EFFECT OF CONSUMING RED DRAGON FRUIT *(HYLOCEREUS COSTARICENSIS)* JUICE ON THE LEVELS OF HEMOGLOBIN AND ERYTHROCYTE AMONG PREGNANT WOMEN

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ABSTRACT
Background: Iron deficiency is the most common cause of anemia during pregnancy. Red dragon fruit is assumed having much iron to increase hemoglobin and erythrocyte level.
Objective: This study aims to examine the effect of dragon fruit juice on levels of hemoglobin and erythrocytes.
Methods: This was a quasi experimental research with non-equivalent control group design. There were 34 respondents recruited in this study using consecutive sampling. The samples were divided into intervention group (17 respondents) and control group (17 respondents). Data were analyzed using Independent t-test and Paired t-test.
Results: There was a statistically significant effect of red dragon fruit juice Hb level on the 7th day of intervention with p-value 0.037 (<0.05), but there was no significant effect on hemoglobin level in the 14th day of intervention with p-value 0.140 (>0.05). This study also revealed that there was a statistically significant effect of red dragon fruit juice on pregnant women's erythrocyte level on the 7th day with p-value 0.025 (<0.05), but there was no significant effect on the erythrocyte level in the 14th day of intervention with p-value 0.094 (> 0.05).
Conclusion: There was a statistically significant effect of red dragon fruit juice on hemoglobin and erythrocyte levels. This study provides the insight of knowledge that the red dragon fruit juice can be an alternative treatment to deal with anemia among pregnant women.

Key words: Dragon fruit, anemia, hemoglobin, erythrocyte level

INTRODUCTION

Anemia is a condition in which the number and size of red blood cells or hemoglobin concentrations is below the normal limit value, which consequently interfere with the blood capacity to transport oxygen around the body.[1] Anemia is an indicator for malnutrition and poor health. Anemia in pregnant women is strongly associated with maternal and infant mortality and morbidity, including the risk of miscarriage, stillbirth, prematurity and low birth weight.[2]

In pregnant women there will be a significant increase in blood volume. In early pregnancy, blood plasma volume will increase rapidly by 40-45%.[3] In addition to plasma volume, erythrocytes volume will also be increased, which the amounts of erythropoietin in pregnant women are 20-30%.[4] This change in blood volume results in a condition of hypervolemia in pregnant women. However, since the increase in erythrocytes is much lower than that of plasma volume, there is hemodilution and decreased Hb concentration and hematocrit.[5] Hemoglobin concentration which initially about 15 gr/dl can drop to below 11 gr/dl. But, if the concentration of Hb below 11 g/dl continues, it may indicate abnormal conditions and is usually more commonly referred to as iron deficiency anemia than hypervolemia.[6]

Occurrence of anemia occurs widely throughout the world, especially in developing countries and in low socio-economic groups.[7] In the adult group, anemia occurs in women of reproductive age, especially pregnant and lactating women because of iron deficiency. Anemia occurs in 45% of women in developing countries and 13% in developed countries.[8] In 2013, about 800 women in the world die every day due to complications of pregnancy and childbirth.[4] The main causes of maternal mortality include bleeding, hypertension, and infection.[6] A woman living in a developing country is more likely to die about 23 times higher than women living in developed countries.[2]

Postpartum hemorrhage due to uterine atony is one of the biggest causes of maternal mortality in Indonesia. This is exacerbated by the condition of pregnant women who have anemia during pregnancy. Anemia in pregnancy is often caused by iron deficiency prevalence, which is still quite high in Indonesia.[9] Anemia is one of the factors that affect the occurrence of postpartum hemorrhage. Maternal mortality rate (MMR) in 2014 based on the data of Health Department of Central Java amounted to 126.55/100,000 live births (711 cases).[10] Factors causing maternal mortality include bleeding (22.93%), hypertension (28.10%), infections (3.66%), circulatory system disorders (4.93%), and others (42.33 %). Of the total number of maternal deaths, there were 62% of mothers with a history of anemic patients during their pregnancy.[10]

Maternal Mortality Rate in 2014 based on data of the Health Office of Semarang was 144.31/100,000 birth of life, and in period of January - December 2015 there were 17 maternal deaths, with various causes.[11] The highest cause of maternal death in 2015 was bleeding (8 cases), and 5 of them were anemia at the time of their pregnancy.[11]

Based on data obtained from the Health Center (Puskesmas) of Leyangan, the number of pregnant women suffering from anemia in 2013 was 42%, while in 2014 was 38% and in 2015 was 43% from total pregnant women in Semarang regency.[12] This health center was ranked fifth of anemia among pregnant women from 26 Puskesmas in Semarang in 2015.

In 2016, the number of pregnant women suffering from anemia was increased slightly of 46% from the total number of pregnant women in Semarang regency.[12] However, those with anemia will experience disorders such as dizziness, fatigue, fatigue, tired and even lead to death.[13]

Efforts that have been done by the Government of Indonesia in reducing the number of anemic patients include holding classes of pregnant women every trimester, distribution of Fe tablets as much as 90 grains, routine counseling at least once during pregnancy about nutrition and iron requirement in pregnant women, supplementary feeding, Hb examination at Puskesmas laboratory twice during pregnancy at the first examination and fourth examination. All midwives have Hb examination tools in the hope of doing routine checks on pregnant women.[11]

Although various efforts have been made to prevent the occurrence of anemia in pregnancy, but the number of pregnant women who suffer from anemia is not decreased significantly each year, therefore, to prevent anemia is needed. There are several types of therapy used to prevent the occurrence of anemia, one of them is non-pharmacological therapy. This therapy is a therapy used to treat diseases without using any drugs or often called natural.[14]

Herbal therapy is one type of non-pharmacological treatment. This therapy is increasingly popular in the community for the treatment and prevention of various diseases. Herbal therapy is a therapy that utilizes medicinal plants, fresh or dried simplicia, and fruits.[15] Many fruits are used as traditional or alternative medicine. One of them is the red dragon fruit.

Red dragon fruit is the fruit of the cactus of the clan of Hyloreceus and Selenicereus. This fruit has been widely consumed by the community as a drug to increase endurance and as a blood booster medicine. Study revealed that dragon fruit that is cooked contains a lot of organic acids, proteins, minerals such as potassium, magnesium, calcium and iron and vitamin C17.[16] In addition, it contains many minerals, iron and vitamin C, and has the properties of lowering blood pressure, blood sugar levels, and sources of antioxidants. Part of red dragon fruit that can be used for health is the flesh, leaf and fruit skin.[16] Thus, it is expected that this fruit can be used as an alternative medicine in treating anemia.

Study has been conducted with white mice revealed that dragon fruit (Hylocereus undatus) can increase hemoglobin and erythrocytes in female white mice within 7 and 14 days; optimum damping percentage was equal to 97.84% with IC50 value was 73.2772 mg/L; while the total mean of antocyanin obtained 58.0720 ± 0.0001 mg/L, and type of antosianin contained in ethanol extract of super red dragon fruit's skin is cyanidin by forming the maximum peak at wavelength 547 nm.[17] Therefore, this study aimed to examine the effect of red dragon fruit on the levels of hemoglobin and *erythrocyte among pregnant women.*

METHODS
Design
This research was a quasi-experimental research with non-equivalent control group design, conducted in the working area of the Health Center of Leyangan on 17 October - 8 November 2016.

Population and Sample
The population in this study was all pregnant women who suffered from anemia in the second and third trimester in the working area of the health Center of Leyangan. There were 34 respondents recruited in this study using consecutive sampling. The samples were divided into

intervention group (17 respondents) and control group (17 respondents).

Intervention
For the intervention group, a red dragon fruit (Hylocereus Costaricensis) was given to the respondents with dose of 500 grams of red dragon fruit flesh contained 30 mg of Fe, added with the intake of food consumed per day containing 31 mg of Fe. The dosage of 500 grams of red dragon fruit flesh is equivalent to the dose of Fe 60 mg tab. In this study, dragon fruit juice was made by the researchers themselves and distributed by enumerators (having Diploma III Midwifery background) to give the juice and observe respondents. All respondents were required to finish the dragon fruit juice in front of the enumerator. Red dragon fruit juice was given 30 minutes before dinner and consuming Fe tablet before sleep at night. All respondents have been given an explanation before the study began, that before dragon fruit juice was sent to the respondent's home, respondents were asked not to eat dinner first. All respondents had red dragon fruit juice for 14 days. While in the control group, respondnets were given health education about balanced nutrition menu using leaflet to be applied every day.

Measure
Laboratory test was performed by analyst to see the hemoglobin and erythrocyte levels before and after the treatment (the 7th and 14th days of the treatment).

Data Analysis
Data were analyzed using Independent t-test to see the difference of the hemoglobin and erythrocyte levels between intevention and control group. Paired t-test was also used to examine the effectiveness of red dragon fruit juice before and after intervention.

Ethical Consideration
The ethical feasibility of the study was obtained from the Health Research Ethics Committee (K.EP.K) of Health Polytechnic of Ministry of Health (Poltekkes) of Semarang with No.187/KEPK/Poltekkes-Smg / EC / 2016. Each respondent had obtained and signed appropriate informed consent.

RESULTS
Table 1 shows that pregnant women in the Health Center of Leyangan area mostly suffered from mild anemia (51.02%). Mild anemia is a condition which Hb levels between 9 - 10 gr / dL in pregnant women. While The characteristic of the respondents as shown in the Table 2 was the majority aged from 20-35 (76.5%), had a good nutritional status (82.4%), primipara (64.7%), had high economic status (58.8%), low educational level (52.9%), and working (58.8%)

Table 1. The incidence of anemia in pregnant women in the Health Center of Leyangan

Category	Frequency	Percentage (%)
Normal	53	36.06
Mild Anemia	75	51.02
Moderate Anemia	12	8.16
Severe Anemia	7	4.76
Total	147	100

Table 2. Characteristics of respondents based on age, parity, education, nutritional status, economic status, and working status

Variable	Intervention		Control	
	F	**%**	**F**	**%**
Age (year)				
< 20 or > 35	4	23.5	2	11.8
20-35	13	76.5	15	88.2
Nutritional status				
Bad	3	17.6	6	35.3
Good	14	82.4	11	64.7
Parity				
Nulipara	4	23.5	5	29.4
Primipara	11	64.7	7	41.2
Multipara	2	11.8	5	29.4
Economic status				
Low	0	0.0	0	0.0
Middle	7	41.2	3	17.6
High	10	58.8	14	82.4
Education				
Low level	9	52.9	4	23.5
Middle level	6	35.3	7	41.2
High level	2	11.8	6	35.3
Working status				
Working	10	58.8	9	52.9
Not working	7	41.2	8	47.1

Table 3. Hemoglobin levels before and after intervention

Variable	Treatement	N	Mean	SD	Min	Max
Intervention group						
Hb levels	Pretest	17	10.04	0.88	7.0	10.8
	Posttest Day 7	17	10.72	0.90	7.9	11.8
	Posttest Day 14	17	10.78	0.53	9.9	11.4
Control group						
Hb levels	Pretest	17	9.88	1.17	7.0	10.9
	Posttest Day 7	17	9.95	1.17	7.2	11.1
	Posttest Day 14	17	10.25	1.30	7.4	12.0

Of 17 pregnant women, before given red dragon fruit juice, the mean Hb level of the patient was 10.04 g/dl with a standard deviation of 0.88 gr/dl. The lowest Hb level was 7.0 g/dl and the highest was 10.8 gr/dl. While after given the red dragon fruit juice, the average of Hb level on the 7th day was 10.72 g/dl with a standard deviation of 0.90 gr/dl, and on the 14th day the mean of Hb level was increased to 10.78 gr/dl with a standard deviation of 0.53 gr/dl. In the control group, the mean of Hb levels in pretest was 9.88 with a standard deviation of 1.17 g/dl. The lowest Hb level was 7.0 g/dl and the highest was 10.9 g/dl. While in the 7th day of treatment, the average of Hb levels became 9.95 g/dl with a standard deviation of 1.17 g/dl; and on the 14th day the mean of Hb level was increased to 10.25 g/dl with standard deviation 1.30 gr/dl.

Table 4. Erythrocyte levels before and after intervention in the intervention and control group

Variable	Treatment	N	Mean	SD	Min	Max
Intervention group						
Erythrocyte levels	Pretest	17	3.75	0.26	3.24	4.29
	Posttest Day 7	17	4.02	0.31	3.46	4.72
	Posttest Day 14	17	4.05	0.30	3.52	4.63
Control group						
Erythrocyte levels	Pretest	17	3.74	0.27	3.02	4.06
	Posttest Day 7	17	3.77	0.32	3.08	4.40
	Posttest Day 14	17	3.85	0.39	3.11	4.53

Table 4 shows that the average level of erythrocytes in the intervention group in pretest was 3.75 gr/dl with standard deviation 0.26 gr/dl. The lowest erythrocyte level was 3.24 g/dl and the highest was 4.29 g/dl. The erythrocyte levels were increased in the 7th day of intervention to 4.02 g/dl with a standard deviation of 0.31 g/dl, and in the 14th of intervention was 4.05 gr/dl with a standard deviation of 0.30 gr/dl. While in the control group, the average of erythrocyte level in pretest was 3.74 gr/dl, with standard deviation 0.27 gr/dl, the lowest erythrocyte level of 3.02 gr/dl and the highest level of 4.06 g/dl. There was a slightly increase of the erythrocyte level on the 7th day of intervention to 3.77 g/dl with a standard deviation of 0.32 g/dl; and on the 14th day of intervention to 3.85 gr/dl with standard deviation of 0.39 gr/dl.

Table 5. Normality test for hemoglobin and erythrocyte levels (Saphiro wilk test)

Variable	Group	Treatment	N	P-value	Remark
Hemoglobin levels	Intervention	Pretest	17	0.502	Normal
		Posttest Day 7	17	0.197	Normal
		Posttest Day 14	17	0.214	Normal
	Control	Pretest	17	0.565	Normal
		Posttest Day 7	17	0.176	Normal
		Posttest Day 14	17	0.123	Normal
Erythrocyte levels	Intervention	Pretest	17	0.620	Normal
		Posttest Day 7	17	0.994	Normal
		Posttest Day 14	17	0.979	Normal
	Control	Pretest	17	0.210	Normal
		Posttest Day 7	17	0.883	Normal
		Posttest Day 14	17	0.898	Normal

Table 5 shows that the data of hemoglobin and erythrocyte levels were normally distributed (p-value > 0.05), which also indicated that there were statistically no difference of the hemoglobin and erythrocyle levels in the intervention and control group.

Table 6. Mean Difference of hemoglobin levels before and after intervention
(Paired t-test)

Variable	Treatment	N	Mean	SD	T	p-value
Intervention group						
Hemoglobin levels	*Pretest*	17	10.04	0.88	-5.800	0.000
	Posttest Day 7	17	10.72	0.90		
	Posttest Day 7	17	10.72	0.90	-0.306	0.763
	Posttest Day 14	17	10.78	0.53		
Control group						
Hemoglobin levels	*Pretest*	17	9.88	1.17	-1.542	0.143
	Posttest Day 7	17	9.94	1.17		
	Posttest Day 7	17	9.94	1.17	-2.249	0.039
	Posttest Day 14	17	10.25	1.30		

As shown in Table 6, it can be seen that the average of Hb level in pregnant women in the intervention group before given red dragon fruit juice was 10.04 gr/dl, then increased to 10.72 g/dl after the intervention on the 7th day. After the 14th day of the intervention, the average of Hb level became 10.78 g/dl. Based on paired t-test test (for pretest with posttest day 7), the t-value was -5,800 with p-value of 0.000(< 0.05), which indicated that there was a statistically significant difference in hemoglobin levels before and after intervention on the 7th day. However, there was no significant difference between hemoglobin level on 7th day and 14th day of intervention with p-value 0.763 (>0.05). While in the control group, there was no significant difference between hemoglobin level in the pretest and posttest day 7 with p-value 0.143, and significant difference between hemoglobin level in posttest day 7 and posttest day 14 with p-value 0.039 (< 005).

Table 7. Mean Difference of erythrocyte levels before and after intervention
(Paired t-test)

Variable	Treatment	N	Mean	SD	T	p-value
Intervention group						
Erythrocyte levels	*Pretest*	17	3.75	0.26	-5.855	0.000
	Posttest Day 7	17	4.02	0.31		
	Posttest Day 7	17	4.02	0.31	-0.569	0.577
	Posttest Day 14	17	4.05	0.30		
Control group						
Erythrocyte levels	*Pretest*	17	3.74	0.27	-0.874	0.395
	Posttest Day 7	17	3.77	0.32		
	Posttest Day 7	17	3.77	0.32	-1.832	0.086
	Posttest Day 14	17	3.85	0.39		

Table 7 shows that the average of erythrocyte level in pregnant women in the intervention group before given red dragon fruit juice was 3.75 gr/dl, then increased slightly to 4.02 g/dl after the intervention on the 7th day. After the 14th day of the intervention, the average of erythrocyte level became 4.05 g/dl. Based

on paired t-test test (for pretest with posttest day 7), the t-value was -5.855 with p-value 0.000 (< 0.05), which indicated that there was a statistically significant difference in erythrocyte levels before and after intervention on the 7th day of intervention. However, there was no statistically significant difference between erythrocyte level on 7th day and 14th day of intervention with p-value 0.577 (>0.05). While in the control group, there was no significant difference between erythrocyte level in the pretest and posttest day 7 with p-value 0.395, and no difference between erythrocyte level in posttest day 7 and posttest day 14 with p-value 0.086.

Table 8. Effect of red dragon fruit juice on hemoglobin and erythrocyte levels (Independent t-test)

Variable	Group	N	Mean	SD	T	*P-value*
Hemoglobin Level						
Posttest Day 7	Intervention	17	10.72	0.90	2.177	0.037
	Control	17	9.95	1.17		
Posttest Day 14	Intervention	17	10.78	0.53	1.536	0.140
	Control	17	10.25	1.30		
Erythrocyte level						
Posttest Day 7	Intervention	17	4.02	0.31	2.354	0.025
	Control	17	4.77	0.32		
Posttest Day 14	Intervention	17	4.05	0.30	1.728	0.094
	Control	17	3.85	0.39		

Hemoglobin level, after given red dragon fruit juice on the 7th day, the mean of Hb level in the intervention group was 10.72, while in the control group it was 9.95. After 14 days of intervention, the mean of Hb levels in the intervention group was 10.78, and in the control group was 10.25. Based on independent t-test (for posttest Day 7), the t-value was 2.177 with p-value 0.037 (<0.05), which indicated that that there was a statistically significant effect of red dragon fruit juice on pregnant women's Hb level on the 7th day with p-value 0.037 (<0.05), but there was no significant effect on hemoglobin level in the 14th day of intervention with p-value 0.140 (>0.05).

Erythrocyte level, after given intervention on the 7th day, the mean of erythrocyte level in the intervention group was 4.02 gr/dl, while in the control group was 4.77 gr/dl. After 14 days of intervention, the mean of erythrocytes levels in the intervention group was 4.05 gr/dl, and in the control group was 3.85 gr/dl. Based on independent t-test (for posttest Day 7), the t-value was 2.354 with p-value 0.025 (<0.05), which indicated that that there was a statistically significant effect of red dragon fruit juice on pregnant women's erythrocyte level on the 7th day with p-value 0.025 (<0.05), but there was no significant effect on the erythrocyte level in the 14th day of intervention with p-value 0.094 (> 0.05).

DISCUSSION
Findings of this study revealed that that there was a statistically significant effect of red dragon fruit juice Hb level on the 7th day of intervention with p-value 0.037 (<0.05), but there was no significant effect on hemoglobin level in the 14th day of intervention with p-value 0.140 (>0.05). This study also revealed that there was a statistically significant effect of red dragon fruit juice on pregnant women's erythrocyte level on the 7th day with p-

value 0.025 (<0.05), but there was no significant effect on the erythrocyte level in the 14th day of intervention with p-value 0.094 (> 0.05).

The low level of hemoglobin and erythrocyte in the 14th day on intervention can be caused by several factors, such as the factor of gestational age, which all respondents in this study was in the trimester II and III. In this phase, the mother will experience a state of hemodilution. The plasma volume increases 45-65% starting in the second trimester of pregnancy, and the maximum occurs in the third trimester and increased about 1000 ml.[5] This may cause the mother still have anemia although having the treatment. Additionally, in the 14th day of intervantion, many respondents did not have dinner because the stomach was full after consuming dragon fruit juice. Thus, the nutritional needs might be reduced, and influenced the hemoglobin and erythrocyte level.[18]

However, the findings of this study revealed that red dragon fruit juice was effective on the increase of hemoglobin and erythrocyte levels in pregnant women. Consumption of dragon fruit during pregnancy is considered to prevent and overcome anemia. It is because dragon fruit is rich in iron as the main constituent of red blood cells. In 100 grams of dragon fruit contains approximately 0.55 irons. This iron will be converted into red blood cells, so it is beneficial for pregnant women who tend to anemia experience. As literature also said that Dragon fruit contains high amounts of iron and vitamin C that help boost your hemoglobin count substantially during pregnancy. Good hemoglobin levels prevent the risk of development of anemia and its adverse effects.[19]

LIMITATION OF THE STUDY

The limitation in this study was that SpO2 was not checked to see how much oxygen hemoglobin can carry, and no erythrocyte quality checks could affect the quantity and quality of hemoglobin. Non probability sampling was used may cause many biases that could not be controlled by the researcher.

CONCLUSION

There was a statistically significant effect of red dragon fruit juice on hemoglobin and erythrocyte levels in the 7th day of intervention, and no significant effect of red dragon fruit juice on hemoglobin and erythrocyte levels in the 14th day of intervention. This study provides the insight of knowledge that the red dragon fruit juice can be an alternative treatment to deal with anemia among pregnant women.

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