



The Relationship Between Consumption of Blood-Added Tablets and Micronutrient Intake with Hemoglobin Levels of Pregnant Woman

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Abstract

Anemia is one of the nutritional problems that often occur in pregnant women. A preliminary survey conducted at the Sangkrah Health Center in Surakarta City found that the prevalence of anemia in pregnant women in 2022 was 13.5%. The purpose of this study was to determine the relationship between consumption of blood supplement tablets and intake of micronutrients (iron, folic acid, vitamin C and vitamin B12) with hemoglobin levels of pregnant women at the Sangkrah Health Center in Surakarta City. The method used was observational with a cross sectional approach. Analysis of relationship test using chi-square statistical test. The results of this study showed that of the 36 respondents who were obedient in taking blood supplement tablets, 18 respondents (50%) had normal hemoglobin levels and 18 respondents (50%) had low hemoglobin levels and of the 18 respondents who were not obedient in taking blood supplement tablets, 6 respondents (33.3%) had normal hemoglobin levels and 12 respondents (66.7%) had low hemoglobin levels. There is no relationship between adherence to taking blood supplement tablets and hemoglobin levels ($p=0.245$), there is a relationship between iron intake and hemoglobin levels ($p=0.003$), there is a relationship between folic acid intake and hemoglobin levels ($p=0.004$), there is a relationship between vitamin C intake and hemoglobin levels ($p=0.019$), there is no relationship between vitamin B12 intake and hemoglobin levels ($p=0.161$).

Introduction

Pregnant women are a group that is vulnerable to malnutrition. During pregnancy there is an increase in nutritional needs to meet the needs of the mother and fetus in the womb. Increased need is due to the growth of the fetus, placenta, increased blood volume and increased basal metabolism. One of the nutritional problems that often occurs in pregnant women is anemia due to increased intake needs and physiological changes in the blood and bone marrow during pregnancy. (Sarwono, 2016). Based on data from the Ministry of Health (Kemenkes) in 2013, the prevalence of pregnancy anemia in Indonesia is relatively high at 37.1%. This prevalence rose to 48.7% in 2018.

Surakarta City is one of the cities in Central Java. In 2022, there are 10,435 pregnant women and as many as 10,424 pregnant women or 99.89% of pregnant women get blood-added tablets. Sangkrah Health Center is one of the puskesmas located in Pasar Kliwon District, Surakarta City. There are 955 pregnant women at Sangkrah Health Center in 2022 and as many as 129 pregnant women or 13.5% of pregnant women have anemia. The number of anemia incidence of pregnant women at Sangkrah Health Center is the highest prevalence in Surakarta City in 2022.

One of the efforts in preventing and overcoming the incidence of anemia in pregnant women is iron supplementation by giving blood-added tablets. The coverage of pregnant women in Central Java in 2018 who received <90 blood-added tablets was 40.30% and pregnant women who received ≥ 90 blood-added tablets of 59.70%, while the coverage of pregnant women who took <90 blood-added tablets was 53.40% and pregnant women who consumed ≥ 90 blood-added tablets of 46.60%.

The provision of blood-added tablets to pregnant women in Surakarta has been good, reaching 99.89% in 2022. However, in 2022, 6.71% of pregnant women in Surakarta experienced pregnancy anemia. During pregnancy, pregnant women receive 90 iron tablets that should be taken for 42 weeks from the first prenatal checkup. The composition of the iron tablet is FeSO₄ which contains 60 mg of iron and 0.4 mg of folic acid (Hiola et al., 2020). In an effort to prevent anemia, in addition to maternal compliance in consuming blood-added tablets, the intake of micronutrients consumed by pregnant women also has an effect. These micronutrients include iron, folic acid, vitamin C, and vitamin B12.

The relationship between consumption of blood-added tablets and micronutrient intake with hemoglobin levels of pregnant women has never been conducted in research at the Sangkrah Health Center in Surakarta City. This is the background for researchers to conduct a study entitled "The Relationship between Blood Added Tablet Consumption and Micronutrient Intake with Hemoglobin Levels of Pregnant Women at Sangkrah Health Center Surakarta City".

Methods

This study was an observational study using a cross sectional approach. The population in this study was pregnant women with the third trimester of pregnancy who were in the working area of the Sangkrah Health Center which amounted to 750 pregnant women. The sampling technique uses the consecutive sampling method with a sample of 54 people. How to collect data for the consumption of blood-added tablets using the questionnaire form, micronutrient intake data using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) form for the last three months and hemoglobin level data using the Cyanmethemoglobin method. Data analysis using the SPSS 21 program. Univariate analysis was performed to look at the frequency and percentage of each variable. Bivariate analysis was used to determine the relationship between consumption of blood-added tablets and micronutrient intake with hemoglobin levels of pregnant women. The statistical test used in this study is the chi-square test.

Result and Discussion

Characteristics of Respondents

The respondents in this study were pregnant women in the Sangkrah Health Center work area, totaling 54 people who met the inclusion criteria. The characteristics of the study respondents can be seen in Table 1.

Table 1. Characteristics of Research Respondents

Variable	Category	Total (n)	Percentage (%)
Age	19 - 24 years	17	31,5
	25 - 34 years	25	46,3
	35 - 44 years	12	22,2
	Sum	54	100
Education	Basis	24	44,4
	Next	30	55,6
	Sum	54	100

Gestational Age	7 months	35	64,8
	8 months	10	18,5
	9 months	9	16,7
	Sum	54	100
Work	Work	24	44,5
	Not Working	30	55,5
	Sum	54	100

Table 1 shows the age of respondents of this study as 46.3% aged between 25-34 years. The minimum age of respondents is 19 years and the maximum age is 44 years. The average age of respondents was 29 years. The reproductive age that is safe for mothers is between the ages of 20-35 years. If pregnancy occurs below or above that age, it can pose a risk of pregnancy and childbirth. This is because at a young age the reproductive organs are not perfect as a whole and are not ready emotionally and mentally (Manuaba, 2010).

The level of education is divided into two categories, including elementary levels namely elementary and junior high school and advanced levels namely high school and college. In the table according to the distribution of education levels, most respondents have a further education level of 55.6%. The level of education has an influence on the process of pregnancy of a woman. The higher the level of education, the higher one's knowledge because it will make it easier to absorb information, especially in terms of maternal and child health. The level of education also affects the attitude of pregnant women in receiving health information during pregnancy, besides it has an impact on the behavior of awareness of consuming iron for pregnant women. Lack of knowledge about the importance of iron during pregnancy is a factor in iron deficiency (Sasono et al., 2021).

Respondents in this study were III trimester pregnant women. The results of Aksari & Imanah (2022) research show that increasing gestational age results in an increase in iron needs. Increased needs that are not balanced with adequate iron consumption can risk anemia in the third trimester of pregnancy.

Most of the subjects in this study were housewives. Research conducted by Azizah et al. (2023) shows that there is a relationship between work and the incidence of anemia in pregnant women. Working mothers who experience anemia may be caused by mothers not paying attention to health conditions and maintaining their diet which can affect the condition of pregnancy. An unbalanced diet will cause the intake of nutrients that enter the body to be unbalanced and can cause malnutrition, one of which is anemia. In addition, income also affects the nutritional status of pregnant women. Lack of income causes a lack of fulfillment of daily food needs, which has an impact on the quality of food consumed by mothers (Rai et al., 2016).

Overview of Blood Add Tablet Consumption

The pattern of consumption of blood-added tablets is one of the indirect factors that can affect the incidence of anemia in pregnant women. The characteristics of research respondents according to the level of adherence to the consumption of blood-added tablets can be seen in Table 2.

Table 2. Overview of Blood Add Tablet Consumption

Compliance Rate	Total (n)	Percentage (%)
Obedient	36	66,7
Disobedient	18	33,3
Sum	54	100

Based on Table 2, it is known that respondents who are obedient to taking blood-added tablets are 66.7%, while respondents who are non-compliant to take blood-added tablets are 33.3%.

Adherence to the consumption of blood-added tablets can affect the incidence of anemia during pregnancy. Prevention of anemia is directed at iron supplementation in accordance with the recommended dosage. However, consumption of blood-added tablets also causes uncomfortable side effects such as nausea and dizziness. This side effect causes maternal non-compliance in taking blood-added tablets in accordance with the recommended dose (Hiola et al., 2020).

Iron Intake Overview

The average level of iron adequacy of respondents was 19.9 mg or 73.81%. The minimum value of respondents' iron adequacy was 46.30% and the maximum value was 98.15%. The characteristics of research respondents according to the level of iron adequacy can be seen in Table 3.

Table 3. Iron Intake Overview

Intake Category	Total (n)	Percentage (%)
Enough	33	61,1
Less	21	38,9

Based on Table 3, it can be seen that most of the study respondents had a sufficient category in consuming iron, which was 61.1%. Iron is one of the essential minerals needed by the body to form components *Heme* from hemoglobin. Sources of iron can be found in foodstuffs *Heme* consisting of meat, fish, liver, eggs and milk and *non-heme* derived from plants such as nuts, green vegetables, fruits and cereals (Tarigan, 2021). Insufficient iron intake in this study may be caused by the diet of pregnant women who are less varied, especially in foods that are sources of iron. In addition, it can also be caused by the consumption of substances that can inhibit iron absorption such as tea, coffee and milk.

Overview of Folic Acid Intake

The average level of folic acid adequacy of respondents was 426.6 µg or 71.10%. The minimum value of folic acid adequacy is 42.30% and the maximum value is 95.70%. The characteristics of research respondents according to the level of folic acid adequacy can be seen in Table 4

Table 4. Overview of Folic Acid Intake

Intake Category	Total (n)	Percentage (%)
Enough	31	57,4
Less	23	42,6

Based on Table 4, it is known that some of the subject respondents were sufficient in consuming folic acid or 57.4%, while 42.6% of subjects had a category of less in consuming folic acid. Folic acid is one of the vitamins whose needs increase twice during pregnancy. Increased need for folic acid is not only important for pregnant mothers, but also important for the growth and development of the fetus being conceived. Folic acid plays an important role in the formation of red blood cells, therefore pregnant women who lack folic acid generally also experience anemia (Hasibuan, 2017).

Overview of Vitamin C Intake

The subjects' average vitamin C adequacy level was 62.3 mg or 73.30%. The minimum value of vitamin C adequacy of respondents was 49.29% and the maximum value was 96.94%. The characteristics of study respondents according to the level of vitamin C adequacy can be seen in Table 5.

Table 5. Overview of Vitamin C Intake

Intake Category	Total (n)	Percentage (%)
Enough	31	57,4
Less	23	42,6

Based on Table 5 it can be seen that most respondents are sufficient in consuming vitamin C or 57.4%, while 42.6% have a category of less in taking vitamin C. Vitamin C deficiency during pregnancy can increase the risk of anemia. Vitamin C deficiency also causes a decrease in body immunity so that mothers are vulnerable to transmission of virus outbreaks (Sumiari et al., 2022). Based on Krisnanda (2020), vitamin C can increase the absorption of iron that is still in ferric form into ferrous form so that it is more easily absorbed by the body and fights the effects of phytate and tannin which can inhibit iron absorption.

Overview of Vitamin B12 Intake

The average level of vitamin B12 adequacy of respondents was 3.3 µg or 72.49%. The minimum value of iron adequacy of respondents was 40% and the maximum value was 97.78%. The characteristics of study respondents according to the level of vitamin B12 adequacy can be seen in Table 6.

Table 6. Overview of Vitamin B12 Intake

Intake Category	Total (n)	Percentage (%)
Enough	35	64,8
Less	19	35,2

Based on Table 6, it can be seen that most respondents are sufficient in taking vitamin B12 or 64.8% and only a small percentage of respondents are lacking in taking vitamin B12 or 35.2%. Vitamin B12 plays a role in the formation of red blood cells. Sources of vitamin B12 in animal foods are more commonly found and easier to absorb compared to vitamin B12 derived from vegetable sources. Vitamin B12 also plays a role in the metabolic process of iron absorption (Butola et al., 2020). Vitamin B12 deficiency can be at risk of anemia, especially during pregnancy. Food sources that contain vitamin B12 include liver, meat, eggs, milk and other animal foods (Chintiabadi Caesaria et al., 2015).

The Relationship between Blood Added Tablet Consumption and Hemoglobin Levels

Adherence to taking blood-added tablets is interpreted as the accuracy of pregnant women in taking blood-added tablets regularly during pregnancy (Anggraini, 2018). Based on bivariate analysis of the degree of compliance of pregnant women with hemoglobin levels is described in Table 7 below.

Table 7. Distribution of compliance rates of pregnant women based on hemoglobin levels

Compliance	Hb levels						p
	Usual		Low		Total		
	n	%	n	%	n	%	
Obedient	18	50%	18,0	50%	36	100%	0,245
Disobedient	6	33,3%	12,0	66,7%	18	100%	

Table 7 shows that 66.7% of non-compliant pregnant women had low hemoglobin levels, while 50% of adherent pregnant women consumed blood-added tablets and 50% had low hemoglobin levels. Test results *Chi Square* With a p value = 0.245 shows no relationship between the level of compliance with the consumption of blood-added tablets with hemoglobin levels of pregnant women. This result is in line with Asmin et al. (2021) research which states that there is no relationship between the compliance of pregnant women in taking blood-added tablets with the

incidence of anemia of pregnant women. However, based on Table 7, pregnant women who are obedient consume blood-added tablets and have more normal hemoglobin levels than non-compliant pregnant women.

Based on the results of interviews with respondents, most of the reasons for non-compliance in taking blood-added tablets are due to forgetfulness and the side effects caused, namely nausea. This is supported by research conducted by Amanah (2019) which states that some of the side effects of taking blood-added tablets include nausea, constipation, diarrhea, dizziness and headaches that cause subjects to be non-compliant in taking blood-added tablets.

In Table 7, it is known that mothers who are obedient to taking blood-added tablets and have anemia are 50%. Based on interviews that have been conducted on respondents, it is known that many respondents consume coffee, tea and milk in the near future with the consumption of blood-added tablets. According to Wahyuningsih (2016), tannins in tea and coffee and calcium in milk can inhibit iron absorption.

This problem requires the role of health workers to overcome it by providing counseling at the time of the visit *antenatal care* (ANC) because health workers play an important role in overcoming anemia by reminding the importance of additional iron, important factors of foods containing iron and the importance of ANC so that they can know the incidence of anemia early (Manuaba, 2010).

The Relationship of Iron Intake with Hemoglobin Levels

The relationship between iron intake and hemoglobin levels of pregnant women can be seen in Table 8.

Table 8. Distribution of iron intake based on hemoglobin levels

Iron Adequacy Level	Hb levels						OR	CI	p
	Usual		Low		Total				
	n	%	n	%	n	%			
Less	4	19%	17	81%	21	100%	0,153	0,04-0,5	0,003
Enough	20	60,6%	13	39,4%	33	100%			

Table 8 shows that pregnant women with less iron adequacy have low hemoglobin levels of 81%, while pregnant women with sufficient iron levels have low hemoglobin levels of 39.4%. Test results *Chi Square* With a p value = 0.003 indicates a relationship between iron adequacy and hemoglobin levels. The results of the closeness analysis show the value of *Odds Ratio* (OR) 0.153 (95% CI 0.04 – 0.5) which means that the chances of pregnant women with iron adequacy levels are less have a 0.153 times chance of having low hemoglobin levels compared to pregnant women with sufficient iron and iron consumption is a risk factor for anemia. This is in line with Retnaningsih et al. (2020) in his research stating that there is a significant relationship between iron intake and hemoglobin levels with a positive relationship strength of 0.326, meaning that the higher the iron intake, the higher the mother's hemoglobin level.

Lack of iron intake may be caused during pregnancy, pregnant women are less in consuming foods that contain high iron. In line with the SQ-FFQ interview that has been conducted, most pregnant women are less varied in consuming animal food sources such as chicken liver 1x / month or some pregnant women do not consume chicken liver and rarely consume red meat and fish. In addition, some respondents like to consume tea where tannins in tea can inhibit the absorption of iron in the body. The habit of consuming tea can be at risk of anemia 2,785 times greater than pregnant women who do not consume tea (Purwaningtyas, 2017).

Relationship of Folic Acid Intake with Hemoglobin Levels

The relationship between folic acid intake and hemoglobin levels of pregnant women can be seen in Table 9.

Table 9. Distribution of folic acid intake based on hemoglobin levels

Folic Acid Adequacy Level	Hb levels						OR	CI	p
	Usual		Low		Total				
	n	%	n	%	n	%			
Enough	19	61,3%	12	38,7%	31	100%	0,175	0,05-0,5	0,004
Less	5	21,7%	18	78,3%	23	100%			

Table 9 shows that pregnant women with insufficient folic acid levels have low hemoglobin levels of 78.3%, while pregnant women with sufficient levels of folic acid have low hemoglobin levels of 38.7%. Test results *Chi Square* With a p value = 0.004 shows a relationship between folic acid adequacy and hemoglobin levels. The results of the closeness analysis show the value of *Odds Ratio* (OR) 0.175 (95% CI 0.05 – 0.5) which means that the chances of pregnant women with adequate levels of folic acid have less than 0.175 times the chance of having low hemoglobin levels compared to pregnant women with sufficient folic acid and folic acid consumption is a risk factor for anemia. The results of this study are in line with research conducted by Meliala et al. (2020) which states that there is a relationship between folic acid and hemoglobin levels in pregnant women with a positive relationship strength of 0.831, which means that the better the intake of folic acid, the better the hemoglobin levels of pregnant women. The results of Tarigan et al. (2021) show that there is a relationship between folic acid and the anemia status of pregnant women. Pregnant women with less folate intake are at risk of 6.7 times (CI 95%: 2.6-16.9) experiencing anemia.

Based on Table 9, it is known that pregnant women who consume less folic acid and experience anemia are more than mothers who consume enough folic acid. This is likely due to the lack of pregnancy during pregnancy pregnant women consume foods that contain high folic acid. In line with the SQ-FFQ interview that has been conducted, most pregnant women consume fish 1-2 times / month, rarely or even do not consume chicken liver and beef liver and consume green vegetables only 1-2 times / day and some pregnant women do not like to eat vegetables. Chicken liver, beef liver and green vegetables such as spinach, broccoli, cabbage, and others are sources of folic acid, so that if you lack in consuming these foods, it can cause a deficit in folate intake (Tarigan et al., 2021).

The Relationship of Vitamin C Intake with Hemoglobin Levels

The relationship between vitamin C intake and hemoglobin levels of pregnant women can be seen in Table 10

Table 10. Distribution of Vitamin C Intake Based on Hemoglobin Levels

Adequate Level of Vitamin C	Hb levels						OR	CI	p
	Usual		Low		Total				
	n	%	n	%	n	%			
Enough	18	58,1%	13	41,9%	31	100%	0,255	0,07-0,8	0,019
Less	6	26,1%	17	73,9%	23	100%			

Table 10 shows that pregnant women with adequate levels of vitamin C lack have low hemoglobin levels of 73.9%, while pregnant women with sufficient levels of vitamin C have low hemoglobin levels of 41.9%. Test results *Chi Square* with a p value = 0.019 shows a relationship between vitamin C adequacy and hemoglobin levels. The results of the closeness analysis show the value of *Odds Ratio* (OR) 0.255 (95% CI 0.07 – 0.8) which means that the

chances of pregnant women with adequate levels of folic acid have less than 0.255 times the chance of having low hemoglobin levels compared to pregnant women with sufficient vitamin C and consumption of vitamin C is a risk factor for anemia. This is in line with Devriany et al. (2018) which states that there is a significant relationship between vitamin C intake and hemoglobin levels with a positive correlation of 0.883, which means that the higher the intake of vitamin C, the better the hemoglobin levels.

Vitamin C deficiency is caused by lack of intake of foods containing vitamin C. Through the analysis of food intake using the SQ-FFQ form, it is known that most respondents rarely consume fruit or only 2 times / week. Consumption of vitamin C plays a role in increasing the absorption of non-heme iron to four times. Therefore, low intake of vitamin C can have an impact on low iron absorption which will affect hemoglobin levels.

Relationship of Vitamin B12 Intake with Hemoglobin Levels

The relationship between vitamin B12 intake and hemoglobin levels of pregnant women can be seen in Table 11.

Table 11. Distribution of Vitamin B12 Intake Based on Hemoglobin Levels

Vitamin B12 Adequacy Level	Hb levels						p
	Usual		Low		Total		
	n	%	n	%	n	%	
Enough	18	51,4%	17	48,6%	35	100%	0,161
Less	6	31,6%	13	68,4%	19	100%	

Table 11 shows that pregnant women with adequate levels of vitamin B12 lack have low hemoglobin levels of 68.4%, while pregnant women with sufficient levels of vitamin B12 have low hemoglobin levels of 48.6%. Test results *Chi Square* With a value of $p = 0.161$ shows no relationship between the level of compliance with the consumption of blood-added tablets with hemoglobin levels of pregnant women. This is not in line with Meliala et al. (2020) research which states that there is a relationship between vitamin B12 intake and hemoglobin levels with *p-value* 0.0001 and a positive correlation of 0.706 which means that the better the intake of vitamin B12, the better the hemoglobin levels of pregnant women.

Based on the analysis of food intake using the SQ-FFQ form in the last three months, it was found that most pregnant women consume food sources of vitamin B12 such as eggs with a frequency of 2-3 times / week and fish with a frequency of 1-2 times / month. Adequate intake of vitamin B12 is very important for fetal growth and development (Jeruszka-Bielak et al., 2017).

Conclusion

There is no relationship between consumption of blood-added tablets with hemoglobin levels ($p = 0.245$), there is a relationship between iron intake and hemoglobin levels ($p = 0.003$), there is a relationship between folic acid intake and hemoglobin levels ($p = 0.004$), there is a relationship between vitamin C intake and hemoglobin levels ($p = 0.019$), there is no relationship between vitamin B12 intake and hemoglobin levels ($p = 0.161$).

Suggestions for the puskesmas to pay more attention to the behavior of pregnant women in consuming blood-added tablets through counseling or assistance to pregnant women, as well as the delivery of information related to pregnant women's food intake to maintain or improve hemoglobin levels to normal. For pregnant women are expected to pay attention to health conditions during pregnancy by regularly taking blood-added tablets and eating nutritious foods.

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