematocrit, erythrocyt, and oxygen saturation values. The intervention will combine torbangun leaves and red guava fruit. Both of these ingredients have their respective advantages, such as the content of red guava fruit, which has several higher levels compared to torbangun leaves, including vitamin C, protein. Meanwhile, torbangun leaves are superior in Fe and beta carotene content. The function of each of these contents is that iron serves to help form blood cells or synthesize hemoglobin and help carry O<sub>2</sub> from the lungs to body tissues. Then that helps in the absorption of iron as well as moving it from transferrin to ferritin is vitamin C, beta carotene plays a role in helping the process of forming erythrocytes (red blood cells) in the bone marrow and helps maintain the immune system, vitamin B6 is a nutrient that affects the synthesis of hemoglobin, vitamin A plays a role in moving FE reserves/iron in the liver and also increases erythropoiesis<sup>8 9 10</sup>. So that if the intervention is carried out in combination, it will obtain maximum research results.

## METHODS

This type of research uses True Experiments with a randomized pretest-posttest with control group design.

The population in this study were all teenagers in the working area of the Purwoharjo Health Center, Comal District. The sample in this study amounted to 34 people who have been determined according to the inclusion and exclusion criteria by using a simple random sampling method using a lottery.

The sample was divided into a control group who was given 60 mg Fe tablets and the intervention group was given 60 mg Fe tablets and a combination of torbangun leaf and red guava fruit extract.

The intervention was given for 14 days. With a dose of 1500 mg (torbangun leaves 1000 mg and red guava fruit 500 mg). This dose contains 0.296 mg of Fe and 26 mg of Vitamin C. Data analysis used *paired t-test* dan *Indepent sample t test*.

**RESULTS**

**Tabel 1: Analysis Effectiveness of Combination Torbangun Leaf and Red Guava Fruit Extract + Fe Tablets on Changes in Hemoglobin Levels**

	Control Mean ± SD	Intervention Mean ± SD	P-value
Pre Test	10.97 ± 0.524	10.98 ± 0.509	0.921 <sup>b</sup>
Post Test	11.39 ± 0.516	12.11 ± 0.438	0.000 <sup>b</sup>
P-value	0.000 <sup>a</sup>	0.000 <sup>a</sup>	
Δ	0.51 ± 0.30	1.12 ± 0.40	0.000

a. paired t-test, b. Independent t-test

The hemoglobin levels of respondents in the control group and the intervention group increased. The increase in hemoglobin in the intervention group was more than the control group. The intervention group experienced an increase in hemoglobin levels of 1.12 g/dl, while the control group experienced an increase in hemoglobin levels of 0.51 g/dl.

The results of statistical analysis showed that in the control group p = 0.000 which means that there are different measurements. Then in the intervention group, the results of statistical tests showed that there was a difference in hemoglobin levels before and after treatment p = 0.000, which means that there was a significant difference.

**Tabel 2: Analysis Effectiveness of Combination Torbangun Leaf and Red Guava Fruit Extract + Fe Tablets on Changes in Hematocrit Levels**

	Control Mean ± SD	Intervention Mean ± SD	P-value
Pre Test	34.47 ± 1,62	34.88 ± 2.14	0.533 <sup>c</sup>
Post test	36.47 ± 1.66	38.65 ± 1.61	0.001 <sup>d</sup>
P-value	0.000 <sup>a</sup>	0.000 <sup>b</sup>	
Δ	2.00 ± 0.93	3.76 ± 1.64	0.001

a.Paired T Test, b.Uji Wilcoxon Test, c.Independent T Test, d.Mann Whitney

The results of the independent t test, it can be ascertained that the pretest p value shows the number > 0.05 so that there is no difference in the hematocrit levels in the pre test value, while in the post test the p-value shows the number 0.001 so it can be said that in the post test group there is a significant difference in hematocrit level.

Changes in the average hematocrit value obtained p = 0.001 indicates that the average difference between the two groups has a significant difference, where the group has an average difference in the increase in hematocrit levels of 2.00 and the intervention group is 3.76.

**Tabel 3: Analysis Effectiveness of Combination Torbangun Leaf and Red Guava Fruit Extract + Fe Tablets on Changes in Erythrocyte Levels**

	Control Mean ± SD	Intervention Mean ± SD	P-value
Pre Test	3.77 ± 0.26	1.85 ± 0,39	0.479 <sup>b</sup>
Post Test	3.95 ± 0.23	4,25 ± 0.27	0.002 <sup>b</sup>
P-value	0.000 <sup>a</sup>	0.000 <sup>a</sup>	
Δ	0.16 ± 0.10	0.40 ± 0.22	0.000

a.Paired t-test, b.Independent t-test

The results of the analysis showed that before the intervention  $p = 0.479$ , which means that there is no significant difference. Then after the intervention  $p = 0.002$  which means it shows a significant difference.

Changes in the average value of erythrocytes obtained  $p$  value = 0.000 indicates that the average

difference between the two groups has a significant difference, where the control group has an average difference of 0.16 erythrocyte levels increase and the intervention group is 0.40.

**Tabel 4: Analysis Effectiveness of Combination Torbangun Leaf and Red Guava Fruit Extract + Fe Tablets on Changes in Oxygen Saturation Levels**

	Control Mean ± SD	Intervention Mean ± SD	P-value
Pre Test	96.18 ± 0.72	95.88 ± 0.60	0.198 <sup>b</sup>
Post Test	97.00 ± 0.70	97.82 ± 0.39	0.001 <sup>b</sup>
P-value	0.001 <sup>a</sup>	0.000 <sup>a</sup>	
Δ	0.82 ± 0.63	1.94 ± 0.65	0.000

*a. Wilcoxon test, b. Mann Whitney*

The results of the Mann Whitney statistical test, it can be concluded that the value before treatment  $p = 0.198$  shows the number  $> 0.05$  so that there is no difference in oxygen saturation levels before treatment. While the post-test  $p$ -value shows the number 0.001 so it can be concluded that in the post-treatment group there is a significant difference in oxygen saturation levels.

Changes in the average value of oxygen saturation obtained  $p$ -value = 0.000 indicates that the average difference between the two groups has a significant difference, where the control group has an average difference in the increase in oxygen saturation levels of 0.82 and the intervention group is 1.94.

## DISCUSSION

1. Analysis Effectiveness of Giving Combination Torbangun Leaf and Red Guava Fruit Extract with FE Tablets on Hemoglobin levels.

The results of this study showed that the mean difference was in the control group and the intervention group after given a combination of torbangun leaf and red guava fruit extract + Fe tablets for 14 days with a dose of 1500 mg ( $p = 0.000$ , effect size 1.5), the intervention group experienced a greater increase in hemoglobin levels than the control group ( $1.12 \pm 0.40$  vs  $0.51 \pm 0.30$ ).

The intervention group was given a combination of torbangun leaves and red guava fruit extract a dose of 1.5 grams plus 60 mg Fe tablets. So that the intervention group received 60.296 mg Fe and 26 mg vitamin C. While the control group was only given 60 mg Fe tablets.

Torbangun leaves contain high iron content, Iron is useful for forming blood or synthesizing hemoglobin, besides that iron also plays a role in transporting oxygen from the lungs to body tissues. While red guava fruit contains high vitamin C, Vitamin C helps the absorption of iron to form hemoglobin and transfers iron from transferrin in the plasma to ferritin<sup>8</sup>. This study after a lab test in the UNDIP laboratory, the results for Fe before being extracted were 11.3 mg/100 grams and after being extracted it was 29.6 mg/100 grams. Meanwhile, Vitamin C in red guava fruit after being extracted is 52 mg/gram.

The intervention using torbangun leaves and red guava fruit ekstrak, both of these ingredients have their respective advantages, such as the content of red guava fruit is several levels higher than that of torbangun leaf, namely vitamin C. While torbangun leaves are superior in Fe content. The function of each of these contents is iron which serves to help form blood cells or synthesize hemoglobin and help carry O<sub>2</sub> from the lungs to body tissues. Then what helps in the absorption of iron and transfers it from transferrin to ferritin is vitamin C<sup>8 9 10</sup>.

The content of vitamin C based on research entitled the effectiveness of guava extract on hemoglobin levels stated that guava is a source of vitamin C. The role of vitamin C in iron absorption, helps convert ferric into ferrous. Guava contains vitamin C which will be absorbed by the small intestine through the duodenum by diffusion. iron can also be absorbed properly when consuming food sources of enhancers such as vitamin C.

Vitamin C can increase acidity so guava can help absorb iron in the stomach <sup>11</sup>

Previous research interventions that have been carried out in increasing hemoglobin levels in adolescents such as giving dates, red guava fruit juice, long bean leaf extract, etc. Research by Yuniarti and Yulia who examined date palm juice to increase hemoglobin in adolescent girls. The number of respondents was 34 people, 17 intervention groups and 17 control groups. This study used date palm juice consumed for 14 days. The results of this study were effective in increasing hemoglobin p-value < 0.05, effect size = 0.05 <sup>12</sup>.

Research from Handayani et al in 2021 related to red guava juice to increase hemoglobin levels in adolescent girls. This study used 30 respondents, 15 respondents became the control group, and 15 respondents became the intervention group. This study was conducted for 14 days with a dose of 100 grams. It can be concluded that red guava juice can effectively increase hemoglobin with a mean delta value of  $0.6 \pm 0.14$ , p-value = 0.001, effect size = 0.015 <sup>13</sup>.

2. Analysis Effectiveness of Giving Combination Torbangun Leaf and Red Guava Fruit Extract with FE Tablets on Hematocrit levels.

This study also measured hematocrit levels, in this study showed that there was a significant difference in the mean in the control group and the intervention group after given a combination of torbangun leaf and red guava fruit extract + Fe tablets for 14 days with a dose of 1500 mg (p = 0.000, effect size 1.1). In the control group and intervention groups in this study, the hematocrit level increased, in the intervention group it was higher than the control group. In the control group the mean difference was  $2.00 \pm 0.93$  and in the intervention group the mean difference was  $3.76 \pm 1.64$ .

Hematocrit value to calculate the average value on erythrocytes, and to determine anemia or not<sup>3</sup>. An increased hematocrit is caused by the formation of too many red blood cells or erythrocytosis. While a decrease in hematocrit levels can occur in several body conditions, such as anemia, acute blood loss, leukemia, pregnancy, malnutrition, kidney failure <sup>14</sup>. In practice, anemia can be indicated by a decrease in hemoglobin, hematocrit, and erythrocyte levels <sup>15</sup>.

Research related to increasing hematocrit levels is the giving of long bean leaf extract which was studied by Nurjanah et al in 2020. The number of respondents was 34 adolescent girl, divided into 2 groups, namely the control group was given Fe treatment and the intervention group was given long bean leaf extract. Giving this extract for 14 days with a dose of 200 mg with an iron content of 0.012 mg. In this study, it can be concluded that the long bean leaf extract was effective in increasing the hematocrit level, p=0.019, effect size=0.7 <sup>16</sup>.

3. Analysis Effectiveness of Giving Combination Torbangun Leaf and Red Guava Fruit Extract with FE Tablets on 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 a combination of torbangun leaf and red guava fruit extract + Fe tablets for 14 days with a dose of 1500 mg (p = 0.000, effect size 1.1). The intervention group experienced a greater increase in erythrocyte levels than the control group ( $0.40 \pm 0.22$  vs  $0.16 \pm 0.10$ ).

Blood in the body has an important role in the working mechanism of the body's organs. The most abundant type of blood cells in the body are red blood cells or erythrocytes<sup>17</sup>. Erythrocytes play a role an important in the blood, erythrocytes are made in the spinal cord which is normally biconcave in shape, has no nucleus, and contains hemoglobin. The biomolecule that contains iron and can bind oxygen is called hemoglobin. The role of hemoglobin is to transport O<sub>2</sub> in the lungs and then the O<sub>2</sub> will be released when erythrocytes cross the capillaries. So that hemoglobin and erythrocytes have an important role in the process of transporting oxygen throughout the body <sup>2</sup>.

4. Analysis Effectiveness of Giving Combination Torbangun Leaf and Red Guava Fruit Extract with FE Tablets on Oxygen Saturation Levels.

The result of this study also measured oxygen saturation levels, which showed that there was a significant difference in the control group and the intervention group after given a combination of torbangun leaf and red guava fruit extract + Fe tablets for 14 days with a dose of 1500 mg (p = 0.000, effect size 1,4). In the control group in this study, oxygen saturation levels increased by an average difference of 0.82, while in the

intervention group the average difference increased by 1.94.

Oxygen saturation is the percentage of oxygen carried by hemoglobin. Oxygen saturation is a measure of the percentage of hemoglobin to oxygen in the arteries. The transport of oxygen by hemoglobin is bound and dissolved. Decreased oxygen saturation is also known as respiratory distress. Oxyhemoglobin is very important for cell tissue metabolism. Hemoglobin is related to oxygen called affinity. If the affinity is low then hemoglobin will have difficulty binding oxygen, but if the affinity increases it will be easier for hemoglobin to bind oxygen<sup>18</sup>.

The increase in hemoglobin and oxygen saturation is in line with a study conducted by Sulastri et al in 2021 on the effectiveness of long beans and dragon fruit in increasing hemoglobin and oxygen saturation in adolescents. The intervention was carried out on 52 adolescents,

divided into 2 groups. First 26 groups with long bean intervention and 26 groups with dragon fruit intervention. This research can be concluded that long beans and dragon fruit are effective in increasing hemoglobin levels, and oxygen saturation.

## CONCLUSION

The combination of torbangun leaf and red guava fruit extract with a dose of 1500 mg given to anemic adolescent girls + Fe tablets for 14 days taken 3 x 1 (morning, afternoon, evening) has an effect and is beneficial in increasing the levels of hemoglobin, Hematocrit, Erythrocytes, Oxygen Saturation. There was a difference in the group that was given a combination of torbangun leaf and red guava fruit extract + Fe tablets with the group that only received Fe tablets in increasing the levels of Hemoglobin, Hematocrit, Erythrocytes, Oxygen Saturation.

## REFERENCES

1. WHO. Worldwide prevalence of anaemia 1993-2005. *Public Health Nutr.* 2009;12:444-54.
2. Amanda QP, Fatimah DS, Lestari S, Widiyastuti S, Oktaviani DJ, Ramadhan SA, et al. Hubungan Kadar hemoglobin, Eritrosit, dan Siklus Menstruasi pada Mahasiswa Farmasi Universitas Padjadjaran Angkatan 2016. *Farmaka.* 2016;17(2).
3. Mansyur A, Hematologi PP. Fakultas Kedokteran UNHAS Makassar. Makassar: Fakultas Kedokteran UNHAS Makassar. 2015;2015:3-4.
4. *Respirologi DD.* Jakarta: EGC; 2009.
5. Truman-Rosentsvit M, Berenbaum D, Spektor L, Cohen LA, Belizowsky-Moshe S, Lifshitz L, Ma J, Li W, Kesselman E, Abutbul-Ionita I, Danino D, Gutierrez L, Li H, Li K, Lou H, Regoni M, Poli M, Glaser F, Rouault TA, Meyron-Holtz EG. Ferritin is secreted via 2 distinct nonclassical vesicular pathways. *Blood.* 2018;131(3):342-52. doi: 10.1182/blood-2017-02-768580, PMID 29074498.
6. Kemenkes. Laporan Nasional Riset Kesehatan Dasar (Riskesmas) Indonesia tahun 2018. Riset Kesehatan Dasar 2018. Badan Penelitian Pengembangan Kesehatan. 2018:182-3.
7. Aulia DM, Kartasurya MI, Rahfiluddin MZ. Hubungan Asupan Zat Gizi dengan Status Gizi dan Kadar hemoglobin pada Remaja Putri Usia 13-15 Tahun dari Keluarga Nelayan (Studi di MTs. Anwar Pemalang Kecamatan Pemalang Kabupaten Pemalang Tahun 2017. *J Kesehatan Masyarakat.* 2017;6.
8. Siallagan D, Swamilaksita PD, Angkasa D. Pengaruh asupan Fe, vitamin A, vitamin B12, dan vitamin C terhadap kadar hemoglobin pada remaja vegan. *J Gizi Klin Indones.* 2016;13(2):67. doi: 10.22146/ijcn.22921.
9. Alit KN, Yuniarti S, Enggusti NA. Konsumsi jus Wortel selama Kemoterapi meningkatkan Kadar hemoglobin pasien kanker Serviks stadium II-B. *J Ners.* 2017;2(2):1-4.
10. Sofiyetti DE, Rahfiludin MZ, W. NS, Afifah DN. Pengaruh suplementasi seng dan vitamin B6 terhadap Kadar hemoglobin, hematokrit dan indeks eritrosit pasien malaria Vivax yang anemia. *Gizi Indones.* 2014;5(1):20-5.
11. Hasanlita H, Amir A, Defrin D. Efektifitas ekstrak Jambu Biji terhadap Kadar hemoglobin pada tikus Bunting. *J Kesehatan Andalas.* 2019;8(2):290. doi: 10.25077/jka.v8.i2.p290-294.2019.
12. Yuniarti YKD. Jurusan Kebidanan Poltekkes Kemenkes Palangka Raya Tujuan penelitian ini untuk mengidentifikasi pengaruh sari kurma pada remaja putri yang anemia defisiensi zat besi. *Mahakam Midwif J.* 2020;5(2):93-8.
13. Handayani TY, Tarigan KRA, Sari DP. Pengaruh jus Jambu Biji merah (*Psidium guajava*) terhadap meningkatkan Kadar hemoglobin pada remaja putri address: Phone. *J Kesehatan.* 2021;4(2):177-85.
14. Ratih RH. Pengaruh Pemberian Zat Besi (FE) terhadap Peningkatan Kadar Hematokrit pada Ibu Hamil yang mengalami anemia. *J Ners Kebidanan (J Ners Midwif).* 2018;5(1):034-8.

15. Agawemu CS, Rumampuk J, Moningka M. Hubungan antara viskositas darah dengan hematokrit pada penderita anemia dan orang normal. *eBM*. 2016;4(1). doi: 10.35790/ebm.4.1.2016.12485.
16. Nurjanah FW, Hadisaputro S, Fatmasari D. Long bean leaf extract for improving haematological status of female adolescent with anemia that gets Fe supplementation. *Kemas*. 2020;16(1):81-7. doi: 10.15294/kemas.v16i1.23203.
17. Truman-rosentsvit M, Berenbaum D, Spektor L, Cohen LA, Danino D, Gutierrez L, et al. Ferritin is secreted via two distinct non-classical vesicular pathways ferritin Trafficking and Secretion. *Am soc Hematol*. 2017 (October).
18. Mardalena I, Darurat AKG. Yogyakarta: Pustaka Baru; 2019.

**How to cite this article:** Almas Syauqina Idzni, Mardiyono, Suryati Kumorowulan. Effectiveness Combination of Torbangun Leaf and Red Guava Fruit Extract to Changes in Hemoglobin, Hematocrit, Erythrocyte and Oxygen Saturation Levels Adolescent Girls Anemia. *Int J of Allied Med Sci and Clin Res* 2022; 10(1): 71-77.

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