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ORIGINAL RESEARCH

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EFFECT OF CONSUMING RED SPINACH (*AMARANTHUS TRICOLOR L*) EXTRACT ON HEMOGLOBIN LEVEL IN POSTPARTUM MOTHERS

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ABSTRACT

Background: Postpartum mothers are susceptible to anemia, due to loss of blood count during labor. Postpartum anemia causes uterine subinvolution which causes postpartum hemorrhage, facilitates puerperium infection, decreases breastfeeding and causes mammae infection. One alternative to prevent anemia in postpartum is to consume vegetables with high iron one red spinach. Red spinach is one of the non-heme iron sources needed to synthesize hemoglobin.

Objective: To determine the effect of red spinach in increasing the levels of hemoglobin in postpartum mothers.

Methods: This was a quasi-experiment with pretest posttest with control group design in October-December 2017 at the Community Health Center of PONEK Tarub, Tegal regency, Indonesia. Thirty postpartum mothers were included using purposive sampling, which 15 assigned in each group. Blood sampling and examination were performed in each respondent. Paired and Independent t-test were done for data analysis.

Results: The results of the 14-day intervention of given red spinach extract showed that there was a significant increase of hemoglobin level (1.25 g / dL) with p-value 0.047.

Conclusion: There is a significant effect of consuming red spinach extract (*Amaranthus tricolor L.*) on the increase of hemoglobin level in postpartum mother. It is recommended that midwives could apply this intervention and cooperate with agriculture and food processing in order to produce red spinach extract that increases hemoglobin, hematocrit and erythrocytes levels.

Keywords: red spinach, *Amaranthus tricolor l*, hemoglobin level, postpartum mothers

INTRODUCTION

Anemia is one of the causes of maternal death.¹ The prevalence rate of anemia is still high, which is 14% in developed

countries and 51% in developing countries.¹ According to WHO (World Health Organization), the higher

prevalence of anemia is among pregnant women group,² supported by Taner et al³ who said that the prevalence of anemia in women is 41.6%.

In Indonesia, the maternal mortality rate is 220 per 100,000 live births, which is 30% due to anemia.¹ While maternal mortality rate in Tegal district has increased significantly from 146.6 in 2013 to 173 per 100,000 live births in 2014.⁴ Anemia has been the third rank of the indirect causes of the maternal mortality.⁴ Therefore the effort the decrease mortality rate is necessity.

The government of Indonesia has been implementing interventions to reduce the number of maternal mortality, such as Basic Emergency Neonatal Obstetric Services (PONED), which is applied in the community health center in Tegal district.⁴

Anemia does not only occur during pregnancy, but also during puerperium. Postpartum anemia leads to uterine subinvolution, hemorrhage, and infection.⁵ Thus to prevent anemia among postpartum mothers is needed. One of the preventive efforts is by consuming red spinach or *Amaranthus Tricolor L* as proposed in this study.

Red spinach has been widely cultivated throughout Indonesia, especially in the mountain areas. It is also easily found both in traditional and modern markets, even some people plant spinach. Spinach contains protein, fat, carbohydrates, potassium, iron, amarantin, routine, purines, and vitamins A, B and C.⁶ Society believe that red spinach can improve kidney function, and digestion because of high fiber content. It is also good for diabetics, high cholesterol, hypertension, anemia, and for maintaining balance of body weight and cleansing of puerperal blood.⁶ Spinach also contains carotenoids and flavonoids that are active

substances with antioxidant properties. The main type of carotenoids in spinach is beta carotene, while the other active substance is chlorophyll. While the types of flavonoids contained in spinach are lutein and quercetin. Quercetin is a powerful antioxidant, which is able to capture superoxide free radicals and inhibit oxidation of LDL cholesterol. In addition, there are two types of spinach, i.e. green spinach and red spinach. Both are rich in vitamin C, but green spinach is richer in vitamin A while red spinach contains more iron.⁶ However, although red spinach has more iron and usually consumed in the society. Little is known about the effect of red spinach in increasing iron, particularly in postpartum mothers. Most of the studies were conducted in mice.

Fajria et al states that red spinach extract increase iron and hemoglobin levels in the blood of mice equal to 17.5% compared with iron supplement.⁷ Aryani et al⁸ showed that the dose of water extract of red spinach leaves affect the amount of erythrocytes and hemoglobin levels in white mice. The most influential dose was the treatment with a dose of 1 gram / Kg weight. Gideon mentioned that there was an increase in Fe serum in Wistar strain female rats, with a mean of total serum of Fe value was 106.7 µg / dL to 113.5 µg / dL after given an infusion of red spinach leaf with dose 10% given as much as 3 cc per day.⁹ Therefore, the objective of this study was to determine the effect of red spinach in increasing the levels of hemoglobin in postpartum mothers.

METHODS

Design

This was a quasi-experiment with pretest posttest with control group design.

Setting

The study was conducted in October-December 2017 at the Community Health Center of Poned Tarub, Tegal regency.

Population and Sample

In this study, there were 30 postpartum mothers included using purposive sampling. Fifteen respondents were assigned in each group. The inclusion criteria were: 1) postpartum mothers (the 1st - 21st day), 2) Mothers with mid-upper arm circumference ≥ 23.5 cm, 3) Mothers who did not consume herbs, 4) Willing to be a respondent. The exclusion criteria were: 1) Sick postpartum mothers and 2) postpartum mothers with complication (infection.)

Intervention

In this study, mothers in the intervention and control group received Fe capsules in the same dose for 14 days. However, in the intervention group, mothers also received red spinach extract in the form of tablet, which was consumed three times per day or 1400 mg per day. The provision of Fe capsule and red spinach extract was given in stages, namely stage I only for 3 days at the beginning of administration after the pretest. Then the researcher was assisted by two enumerators (midwives) to do a home visit as a stage II to give Fe capsule and red spinach extract for the next 3 days, and continued until 5 stages and ended at the day 14. These steps were done in order that the researcher could monitor and ensure that the Fe capsule and red spinach extract were properly consumed regularly up to 14 days intervention in both control and intervention groups. Provision of Fe capsules and red spinach extract capsules was done for 14 days because the erythropoiesis process occurs in 7 days, and formation or synthesis of hemoglobin

takes approximately 7-10 days until it becomes mature and ready to be circulated throughout the body with red blood cells.^{10,11}

Instrument

Blood sampling and examination were performed before and after intervention (the day 15). All blood examination was examination on the lab.

Data analysis

Comparative test of mean difference of hemoglobin level between treatment and control group was analyzed using independent t-test because the data were normally distributed. Paired t-test was also performed to see the effect of intervention.

RESULTS

Table 1 shows that the majority of the respondents in the intervention and control group aged 25-27 years, had normal BMI, 26 MUAC, 40% appropriate intake, and not working. Analysis showed p-value > 0.05 in all variables, which indicated that there was no significant difference of the characteristics of the respondents between intervention and control group.

Independent t-test as shown in the table 2 indicated that there is no difference of hemoglobin level in the intervention and control group with p-value 0.743. However, there is statistically significant difference of hemoglobin after intervention with p-value 0.023 in the intervention and control group.

While paired t-test showed there is a significant effect of red spinach in the intervention group and standard intervention in the control group on hemoglobin in postpartum mothers with p-value < 0.05 . However, the mean

difference of hemoglobin level in the intervention group (1.253) was higher

than hemoglobin in the control group (0.307).

Table 1 Characteristic of Postpartum mothers in the intervention and control group

Characteristics of respondents	Group		p-value
	Intervention	Control	
Age (Year)			
Mean ± SD	25.60±4.120	27.80±5.031	0.426
Median	24.00	27.00	
Min±max	20±32	20±30	
Body Mass Index			
Thin	0.00 %	0.00 %	0.916
Normal	60.0%	73.3%	
Overweight	40.0%	26.7%	
Mid Upper Arm Circumference (Cm)			
Mean ± SD	25.93±1.486	26.20±1.568	0.897
Median	26.00	26.00	
Min±max	24±28	24±29	
Nutrition intake			
Appropriate	40.0%	46.7%	0.139
Inappropriate	60.0%	53.3%	
Educational level			
Low	73.3%	60.0%	0.150
Middle	26.7%	40.0%	
High	0.00 %	0.00%	
Working status			
Working	40.0%	53.3%	0.134
Not working	60.0%	46.7%	

Table 2 Difference of hemoglobin levels in the intervention and control group

Hemoglobin (g/dL)	Group		p-value
	Intervention	Control	
Pretest			
Mean ± SD	11.57±1.37	11.71±1.04	0.743 ¹
Min±max	9.60±13.70	9.60±13.20	
Posttest			
Mean ± SD	12.91±0.97	12.02±1.06	0.023 ¹
Min±max	11.40±14.30	9.90±13.80	
Mean difference of pretest-posttest			
p-value	0.000 ²	0.001 ²	
Difference of mean of hemoglobin level			
Mean±SD	1.253±0.49	0.307±0.27	0.000 ²
Min±max	0.2±1.9	0.00±1.00	

¹Independent t-test ²Paired t-test

DISCUSSION

The aim of this study was to determine the effect of red spinach on hemoglobin level. Findings of this study revealed that red spinach or *Amaranthus Tricolor L* has a significant effect on the increase of hemoglobin levels. This indicates that red spinach increases the hemoglobin not only in rats, but also in human, particularly in postpartum women.

The increase of hemoglobin in this study because of red spinach contains more iron, which is easy to be absorbed in the duodenum and upper intestine (proximal jejunum).¹² Non-hem iron in food and inorganic iron salts or other complexes must first be converted to ferrous free iron before being absorbed by intestinal mucosal cells.^{10,12} The iron will soon join in the blood plasma with beta globulin, i.e., apotransferrin, to form transferrin, which is then transported in plasma. This iron loosely binds to the transferrin and consequently can be released into every cell of tissue in each part in the body. In the cell cytoplasm, this iron joins primarily with a protein, i.e., apoferritin to form ferritin.¹⁰ Apoferritin has a molecular weight of about 460,000, and various amounts of iron can join in the form of a group of iron radicals with this large molecule. Ferritin may contain only a small amount of iron or even a large amount of iron. The iron stored as ferritin is called a spare iron.¹⁰

In addition to the high iron content, there are other substances in the content of red spinach that plays a role in the formation of hemoglobin and erythrocytes.¹¹ Folic acid and vitamin B12 are the main ingredients in the formation of cell nuclei. Vitamin B6 and amino acids and glycine in red spinach in the initial reaction of heme formation. Vitamin B6 and B12 are needed in the process of formation of globin synthesis.¹¹

While Vitamin C in red spinach is also very helpful for the absorption of non-heme iron by changing the shape of ferric to ferrous so as to facilitate the body in the iron absorption process. High iron and vitamin C content in red spinach causes iron more easily absorbed by the body four times faster than without vitamin C.¹³

However, the result of this study is in line with Astuti et al who mentioned that the hemoglobin level in pregnant women was increased 0.93 gr/dL after given red spinach extract in two weeks. This study provides evidence that red spinach could increase the level of hemoglobin (1.25 gr/dL) in postpartum women who received iron supplement capsules.

CONCLUSION

According to the results of this study, it can be concluded that there is a significant effect of consuming red spinach extract (*Amaranthus tricolor L.*) on the increase of hemoglobin level in postpartum mother. It is recommended that midwives could apply this intervention and cooperate with agriculture and food processing in order to produce red spinach extract that increases hemoglobin, hematocrit and erythrocytes. Further research is needed to investigate about the other substances contained in red spinach extract that can increase hemoglobin, hematocrit and erythrocyte levels; and also, research related to side effects of red spinach extract is needed.

Declaration of Conflicting Interest

None declared

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Author Contribution

All authors contributed equally in this study.

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