Anastasia SS, et al. Belitung Nursing Journal. 2017 October;3(5):515-524
Received: 5 March 2017 | Accepted: 30 October 2017
http://belitungraya.org/BRP/index.php/bnj/

ORIGINAL RESEARCH **ISSN: 2477-4073**

EFFECT OF CONSUMING GREEN BEAN (PHASEOLUS RADIATUS) JUICE ON MATERNAL BLOOD PROFILE DURING PREGNANCY

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ABSTRACT

Background: Most of anemia in pregnancy is caused by iron deficiency. Thus, giving iron tablets is an effort to deal with anemia. A green bean (Phaseolus Radiatus) juice is considered helping the absorption of iron effectively.

Objective: To analyze the effect of green bean (Phaseolus Radiatus) juice on changes in blood profile levels in pregnant women with anemia who received Fe tablet supplementation.

Methods: This was a quasi-experimental study with pretest posttest with control group design conducted from November 2016 to January 2017 in the working area of the Community Health Center of Kedungmundu Semarang, Indonesia. Consecutive sampling was used in this study to select 40 samples based on the hypothesis formula of two independents. There were 20 samples assigned in each group. Data were analyzed using paired t-test and Independent t-test.

Results: The results of this study showed that there were significant increases in hemoglobin, hematocrit, and erythrocytes ($p = 0.000$) after given green bean (Phaseolus Radiatus) juice.

Conclusion: There was a significant effect of green bean (Phaseolus Radiatus) juice in increasing the levels of hemoglobin, hematocrit, and erythrocytes. It is expected that this green bean juice can be used as an alternative treatment to deal with anemia in pregnant women.

Keywords: anemia, pregnant mother, green bean juice, blood profile level

Editor's Note: This article has been updated on 8 July 2020 in terms of minor changes in the reference format. The update is according to BNJ Policy on article correction.

INTRODUCTION

Anemia is a very common disorder both in clinics and in the field.[1] Anemia in pregnancy is a condition of mothers with hemoglobin levels below 11gr% in the first and third trimesters or levels below 10.5gr% in the second trimester. Most of anemia in pregnancy is caused by iron deficiency and acute hemorrhage or even mixed. [1,2]

Anemia in pregnant women occurs due to an increase in the amount of plasma and erythrocytes. Three times increased of plasma and erythrocyte amounts will lead to a decrease in hemoglobin-hematocrit ratio, thus increasing the risk of physiologic anemia at the time of pregnancy although it is considered as under normal circumstances.[1]

The natural physiological changes that occur during pregnancy will affect the number of normal blood cells in pregnancy. Iron deficiency anemia is still a major nutritional problem in Indonesia. Anemia in pregnant women can be caused by several factors, such as malnutrition, lack of iron, mal-absorption, large blood loss during labor or previous menstruation, and chronic diseases.[3] In pregnant women iron has an important role for the growth of the fetus. Iron is not only required for the formation of hemoglobin, but also plays a role in the storage and transport of oxygen. Iron is also found in some enzymes that play a role in the oxidative metabolism, neurotransmitter and catabolism process. Thus, iron deficiency will cause disorders of child development, decrease endurance and the concentration of learning.[4]

The process of absorption of iron also requires vitamin C to help in the process of iron absorption and help remove iron from the storage. Vitamin C can play a role in increasing the absorption of non-heme iron to four times. Vitamin C and iron form compound metal ascorbate compounds that are easily soluble and absorbed.[5] This is in line with Argana[6] research indicated that there is an effect of vitamin C as a dominant factor on hemoglobin levels.

Green beans are effective in overcoming anemia in cancer patients with chemotherapy. Study stated that consumption of two cups of green beans could meet 50% of daily iron requirement and 80% meet the daily requirement of vitamin C and other vitamins such as thiamine, riboflavin, and niacin.[7] Another study conducted by Nora Maulina[8] revealed that there was a significant effect of green beans (Phaseolus Radiatus) with a dose of 18gr / kg / day on the increase of hemoglobin levels in White Wistar rats.

Green beans are one of the ingredients that contain substances needed for the formation of blood cells that can overcome the effects of Hb decrease. Green beans can also play a role in the formation of red blood cells and prevent anemia because the content of phytochemicals in green beans is so complete to help the process of hematopoiesis. Green beans also contain vitamins and minerals such as calcium, phosphorus, iron, sodium and potassium.[9] In a half cup of green beans contain 90 grams of water, 127 kcal of energy, 11 grams of protein, 10 grams of carbohydrate, 4 grams of fiber, 6 grams of fat, 131 mg of calcium, 2.25 mg iron, 54 mg magnesium, 485 mg potassium, 13 mg sodium, 0.82 mg zinc, 7 micrograms of

vitamin A, 0.23 mg thiamine, 0.14 mg riboflavin, 1.13 mg niacin, 0.05 mg vitamin B6, 100 microgram folate, 15 mg vitamin C and 1 microgram selenium.[7]

Based on preliminary study in Kedungmundu Public Health Center, the total number of pregnant women up to July 2016 was 1299 pregnant women from 7 sub-districts namely in Kedungmundu (104), Tandang (262), Jangli (64), Sendangguwo (247), Sendangmulyo (395), Sambiroto (135), and Mangunharjo sub-district (92). While the number of pregnant women on the first visit and who received Fe tablets in July was 220 pregnant women and 6 of them were from outside of Kedungmundu area, so the total number of pregnant women who got Fe tablets at the initial visit was 214 pregnant women, and data obtained on July 2016 showed 25 pregnant women with Hb 8-11 mg / dL and 7 pregnant women with Hb <11 mg / dL. This number has increased from the previous month that was only 22 pregnant women who have anemia.[10] Therefore, with the phenomena of pregnant women with anemia and the benefits of green beans, this study aimed to examine the effect of green beans (Phaseolus Radiatus) on blood profile in pregnant women who got Fe tablets.

METHODS

Design

This study was a quasi-experimental study with pretest posttest with control group design. This research was conducted in the working area of the Community Health Center of Kedungmundu Semarang from November 2016 to January 2017.

Population and Sample

The target population of this study was all pregnant women in the trimester II and III in the working area of the Community Health Center of Kedungmundu Semarang amounted to 98 pregnant women. Consecutive sampling was used in this study to select 40 samples based on the hypothesis formula of two independents. There were 20 samples assigned in experimental group (received green bean juice and Fe tablets) and control group (only received Fe tablets).

The inclusion criteria of sample were pregnant women in the trimester II and III who received iron tablet supplementation in the working area of the Community Health Center of Kedungmundu Semarang, no experiencing nausea and no vomiting, understanding Indonesian language and willing to be respondents. The exclusion criteria were mothers who have a history of allergies with green beans, and consuming vitamin C supplements.

Intervention

The experiment group was given green bean juice and Fe tablet for 14 days, while the control group only received Fe tablets. The green bean juice was made from a very good quality of bean. The researchers made and processed the juice by first cleaning and boiling the beans, then mashed using a juice blender with added sugar, salt, ginger, and pour enough water until became smooth. The green bean juice (250 cc) could be served in cold or warm juice.

Instrument

A blood examination was performed to measure maternal blood profile in the Laboratory of the University of Muhammdiyah Semarang. A blood

sampling was done before intervention and after 14 days of intervention.

Ethical consideration

The ethical clearance in this study was obtained from the Ethics Commission of Poltekkes Kemenkes Semarang with No.06 / KEPK/ Poltekkes-Smg / EC / 2017. The researchers have confirmed that each respondent in this study has obtained an appropriate informed consent.

Data Analysis

Data were analyzed using Independent t-test and Paired t-test.

RESULTS

Diagram 1 shows that the characteristics of respondents in the experiment and control group aged ranging from 25-35 years, considered as productive age. The majority of the respondents had junior and senior high school background, not working and primigravida. There was no significant difference in the characteristics of the respondents in terms of age, education, working status, and gravida status between the experiment and control group.

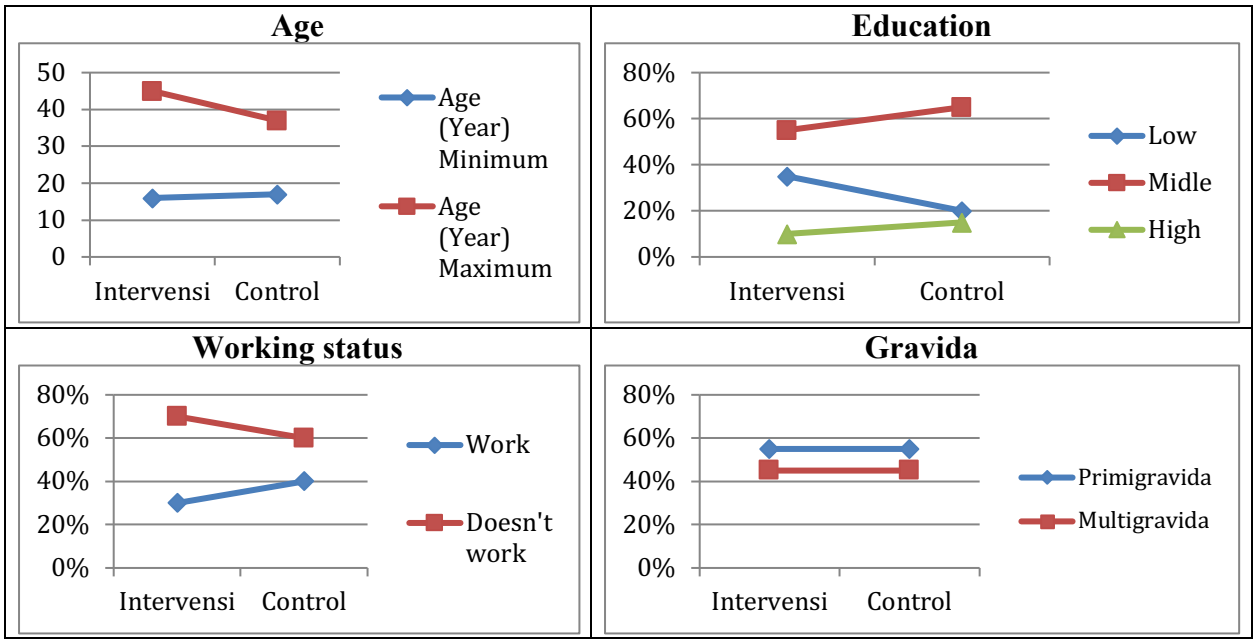

Diagram 1 Characteristics of the respondents

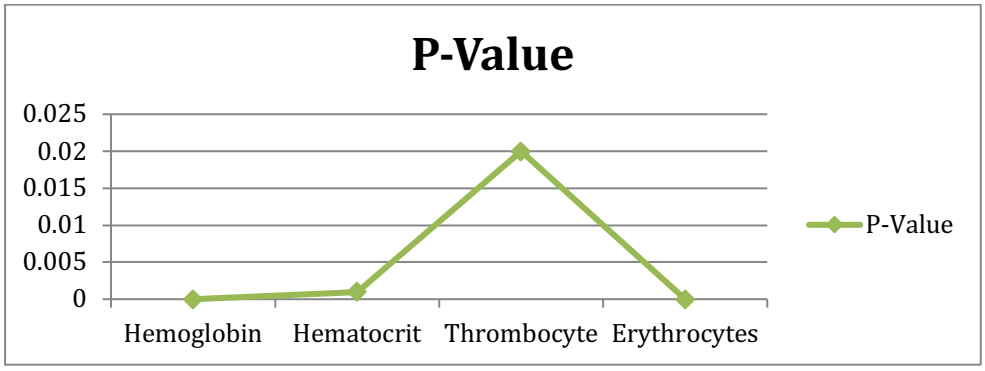

Diagram 2 Mean difference of blood profile before and after given intervention between the experiment and control group using Independent t-test

The Independent t-test results as shown in the diagram 2 indicates that there was a significant difference between the mean value after given intervention on hemoglobin levels (p=0.000), hematocrit (p=0.001), thrombocyte (p=0.002), and erythrocytes level (p=0.000).

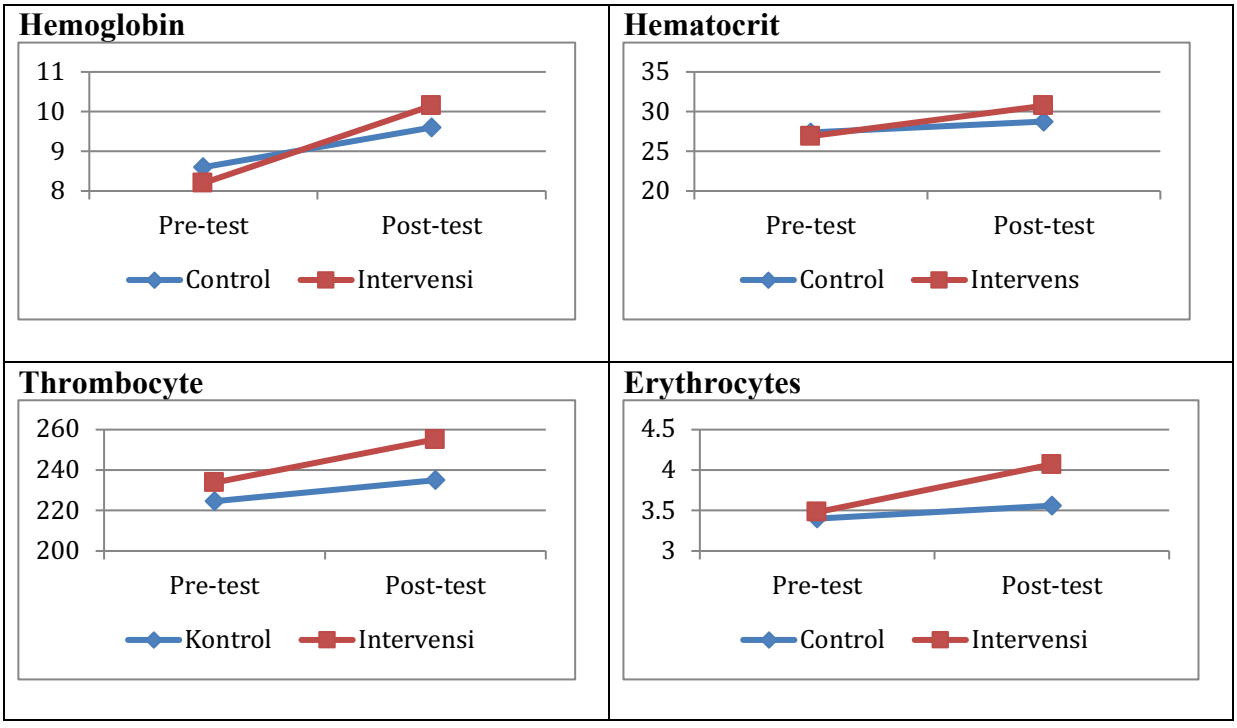

Diagram 3 Blood profile (hemoglobin levels, hematocrit, thrombocyte and erythrocytes level) before and after given intervention in the experiment and control group

Diagram 3 shows that the average of hemoglobin levels before given intervention in the control group was 8.6 g/dL and in the experiment group was 8.2 gr/dL. While the hemoglobin levels after given intervention in the control group was 9.6 g/dL and in the experiment group was 10.15 gr/dL.

The mean value of hematocrit before given intervention in the control group was 27.38% and the experiment group was 26.91%. There was an increase after given intervention, which the mean value of hematocrit in the control group was 28.75% and in the experiment group was 30.74%.

Similar with the thrombocyte levels, there was an increase of the levels of thrombocytes in both groups, which in the control group was increased from 224.65 thousands/uL before intervention to 235.05 thousands/uL after intervention; and in the experiment group was increased from 233.85 thousands/uL before intervention to 255.25 thousands/uL after intervention.

There was an increase of the levels of erythrocytes in both groups, which in the control group was increased from 3.40 million/uL before intervention to 3.56 million/uL after intervention; and in the experiment group was increased from 3.48 million/uL before intervention to 4.07 million/uL after intervention.

Table 1 Mean difference in hemoglobin levels before and after given intervention using Independent t-test

Hemoglobin (gr/dl)	**Mean±SD; Median; Min±Max**		***P-Value***
	Control (n=20)	**Experiment (n=20)**	
Pretest	8.6±0.84; 8.75; 7.3±10.0	8.2±0.675; 8.30; 7.3±9.4	0.134
Posttest	9.6±0.87; 9.60; 8.4±11.3	10.15±0.65;10.0; 9.1±11.2	0.037
Mean difference pretest and posttest			
P-value	0.000	0.000	
Mean difference			
	0.94±0.24; 1; 0.2±1.3	1.83±0.41; 1.85; 1.20±2.90	0.000

Table 1 shows that there was a significant difference in mean value of hemoglobin levels after given intervention between the two groups with p-value 0.037 (<0.05). However, the mean difference of hemoglobin levels (before – after intervention) in the experiment group (1.83 gr/dL) was higher than the mean of hemoglobin in the control group (0.94 gr/dL).

Table 2 Mean difference in hematocrit levels before and after given intervention using Independent t-test

Hematocrit (%)	**Mean±SD; Median; Min±Max**		***P-Value***
	Control (n=20)	**Intervention (n=20)**	
Pretest	27.38±1.69; 27.8; 23.4±29.5	26.91±2.12; 27.2; 23.0±29.4	0.440
Posttest	28.75±1.9; 28.5; 26.3±33.0	30.74±1.87; 30.8; 27.5±34.3	0.002
Mean difference pretest and posttest			
P-value	0.010	0.000	
Mean difference			
	1.37±2.13; 0.8; -2.8±7.90	3.83±2.03; 3.25; 1.10±8.9	0.001

Table 2 shows that there was a significant difference in mean value of hematocrit levels after given intervention between the two groups with p-value 0.002 (<0.05). However, the mean difference of hematocrit levels (before – after intervention) in the experiment group (3.83 %) was higher than the mean of hematocrit in the control group (1.37 %).

Table 3 Mean difference in thrombocytes levels before and after given intervention using Independent t-test

Thrombocytes (thousands/uL)	Mean±SD; Median; Min±Max		*P-Value*
	Control (n=20)	Intervention (n=20)	
Pretest	224.65±27.4; 222.5; 180±307	233.85±26.3; 224.5; 198±291	0.286
Posttest	235.05±24.3; 233.5; 199±303	255.25±27.4; 248.0; 209±319	0.018
Mean difference pretest and posttest			
P-value	0.318	0.000	
Mean difference			
	10.4±45.3; 9; -108±98	21.4±8.14; 23; 1.0±32.0	0.298

Table 3 shows that there was no significant difference in mean value of thrombocytes levels after given intervention between the two groups with p-value 0.018 (<0.05). However, the mean difference of thrombocytes levels (before – after intervention) in the experiment group (21.4) was higher than the mean of thrombocytes in the control group (10.4). In this analysis, p-value of control group was 0.318, indicated no difference of thrombocytes value before and after intervention in the control group.

Table 4 Mean difference in erythrocytes levels before and after given intervention using Independent t-test

Erythrocytes (million/uL)	Mean±SD; Median; Min±Max		*P-Value*
	Control (n=20)	Intervention (n=20)	
Pretest	3.40±0.15; 3.39; 3.22±3.78	3.48±0.226; 3.48; 3.07±3.83	0.234
Posttest	3.56±0.13; 3.56; 3.33±3.84	4.07±0.179; 4.01; 3.74±4.32	0.000
Mean difference pretest and posttest			
P-value	0.000	0.000	
Mean difference			
	0.15±0.08; 0.11; 0.06±0.33	0.59±0.12; 0.59; 0.34±0.8	0.000

Table 4 shows that there was a significant difference in mean value of erythrocytes levels after given intervention between the two groups with p-value 0.000 (<0.05). However, the mean difference of thrombocytes levels (before – after intervention) in the experiment group (0.59) was higher than the mean of thrombocytes in the control group (0.15).

DISCUSSION

Findings of this study revealed that there was a significant effect of green bean juice (Phaseolus Radiatus) on blood profile levels of hemoglobin, hematocrit, and erythrocytes, but not in platelets. Physiologically, hemodilution occurs due to the higher increase of blood cell cells compared with the increase of plasma, which results in blood dilution, with proportion of plasma 30%, blood cells 18% and hemoglobin 19%.[11]

The function of hemodilution is: 1) to meet the needs of a large uterus with a vascular system with severe hypertrophy, 2) to protect the mother and fetus against the adverse effects of venous backflow in the supine and upright position, and 3) to protect the mother against the effects expulsion of blood at the time of delivery.[11]

Hemoglobin is a protein in erythrocytes that serves as a transporter of oxygen from

the lungs throughout the body. Hemoglobin also transports carbon dioxide back to the lungs to be removed from the body. In pregnant women there is an increase of 30% to 40% volume of blood plasma resulting in blood dilution.[11]

Another way to reduce the incidence of anemia in pregnant women is not only to be given iron tablets, but also must be supported and assisted by providing intake of nutrients rich in iron. Vitamin C can increase the absorption of non-hem iron up to fourfold. Vitamin C with iron has a complex soluble ascorbic acid compound that is easily absorbed, therefore fresh vegetables and fruits containing lots of vitamin C should be eaten to prevent anemia.[3]

The role of vitamin C in the iron absorption process is by reducing denoted iron (Fe^{3+}) into Ferro (Fe^{2+}) in the intestine so that it is easily absorbed. The reduction process will become larger when the PH in the stomach increases; thereby increase the absorption of iron up to 30%. Vitamin C inhibits the formation of hemosiderin, which is difficult to mobilize to free iron when necessary. While the inhibiting factor of iron absorption is a material derived from nature. The most powerful inhibitors are those containing polyphenol compounds such as tannin.[12]

The process of iron absorption in the intestine is iron absorbed in the duodenum and upper jejunum through a very complex process. The iron present in the food either in the form of Fe^{3+} or Fe^{2+} begins to undergo a process of digestion. In the stomach, Fe^{3+} dissolves in gastric acid, then bound by gastroferrin and is reduced to Fe^{2+} in the presence of ascorbic acid (Vitamin C). In the intestine, Fe^{2+} is oxidized to Fe^{3+}, which then binds to the apoferritin, which is then transformed into ferritin, releasing Fe^{2+} into the blood plasma. In plasma, Fe^{2+} is oxidized to Fe^{3+} and binds to transferrin. Transferrin transports Fe^{2+} into the bone marrow to merge to form hemoglobin. Transferrin transports Fe^{2+} into iron storage in the body (liver, bone, spleen, and reticuloendothelial system) and then oxidized to Fe^{3+} and will join apoferritin to form ferritin which will then be stored.[13]

The results of this study were in line with the research conducted by Hellty[14] which showed that green bean juice has a significant effect on the increase of hemoglobin level and blood cell cells of cancer patients who underwent chemotherapy after being given 2 glasses of green beans (250 cc per glass) per day for 7 days. The mean elevated levels of hemoglobin, erythrocytes, leukocytes, and platelets were 1.12 g/dL, 0.5 ml/ul, 112 thousand ul and 97.43 thousand/ul, respectively. Similar with the study conducted by Nora Maulina[8], proves that consuming green beans with a dose of 18 gr/weight/day and 36 gr/weight/day given to white mice proves that green beans are very effective against elevated hemoglobin levels because of the iron content in the green beans.

Vitamin C and zinc substances help in the process of iron absorption, release iron from the storage area, and increase the absorption of non-heme iron to fourfold.[15] Moreover, in green bean juice there are several ingredients needed for the formation of hemoglobin and blood cells such as folic acid, cobalt iron, magnesium, zinc, amino acids, vitamin B, and vitamin C.[16] Thus it can be concluded that routinely consuming green bean juice for

14 days can increase the formation of hemoglobin, hematocrit, and erythrocytes. Green beans contain the ingredients needed for the formation of hemoglobin and blood cells. It is because green bean juice was only about 42% of the daily requirement of the body, thus it does not affect the value of platelets, besides, the immunity factor also plays a role in value of platelet.

CONCLUSION

It is concluded that there was a significant effect of green bean juice in increasing the levels of hemoglobin, hematocrit, and erythrocytes, but not in the level of thrombocytes, for the pregnant women who received Fe tablets. This intervention was effective compared with the intervention that just gives the Fe tablets alone. Therefore, it is expected that the community health center to promote the benefits of green bean juice, especially for mothers to consume 250 cc of green bean juice before consuming Fe tablet to help the absorption of iron.

Declaration of Conflicting Interest

None declared.

Funding

This study was supported by Magister Applied Midwifery, Politeknik Kesehatan Kementrian Kesehatan Semarang, Indonesia.

Authorship Contribution

All authors contributed equally in this study.

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Cite this article as: Anastasia S, Soehartono, Ngadiyono, Muchlis, Dyah. Effect of consuming green bean (Phaseolus Radiatus) juice on maternal blood profile during pregnancy. *Belitung Nursing Journal.* 2017;3(5): 515-524. https://doi.org/10.33546/bnj.197