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EFFECT OF MORINGA LEAVES AND VITAMIN C CAPSULE COMBINATIONS IN INCREASEING HEMOGLOBIN LEVELS OF YOUNG WOMEN WITH ANEMIA

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ABSTRACT

***Background**: The prevalence of anemia suffered by girls aged 10-18 years according to the Household Health Survey (SKRT) is 57.1%. The highest contributor of anemia cases in Central Java is Grobogan district, especially in Tanggungharjo Community Health Center, with increasing prevalence of anemia among young women in 2017 from 5.4% to 25.7%. Based on background, researcher wants to determine the effect of Moringa leaf combination dozed 250 mg x 2 / day and vitamin C 50 mg x 2 / day on hemoglobin level changes of young women suffering anemia to decrease anemia in young women*
***Methodology**: This quasi experimental research with pretest-posttest control group design involved young women aged 14-19 years suffering anemia. The method of sampling selection was purposive sampling with total 22 respondents assigned as intervention group and other 22 respondent assigned as intervention group. The data analysis used Mann-Whitney test.*
***Results:** The average of hemoglobin level in the intervention group increased from 9.37 to 12.10. It proved statistically that there was effect of giving Moringa leaf and vitamin C combination to increase level of hemoglobin of young women suffering anemia.*
***Conclusion:** Moringa leaves could significantly increase hemoglobin levels in blood of young women suffering anemia. Raising awareness of anemia and its prevention and treatment among young women should be recommended.*

***Keywords**: Anemia, young women, Moringa leaf, Vitamin C, hemoglobin*

INTRODUCTION

Anemia is a nutritional problem spread throughout the world, both in developing and developed countries. Anemia in adolescence is a condition experienced by a teenager with hemoglobin level less than 12 gr [1]. According to Kulkarni's research *et al* (2012) adolescents suffering anemia have a high risk of death during pregnancy, the high risk of premature and low-weight babies, and high perinatal mortality and fetal disorders [2].

Based on Domestic Health Survey, in Central Java, the anemia case of young women aged 10-18 years in 2013 was 57.1% found in Grobogan district as the second highest contributor especially at Tanggungharjo Community Health Center from 2016 to 2017 and was increased by 5.4%.

The data above is in line with research conducted by Premalatha, *et al* (2012) that young women were not aware of anemia dangers with percentage 80.75% [3]. Therefore, the government created 2015-2019 National Medium-Term Development Plan (RPJMN) to change provision of blood tablets for girls aged 12-18 years at a dose of 1 tablet per week throughout the year in order to make more effective and easy implementation with 30% target in 2019.

One of Indonesian popular herbal medicine is Moringa leaf. Moringa leaf could increase hemoglobin levels. The contents of moringa leaf are 28.2 mg Fe, 2003 calcium, 16.3 vitamin A, 220mg vitamin C, and antioxidants [9]. Madukwe, *et* al research (2013), dried Moringa leaf powder is very effective to increase hemoglobin levels because Fe in moringa leaf has no side effects [4]. The dosage of moringa leaf based on Estiyani, *et* al (2017) stated that there was hemoglobin level change in postpartum mothers by consuming Moringa leaf capsule - 250 mg x 2 / day for 14 days, resulting in increasing hemoglobin levels about 11.9467 [6]. Consuming moringa supplement and vitamin C increase hemoglobin. Siti Asiyah, *et al.* (2014) stated that there were different effects of supplementation by having blood-supplemented tablets with vitamin C - 100 mg for 14 days on hemoglobin level changes found in 15 respondents with 16-32 week pregnancy in Keniten Village. , Mojo Subdistrict, Kediri Regency to have increasing level 1.1 gr / dL [7].

Based on this background, the authors are interested to conduct research on the effect of the combination of Moringa leaf capsules and vitamin C on hemoglobin level changes of young women at the Miftahul Huda Islamic Boarding School in Tanggungharjo Grobogan.

METHODOLOGY

After gaining ethical clearance, *076/KEPK/Poltekkes-Smg/EC/2018,* this quasi experimental research with *pretest-posttest control group design* was conducted. The population of this research consists of 180 girls from Islamic boarding school in February – April 2018. The reason to choose boarding was because their activities made them only working on one place and had same meal each other. The samples in this research are 44 respondents, evenly grouped into intervention group with Moringa and Vitamin C leaf capsules and control group with Fe tablet. The sampling technique uses purposive sampling with inclusive criteria: young women aged 14-19 years, already get menstruation, hb levels <11gr/dl.

The technique of collecting data are observation sheet and checking hb levels before and after intervention to determine difference of first and last hemoglobin normal level checks (above 11gr/dl) of young women in boarding schools.

Univariate data analysis was used to describe the frequency distribution for each data. Bivariate analysis used *paired t-test* to determine differences before and after treatment in each group and *Mann Whitney* test used to determine differences in the two groups are used to analyze the data.

RESULTS

Respondents in this study are young women suffering anemia. One of the characteristics in this study is age. The variable in this study is combination of Moringa leaf capsule and vitamin C.

Table 1. Characteristics of the Respondents' Ages

	N	Mean	SD	Min	Max
Intervention group	22	16.59	1.623	14	19
Control Group	22	16.77	1.850	14	19

Based on table 1, the average age of respondents in the intervention and control groups are equal, 16 years.

Table 2. Hemoglobin Level Average

		Mean	SD	Min	Max
Intervention group	Pre test	9.37	1.013	7	10.8
	Post test	12.1	1.158	10	14.1
Control Group	Pre test	16.77	0.9	7.2	10.2
	Post test	10.08	1.064	7.8	11.9

Based on table 2, the average of hemoglobin level in the intervention group before and after intervention increases from 9.37 to 12.10. Whereas in the control group before treatment the average hemoglobin level is 9.09, increases to 10.08.

Table 3. Normality Test of Hemoglobin Level

		Shapiro Wilk pvalue	Normality
Intervention group	Pre test	0.434	Normal
	Post test	0.714	Normal
Control Group	Pre test	0.104	Normal
	Post test	0.288	Normal
Difference of hb levels		0.019	Abnormal

Based on Figure 3, the normality test of data uses *Shapiro-Wilk*. The results of the data normality test in the intervention group and in the control group (*pre-posttest*) are known to have normal data distribution (*p-value* > 0.05). The statistical test to use is te *t-test (paired t-test)test* and *Mann-Whitney* with 95% confidence level and *a* <0.05.

Table 4. Homogeneity of Hemoglobin Level Results

	N	Pvalue	
Pretest Intervention group	22	0.543	Homogenous
Pretest Control Group	22		

Based on Table 4, the test results obtained before being given treatment both in the intervention group and the control group had a *p-value* of 0.543 (> 0.05), so it can be concluded that before each treatment was given in each group, hemoglobin level data is homogeneous.

Table 5. Differences of Hemoglobin Levels

	N	Mean Rank	Z	Pvalue
Intervention group	22	20.57	-4.559	0.001
Control Group	22	10.43	-3.025	

Based on Table 5, the results of statistical tests of 22 respondents in the intervention group before being intervened is averagely 9.37. It varies from 8.36 to 10.38, with the highest value 10.8 and the lowest

value 7. Meanwhile after being given treatment the average hemoglobin level is 12.1 which varies from 10.94 to 14.03 with the highest value 14.1 and the lowest value 10. After the effect test (carrying out *pretest and posttest*) by using the *dependent t-test,* it isobtained *p-value* 0.002 (<0.05) meaning there is effect of the combination of Moringa leaf capsules and vitamin C in increasing hemoglobin levels of young women suffering anemia.

In the control group with the number of respondents 22 people has an average score of hemoglobin before being intervened is 9.09, varying from 8.18 to 9.99, with the highest value 10.2 and the lowest value 7.2. After being intervened, the average score is 10.8, started from 9.47 to 11.86, with the highest value 11.9 and the lowest value 7.8. After an influence test using *an independent t-test* (*pre-posttests*), it is obtained *p-value*0.000 (<0.05), so it can be concluded that there is effect of giving Fe tablets to increase hemoglobin levels in young women.

Table 6. Effect of Giving Moringa Leaf and Vitamin C Combination of Capsules on Hemoglobin Level Changes

	Groups	N	Mean	*P-Value*
Δ	Intervention	22	32.20	0.001
	Control	22	12.80	

**Mann-Whitney*

Based on the tables 6, the results of statistical tests using *Mann-Whitney* test obtains *p-value* 0.001 (p <0.05), so it can be concluded that there is significant difference of in hemoglobin levels in the intervention group and the control group, and the results shows that there is effect of the combination of Moringa and Vitamin C leaf capsule on increasing hemoglobin levels in young women with a *p-value* <0.05.

DISCUSSION

Moringa is a plant that can be used as herbal medication vegetable. Substances of moringa leaves contain various macro and micro nutrients as well as active substance, such as antioxidants [8]. Moringa leaves contain important nutrients such as iron 28.2 mg (25 times more than spinach) and more absorbable into the blood [11], calcium 2003.0 mg and vitamin A 16.3 mg rich in β-carotene, protein 27.1 gr, vitamin A 16.3 mg, vitamin C 220.00 mg fresh leaves, vitamin E 113.00 mg, and vitamin B (thiamine 2.6 mg, riboflavin 20.5 mg, nicotinic acid 8.2 mg) [9]. Various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids. Moringa is also used as the main substance of hundreds of drugs, both for prevention and treatment, which are easily digested and assimilated by the human body [10]. According to the results of the study, leaves from Moringa trees contain various macro and micro nutrients as well as active substances which are antioxidants [8]. Moringa leaves contain important nutrients such as iron 28.2 mg, calcium 2003.0 mg and vitamin A 16.3 mg rich in β-carotene, protein 27.1 gr, vitamin A 16.3 mg, vitamin C 220.00 mg fresh leaves, vitamin E 113.00 mg, and vitamin B (thiamine 2.6 mg, riboflavin 20.5 mg, nicotinic acid 8.2 mg) [9]. Various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids. Moringa is also used as the main substance of hundreds of drugs, both for prevention and treatment, which are easily digested and assimilated by the human body [10].

Iron in Moringais 28.2 mg / 100 grams. Meanwhile on dried leaves, the content is 25 times more than spinach, 3 times more than almonds and 1.77 times more absorbable into the blood [11].

In this research shown that changes of hemoglobin levels seen on intervention group rises from 9.37 to 12.1. Moringa leaf supplementation can significantly increase hemoglobin levels within around 3 weeks about 0.794-0.81 because of Fe content [5]. This is in in line with study of Yulianti *et al.* (2016) stating

that increasing hemoglobin levels is caused Fe content in Moringa leaves by 91.72 mg per 100 grams of material [10]. This is also in line with Madukwe *et al* (2013) stating the content of Moringa leaves has high quality and quantity of protein, iron, vitamins A and C [4].

In this study, the reason of combining Moringa leaves with vitamin C because vitamin C is a micronutrient that also plays a role in the formation of red blood cells. The presence of vitamin C in consumed food facilitates the reduction of ferric iron to ferro which is more easily absorbed by the small intestine. Iron absorption *Non-heme* increases four times greater when there is vitamin C [12]. Vitamin C inhibits the formation of hemosiderin which is difficult to mobilize and to freed iron if needed. Therefore, the best way to consume Fe tablets is combining the tablets with orange juice or vit C drink.

Research conducted by Asiyah, *et al* (2014), states that there are differences in the effect of supplementation of Fe blood supplementation tablets, with and without vitamin C on hemoglobin levels of pregnant women with 16-32 weeks gestational age in Keniten Village, Mojo District, Regency Kediri. Provision of Fe-supplemented tablets with vitamin C has been more effective in increasing hemoglobin levels than tablets with only Fe blood [7]. The researcher did not use vitamin C on control group because it will not make any differences with intervention group (moringa leaf and vit c) and the standart treatment for anemic young women is only Dw tablets. Supported by Trisnawati's research (2014), it shows that the direction of the correlation between vitamin C intake and the anemia case in the same direction, in which the better intake of vitamin C, the lower anemia cases will be (13). The correlation between vitamin C intake and the anemia cases shows positive correlation indicating that the higher the intake of vitamin C, the higher the hemoglobin level. It means anemia cases are getting lower. It proves that vitamin C can increase iron absorption in the body [14].

The process of iron absorption in the form of Ferric (Fe^{3+}) or Ferro (Fe^{2+}) initially undergoes within process of digestion. In the intestine, Fe^{3+} dissolves within stomach acid then is bound by gastroferin and reduced to Fe^{2+}. In the intestine, Fe^{2+} ^{is} oxidized to Fe^{3+}, then binds to *apoferritin* which is then transformed into *ferritin*, releasing Fe^{2+} into blood plasma. Vitamin C consumed will help the process of absorption of iron (Fe^{2+}) in the small intestine. Within the plasma, Fe^{2+}will bind by transferrin. Transferrin transports Fe^{2+} into the bone marrow to join and to form hemoglobin [15].

Based on the results of statistical tests using *Mann-Whitney*, it is obtained *p-value* 0.001 (p<0.05) so it can be concluded that there is effect of giving a combination of Moringa leaf capsule and vitamin C to increasing hemoglobin levels of young women suffering anemia.

This is in line with Yulianti (2016) stating there is a significant effect between Moringa leaf extract on increasing hemoglobin levels in young women with *p-value* = 0,000. Thus, it is in line with studies that *Moringa oleifera* significantly increases hemoglobin levels of young women suffering anemia [16].

CONCLUSION

Based on the results of the study it can be concluded that combination of moringa leaf capsule and vitamin C could increase hemoglobin levels significantly. There is significant difference in hemoglobin levels between the intervention group and the control group with *p-value* 0.001 (p <0.05) due to the combination of capsules and Moringa and vitamin C.

ADVICE

1) Young women
   Advices for young women should be aware of anemia since early stage, consume healthy foods (balanced nutrition), and consume Fe tablets as doctor recommended.
2) Midwives

Advices for midwives should educate young women with anemia since early stage, recommend young women to consume balanced nutrition and Fe tablets, and check periodically hemoglobin levels of young women to prevent anemia.

3) Community people
They should help midwives to promote awareness of anemia

4) Further researcher
Further researcher should continue this research by observing food recall, menstrual patterns, or disturbance factors, or larging the samples.

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