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Beetroot juice (*Beta Vulgaris L*) alternative handling of anemia in pregnancy

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ABSTRACT

Iron deficiency anemia has become an important issue not only at the global level but even internationally. Iron supplementation is chosen as a solution to overcome iron deficiency anemia during pregnancy. The choice of iron as a solution has a negative effect because iron can initiate oxidative stress which is bad for health. The purpose of this study was to comparing the effect of supplementing Fe and beetroot juice in the treatment of anemia in pregnant female rats. This research was experimental study with a Randomized Posttest Only Control Group Design. The sample used was 20 pregnant female rats. The variables of this study were erythrocytes counts and hemoglobin levels. Statistical testing used the One-way ANOVA test. The mean of erythrocytes counted in the beetroot juice group of beetroot 3.6 gr /BW was able to compensate for the average of erythrocytes counts in the Fe supplementation group 1.08 mg/BW, followed by the group of 1.8g/BW beetroot juice. The average analysis of beetroot juice 3.6 gr/BW had no difference with the supplementation of Fe 1.08 mg/BW. This fact shows that the administration of 3.6 gr/BW beetroot juice was as effective as the supplementation of Fe 1.08 mg/BW in increasing hemoglobin levels. Beetroot juice was proven as an alternative product for handling anemia during pregnancy.

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INTRODUCTION

The need for iron during pregnancy is significantly higher than not getting pregnant. This need will increase with increasing gestational age. The increase began to be felt in the second trimester marked by the expansion of red blood cell mass, increased iron transfer from mother to fetus, placental growth, restoration of post-saline conditions and preparation for lactation. However, the fact is iron-deficiency anemia remains a problem in almost every pregnancy. This shows the supply of iron in pregnant women has not been able to meet the increasing needs, so supplementation is the solution to this problem[1].

Iron deficiency anemia has become an important issue not only at the global level but even internationally. In 2018 there were 48.9% of pregnant women in Indonesia suffering from anemia[2]. World Health Organization (WHO) as the world health body recommends iron supplementation 30-60 mg/day during pregnancy[4]. The Government of Indonesia through the Ministry of Health of the Republic of Indonesia issued Minister of Health Regulation No.88 of 2014 concerning the Standard for Adding Blood Tablets for Fertile Women and Pregnant Women. The Minister of Health said that to overcome iron

nutritional anemia in women of childbearing age with priority in pregnant women, 60 Fe tablets were given daily during pregnancy or at least 90 tablets[5].

Iron is an important element needed by the body in preventing anemia but on the other hand, iron also has a detrimental effect on the body, which can initiate oxidative stress reactions that are believed to be one of the causes of pathological conditions in the body[3]. It is also known that in pregnancy there is a tendency to increase in free radicals compared to non-pregnant conditions so that the presence of iron will automatically further increase free radicals in the body[6].

The use of natural medicines for the treatment of anemia one of which aims to avoid the toxic effects of iron. Several natural plants are known to have an effect in preventing anemia, one of which is beetroot or known by the Latin name Beta Vulgaris L. Beta Vulgaris L increases the number of red blood cells and hemoglobin concentration as a sign of anemia[8]. Selection of beetroot (Beta Vulgaris L) as an anemia supplementation because it is known that Beta Vulgaris L is rich in folic acid which is good for heart health, a source of fiber, potassium, magnesium, iron, vitamin C[8] besides that beta Vulgaris is also antiradical, antimicrobial and has cytotoxic activity[7,10,11]. Previous studies have provided evidence that beetroot has a good effect on regulating body iron balance, such as an increase in hemoglobin levels, hematocrit, serum iron, ferritin levels, erythrocytes counts and MCV, MCH, MCHC. The fact that beetroot provides many benefits for the body's iron balance encourages the conduct of this study[8,9,18,19,20].

METHOD

This research is purely experimental. The experimental design used was the Randomized Posttest Only Control Group Design. *Ethical clearance* in this study has been established by the Ethics Committee University of Respati Yogyakarta with document number No.210.3/UNRIYO/PL/VIII/2018. Aimed at comparing the effects of Fe supplementation and beetroot juice in the treatment of anemia in pregnant rats. The sample of this study was divided into five groups were show in table 1.

Table 1 Division of Research Groups

No	Observation Groups	Treatment
1	Negative control group	Group of rats without any treatment or healthy pregnant rat
2	Positive control group	Group of rats that were treated with low Fe foods so that they were anemic
3	Iron supplementation 1.08 mg / BW group	Group of rats that were treated with low Fe foods so that they were anemic and were given iron supplementation with Ferro Sulfate 300 mg was equivalent to 60 mg of an iron element (1.08 mg / BW)
4	Beetroot juice 3.6 gr / BW	Group of rats that were treated with low Fe foods so that they were anemic and were given beetroot juice of 3.6 gr / BW
5	Beetroot juice 1.8 gr / BW group	Group of rats that were treated with low Fe foods so that they were anemic and were given beetroot juice of 1.8 gr / BW

Acclimatization was carried out for 7 days before the rats were treated. Milling is done by paying attention to the mating time of the mouse, which is during the estrus period. This phase lasts approximately 12 hours, often at night[12]. Mating is done by mixing female and male rats in a ratio of 1: 2 in each cage. Treatment of female rats (*Rattus norvegicus*) was carried out for 21 days. Rat maintenance was carried out in the Laboratory of the Center for Food and Nutrition Studies at the University of Gajah Mada Yogyakarta. Measurement of erythrocytes counts and hemoglobin levels was carried out through rat orbital veins just before treatment and after treatment. Analysis of the data used was ANOVA One Way.

RESULT

Comparison of Mean Erythrocytes Counts

Analysis of mean erythrocytes counts using the Anova One Way analysis test showed a significant difference in the mean of the five observation groups, indicated by the p-value < 0,001. Table 2 shows the comparison of mean erythrocytes counts between the negative control group, positive control group, iron supplementation 1.08 mg / BW group, beetroot juice 3.6 gr / BW group and beetroot juice 1.8 gr / BW group.

Table 2 Comparison of Mean Erythrocytes Counts (10^6/µL)

Observation Groups	n	Mean ± stan.dev	*p-value*
Negative control group	4	11,06±0,09[a]	
Positive control group	4	4,26±0,03[b]	
Iron supplementation 1.08 mg / BW group	4	9,70±0,07[c]	0.000
Beetroot juice 3.6 gr / BW	4	9,01±0,06[d]	
Beetroot juice 1.8 gr / BW group	4	8,04±0,18[e]	

Note: On the mean ± sd if it contains different letters it means that there are significant differences (p-value <0.05) and if it contains the same letters it means there are no significant differences (p-value> 0.05).

Based on the results of the mean of erythrocytes counts it appears that the group giving beetroot juice of 3.6 gr / BW in anemic pregnant rats (9,01 ± 0.06d 106 / µL) has a mean approaching the iron supplementation group 1.08 mg / BW in anemic pregnant rats (9,70 ± 0.07c 106 / µL) and these two groups were the closest to the number of negative control groups (11,06 ± 0.09a 106 / µL). It can be seen that the mean of erythrocytes counts in the beetroot juice group of beetroot 3.6 gr / BW was able to compensate for the mean of erythrocytes counts in the iron supplementation group 1.08 mg / BW, followed by the group of 1.8g / BB beetroot juice.

Comparison of Mean Hemoglobin Levels

Anova One Way analysis test was also used to analyze the mean levels of hemoglobin in anemic pregnant rats. Data from the analysis showed that there were significant differences in the mean of the five observation groups, this was indicated by the p-value < 0,001. Table 3 shows the comparison of mean hemoglobin levels between the negative control group, positive control group, iron supplementation 1.08 mg / BW group, beetroot juice 3.6 gr / BW group and beetroot juice 1.8 gr / BW group.

Table 3 Comparison of Mean Hemoglobin Levels (gr/dl)

Observation Groups	n	Mean ± stan.dev	*p-value*
Negative control group	4	14,48±0,22[a]	
Positive control group	4	8,82±0,20[b]	
Iron supplementation 1.08 mg / BW group	4	13,86±0,44[c]	0.000
Beetroot juice 3.6 gr / BW	4	13,97±0,06[c]	
Beetroot juice 1.8 gr / BW group	4	12,69±0,19[d]	

Note: On the mean ± sd if it contains different letters it means that there are significant differences (p-value <0.05) and if it contains the same letters it means there are no significant differences (p-value> 0.05).

The results of table 3 show that the administration of beetroot juice of 3.6 gr / BW is comparable to that of supplementation of Fe 1.08 mg / BW in anemic pregnant rats. Based on table 3 known that of the mean analysis of beetroot juice 3.6 gr / BW (13,97 ± 0,06[c] gr / dl) had no difference with iron supplementation 1.08 mg / BW (13,86 ± 0,44[c] gr / dl). This fact shows that the administration of 3.6 gr / BW beetroot juice is as effective as the supplementation of Fe 1.08 mg / BW in increasing hemoglobin levels.

DISCUSSION

The balance of iron in the body is regulated by a complex regulation, the process starts from absorption of the source of iron through the intestine, transports into each cell and

released into the circulatory system. Transferrin is a protein that is responsible for binding iron during blood circulation because free iron can increase the risk of oxidative stress. Iron will be stored in the bone marrow, liver and lymph to be used in the process of erythropoiesis[14]. The need for iron during pregnancy is higher than when not pregnant. This increase is needed to meet the needs of feto-maternal iron transfers. Increased demand will continue to occur in line with the increasing size of the fetus and placenta, maximally occurring before delivery[15].

Based on the data it is known that 41.8% of pregnant women in the world have anemia, half is assumed to be caused due to iron deficiency[4]. Giving 60 mg iron supplementation is a solution offered to the public. However, several previous studies have explained the adverse side effects of iron supplementation during pregnancy. The provision of iron supplementation starting in trimester 1, trimester 2 or trimester 3 apparently both influence the regulation of iron balance in the body, where an increase in transferrin saturation exceeds normal[14]. Increased transferrin saturation indicates the amount of free iron circulating in the body results in oxidative stress reactions in tissues[16].

Looking for new alternatives as a source of iron in addition to 60 mg iron supplementation needs to be done. Beetroot (Beta Vulgaris L) is known to be rich in folic acid, fiber, potassium, magnesium, iron, and vitamin C. Beetroot can build, cleanse and strengthen the circulatory system and red blood cells so that the supply of nutrients in the body remains balanced and the body will avoid the shortage of red blood cells[17].

Giving beetroot juice 3.6 gr / BW in this study was known to be able to increase of erythrocytes counts in *Rattus norvegicus* anemia, even able to offset the mean of erythrocytes in the Fe supplementation group 1.08 mg / BW, followed by the group giving 1.8 g / BB beetroot juice. The results of this study are in line with previous studies which state that consumption of beet extract for 24 days is known to be able to increase the number of red blood cells in *Rattus norvegicus* rats that have anemia. Beetroot is believed to have a hematinic effect[8]. Beetroot can increase the number of red blood cells in albino rats. Giving beetroot extract for 16 days was able to increase the number of red blood cells in each study observation group[9].

As a high source of antioxidants, beetroot is known to have the ability to overcome anemia[17]. Beetroot can increase haematopoetic markers, one of which is hemoglobin levels in albino rats. Many previous studies have explained the ability of beetroot to increase hemoglobin levels and overcome anemia. Giving beetroot extract in albino rats with various doses for 16 days is known to be able to increase the levels of hemoglobin and the higher the dose given, the hemoglobin level increases and even exceeds control[9]. Consumption of beetroot extract for 24 days is known to be able to increase hemoglobin levels in *Rattus norvegicus* rats that have anemia[8]. Research carried out by taking the results of hematology tests on 7 female subjects who had been given 8 grams of beetroot for 20 days. It was found that an increase in hemoglobin and ferritin levels after being exposed to 8 grams of beets compared to before exposure[18]. Other studies described that consumption beetroot for 6 weeks can be increased Hemoglobin and red blood cell level in Female Soccer Players[20]. The results of this study showed that the administration of beetroot juice increased hemoglobin levels in Rattus norvegicus anemic rats. Although, the mean of beetroot juice extract of beetroot 3.6 gr / BW was no different from the supplementation of Fe 1.08 mg / BW it showed that giving of beetroot juice of 3.6 gr / BW was as effective as giving supplementation of Fe 1.08 mg / BW in increasing hemoglobin levels.

This research increasingly shows that beetroot can increase iron levels in the body. Beta vulgaris L works by stimulating the building, cleansing and strengthening of the circulatory system and red blood cells so that the blood can transport substances needed by the body properly and can prevent the lack of red blood cells in the body. Beetroot are known to be used for the treatment of leukemia in Eastern Europe[13].

CONCLUSION

Beetroot juice is proven as an alternative product for handling anemia during pregnancy. Studies to find beet-based products that are more durable and easily packaged, in addition to juices need to be continued, to increase the use of beetroot as an alternative supplementation for the prevention and treatment of anemia.

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