



Comparative Study : Effect of Giving Fe Tablets and Moringa Leaves on Hb Levels in Pregnant Women

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Abstract: Overview: Normal Hemoglobin levels during pregnancy are very important in preventing anemia and complications that can occur during pregnancy. Moringa capsules contain iron, vitamin C, and antioxidants that can support the absorption of iron in the body, Fe tablets that support oxygen transport and the formation of red blood cells. Objective: Analyzing the effect of giving moringa leaf capsules and iron tablets on hemoglobin levels in pregnant women. Research Method: This study used a Quasi-experimental design method. This study was conducted in the Ambal II Kebumen Health Center Working Area with a sample of 30 respondents. In this study, 2 groups were used, namely those who received intervention (moringa leaf capsules and Fe tablets) and the control group (Fe only). Data analysis using the Wilcoxon test. Research Results: Showed that there was a difference in Hemoglobin levels in the Moringa leaf and Fe groups with a p value = 0.008 and as many as 14 pregnant women experienced an increase in Hb. While in the control group the analysis results showed a difference with a p value = 0.007. However, as many as 13 mothers experienced a decrease in Hb levels. Conclusion: giving moringa capsules and Fe tablets has better effectiveness in increasing Hb levels compared to just Fe tablets alone.

Keywords: Moringa Leaf Capsules, Pregnant Women, Haemoglobin Levels

1. INTRODUCTION

Pregnancy is a time that makes mothers susceptible to anemia. Anemia is a condition in which the mass of Hb (hemoglobin) or erythrocytes or red blood cells in the blood circulation is reduced, where it can no longer function to carry oxygen to all tissues.(Hartati et al., 2024) Anemia in pregnancy is a condition in which a mother has Hb <11 gr% in the 1st and 3rd trimesters or <10.5 gr% in the 2nd trimester due to hemodilution in the 2nd trimester. (Susanti et al., 2021) WHO (World Health Organization) states that the recommended Hb level for pregnant women is ≥ 11 gr/dl, if it is below it indicates anemia. Hb 10,0–10,9 g/dL dianggap anemia ringan, 7,0–9,9 g/dL sedang, dan <7,0 g/dL berat. (Sharma et al., 2021)

Prevalence of anemia in pregnant women from all over the world in the last 19 years has decreased by 4.5%, namely from 2000-2019, while in 2019 in Indonesia it increased by 44.2% from the previous 42.1% in 2015. (Sulung et al., 2022)

Anemia that is often found during pregnancy is anemia due to lack of iron.(Hartati et al., 2024) Referring to data provided by RISKESDAS, the number of pregnant women with anemia in Indonesia reached 48.9%, which almost occurred between the ages of 15 and 24 years with a total of 84.6%. Meanwhile, the proportion of recipients of iron supplement tablets was 73.2%, of which 24% were given 90 and 76% received <90 tablets, while approximately 26.8% did not receive them.(Kemenkes RI, 2018) (Ministry of Health of the Republic of Indonesia, 2018).

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The body's need for iron during pregnancy ranges from 800-1040 mg, $\pm$ 50-75 mg is needed to form the placenta, $\pm$ 300 mg for fetal growth, $\pm$ 500 mg is used to increase Hb mass, $\pm$ 200 mg is excreted through urine, intestines, and skin, then $\pm$ 200 mg will be lost during labor. (Susanti et al., 2021) Iron for pregnant women has a crucial role, especially for fetal development. Anemia if it occurs during pregnancy will increase the risk of death of the child or mother, premature birth, and infectious diseases. Anemia due to lack of iron will also affect the development and growth of the baby/fetus both while in the womb and afterwards. One of the government's efforts to deal with anemia in pregnant women is carried out by providing iron supplement tablets or blood-boosting tablets, but the results obtained are still not optimal. (Suheti et al., 2020)

Anemia in pregnant women can increase the risk of premature birth, maternal and child mortality, and infectious diseases. Iron deficiency anemia in mothers can affect the growth and development of the fetus/baby during pregnancy and after. The anemia control program carried out in pregnant women is carried out by providing 90 Iron Supplement Tablets to pregnant women during their pregnancy. The coverage of pregnant women receiving 90 Iron Supplement Tablets in Central Java Province in 2023 was 90.82 percent. (Central Java Provincial Health Office, 2023) The coverage of providing Iron Supplement Tablets of at least 90 Tablets to pregnant women in Indonesia in 2023 was 88.5%. This figure increased compared to 2022 which was 86.2%. (Ministry of Health of the Republic of Indonesia, 2023)

A number of people were found to dislike consuming iron supplement tablets because of the nausea and other effects (Suheti et al., 2020). The prevalence of anemia for the Central Java region is 57.7%, which is still considered a public health problem because it has a percentage exceeding 20%. Pregnant women are susceptible to anemia because the volume of blood during pregnancy will increase by around 50%. (Sulistiani et al., 2021) Referring to previous research by Rismawati (2021), the results showed that there was a relationship between giving Moringa leaves to pregnant women and increasing Hb levels. (Rismawati et al., 2021)

The iron needed in the first trimester is around 1 mg per day (basal loss of 0.8 mg per day) accompanied by 30-40 mg of additional requirements for red blood cells and the fetus.

Then for the second trimester it is around 5 mg per day, (basal loss of 0.8 mg per day) accompanied by the need for a conceptus of 115 mg and red blood cells of 300 mg. Furthermore, in the third trimester, it is 5 mg per day (basal loss of 0.8 mg per day) accompanied by the need for a conceptus of 223 mg and red blood cells of 150 mg. This condition is proven by the results of bivariate analysis with p of 0.000 (<0.05) which reflects the influence of giving moringa leaf capsules with Hb levels. (Rismawati et al., 2021) In previous research on the use of beetroot and lemon combinations written by Suci Setiyaningsih in 2020, this study provided results that giving beetroot and lemon juice accompanied by Fe tablets provided good effectiveness in increasing Hb levels in pregnant women. (Setiyaningsih et al., 2020)

Researchers use moringa leaf media as an instrument in other words, moringa leaf capsules in terms of economy, the price of moringa leaf capsules is cheaper than beetroot and lemon, based on other points of view, moringa leaf capsules are easy to obtain, moringa leaf capsules are more practical to consume compared to beetroot juice combined with lemon. The influence of moringa leaves on increasing Hb levels occurs because it contains 28.29 mg of iron per 100 grams of moringa leaves. Plants with the Latin name "moringa oleifera" or commonly called moringa have stems that are easily broken and sparse, with small oval-shaped leaves arranged in a stalk. Moringa can grow well in areas between 300-500 meters above sea level. Because it has various benefits and easy maintenance, Moringa is widely cultivated through cuttings independently. (Rahmawati, 2017)

Referring to the explanation and based on a preliminary study conducted by researchers at the Ambal II Health Center, data from all pregnant women in 2022 were 317 people, while those suffering from anemia were 149 people. So that there are 47% of pregnant women who experience anemia, therefore, in order to meet the iron needs during pregnancy, one of the interventions that can be implemented is to provide moringa leaf capsules. So that researchers here intend to conduct research to describe the effectiveness of consuming iron tablets and moringa leaf capsules on Hb levels of pregnant women with anemia at the Ambal II Health Center

2. PRELIMINARIES OR RELATED WORK OR LITERATURE REVIEW

Moringa leaves

Moringa oleifera Lam or Kelor is a domestic plant that has been known for centuries to be multipurpose, efficacious as a medicine, and dense in nutrients. It has many natural compounds that are different when compared to other similar plants. Referring to the results of

the study, Moringa leaves have a high content of vitamins (A, B, and C), potassium, protein, calcium, and iron and are easy to digest. The high iron content in Moringa leaves in the form of flour or dry is equivalent to 25 times spinach, so it can be used as an alternative in treating anemia.(Pratiwi, 2020) Moringa leaves have been used for centuries for traditional medicine due to their various health benefits, such as:

- a. Increase immunity: Moringa leaves have antioxidant content that can strengthen immunity while protecting against damage caused by free radicals.
- b. Lower blood pressure: Moringa leaves can overcome high blood pressure and maintain heart health
- c. Reduce inflammation: The anti-inflammatory content in Moringa leaves can help inflammation in the body.
- d. Improves digestion: Moringa leaves have natural laxative properties that will help improve digestion and reduce digestive problems such as constipation.
- e. Maintains healthy skin: The antioxidant and vitamin content of Moringa leaves will help maintain healthy skin and slow down aging.
- f. Increase Hemoglobin: Moringa leaves can be used to increase hemoglobin levels. Moringa leaves have a lot of vitamin C, iron, and other nutrients to support the improvement of Hb levels.

Moringa Leaves in Overcoming Anemia in Pregnant Women: Consuming moringa leaves can be an alternative in overcoming malnutrition. Obtaining from modern scientific research has evidence that moringa leaves are included as a food source that has high nutritional content. Moringa leaves are also rich in Fe or iron, moringa leaves that have been made into flour even have greater iron, which is 28.2 mg per 100 grams. Then in moringa leaves there are also nutrients in the form of 4 times more vitamin A than carrots, 3 times more potassium than bananas, 7 times more vitamin C than oranges, 2 times more protein than eggs or yogurt, 4 times more calcium than milk, and 3 times more iron than spinach.

Moringa leaf powder has an iron content of up to 60.5 mg per 100 grams and vitamin C up to 17.3 mg. Moringa is widely known throughout the world to have nutrients, where WHO itself has introduced moringa as an alternative food in dealing with malnutrition (nutritional problems). Moringa leaves in Asia and Africa are used as supplements with high nutrients for children and breastfeeding mothers. All parts of moringa are beneficial for health, have nutritional value, and are useful in the industrial sector. The high nutrition, benefits, and properties of moringa have earned it the nickname "Mother's Best Friend and Miracle Tree".

However, its use in Indonesia tends to be less than optimal, where it is generally known only as a vegetable menu. In addition to being consumed directly, moringa can be processed first so that it becomes flour that can be used as a fortifier to meet nutrition. In various food products, for example in processed cakes, puddings, biscuits, nuggets, crackers, or other processed products, moringa leaf flour can be added to act as a nutritional supplement. There are a number of ways that can be carried out in drying moringa leaves, including: 1) drying indoors, 2) utilizing the sun, and 3) using a drying machine. Although the treatments are different, basically all three are carried out to suppress water levels and inhibit enzymatic reactions in plants.(Kurniawati et al., 2018) Moringa leaves have rich and diverse nutritional content, making them one of the popular superfood plants. The combination of these nutritional contents in Moringa leaves can help improve hemoglobin levels in the body and overcome anemia. The content of Moringa leaves in every 100 grams is as follows.

	Daun kelor	Tepung daun kelor
Kalori (kkal)	92,00	205,00
Protein (g)	6,70	27,10
Lemak (g)	1,70	2,30
Karbohidrat (g)	13,40	38,20
Serat (g)	0,90	19,20
Ca (mg)	440,00	2003,00
Mg (mg)	24,00	368,00
P (mg)	70,00	204,00
K (mg)	529,00	1324,00
Cu (mg)	1,10	0,60
Fe (mg)	7,00	28,20
S (mg)	137,00	870,00
Vitamin A-B carotene (mg)	6,80	16,30
Vitamin B-choline (mg)	423,00	-
Vitamin B1-thiamin (mg)	0,21	2,60
Vitamin B2-riboflavin (mg)	0,05	20,50
Vitamin B3-nicotinic acid (mg)	0,80	8,20
Vitamin C-ascorbic acid (mg)	220,00	17,30
Vitamin E-tocopherol	-	113,00

Figure.1 Moringa content

Source: (Isnan & Nurhaedah M., 2017)

Consumption of moringa leaves can have a positive effect on increasing Hb levels in pregnant women with anemia. Moringa leaves contain a number of important nutrients that can help in the production of red blood cells, including folic acid, iron and vitamin C. The effect of giving moringa leaf capsules + Fe tablets is higher than just Fe tablets.(Frianti et al., 2022)

Referring to Sartika et al. (2023) in their study, the average Hb level before treatment was 11.440 grams/dL (SD=0.7890), while after treatment it was 12.055 grams/dL (SD=0.7797). Referring to the dependent T test, a p value of 0.000 was obtained, meaning that there was an effect of the efforts to give moringa leaf extract capsules with increasing Hb levels during pregnancy.(Sartika et al., 2023)

Meanwhile, referring to the research of Rismawati et al. (2021) obtained the average Hb level before giving moringa leaf capsules and Fe in the intervention group, namely 9.907 grams/dl, while for the control group it was 9.800 grams/dl. Furthermore, the average Hb level in the intervention group after giving moringa leaf capsules and Fe was 11.327, while for the control group it was 10.700 grams/dl. 0.90. Furthermore, through bivariate analysis, p was obtained at 0.000 (<0.075). In addition to being able to increase Hb levels, moringa leaf capsules have also been proven to be able to prepare for the smooth production of breast milk after giving birth.(Rismawati et al., 2021) This is in accordance with research from Wardani & Mirna (2022) which explains that the proportion of postpartum mothers who are able to produce breast milk smoothly in the intervention group is 85.0%, while for the control group it is only 25.0%. These results show that extracts from Moringa leaves can increase breast milk production in postpartum mothers.(Wardani & Mirna, 2022)

Anemia

Anemia is a medical condition indicated by low red blood cells or low Hb levels. Anemia due to lack of iron is called iron deficiency anemia or iron deficiency. Iron deficiency anemia is the most common type of anemia that occurs from all corners of the world. Iron deficiency can occur due to several reasons, including insufficient iron through food, poor absorption of iron, or excessive iron loss due to bleeding. Normally, Hb levels in pregnancy are slightly lower than non-pregnant, because the blood volume of pregnant women increases more than the increase in Hb production. (Amalia & Tjiptaningrum, 2016)

First Trimester: Normally, Hb levels in pregnancy usually range from 11-12.5 grams per deciliter (g / dL). If this level is below 11 g / dL, it can indicate anemia and needs to be evaluated further. Second and Third Trimesters: During the second and third trimesters, Hb levels usually decrease slightly further and range from 10.5-11.5 g / dL. However, if the Hb level drops below 10.5 g/dL, it can be an indication of anemia and requires further treatment. A number of factors that can potentially cause anemia in pregnancy include:

a. Iron deficiency

The increased need for iron during pregnancy occurs because the body needs it to produce more red blood cells. If iron intake through food is insufficient, it can potentially cause anemia.

b. Vitamin B12 or folate deficiency

Lack of vitamin B12 or folate can also trigger anemia, both of which play an important role in producing healthy red blood cells.

c. Nutritional disorders

An imbalanced diet or lack of nutrition during pregnancy also triggers anemia. Anemia in pregnancy can have a significant impact on the fetus and mother, some of the impacts include:

d. Risk of premature birth

Pregnancy accompanied by anemia will have a greater risk of premature birth, namely before the baby is 37 weeks old.

e. Low birth weight

Anemia in pregnancy will also cause the baby to have a low birth weight, which can cause health problems for the baby.

f. Fetal growth disorders

Severe anemia can result in fetal development disorders and affect the function of its organs

g. Risk of complications in the mother

Anemia in pregnancy can increase the risk of complications, such as infection, severe bleeding during childbirth, or other health problems in the mother.

Treatment for anemia in pregnancy depends on the cause. Doctors can recommend iron, folic acid, or vitamin B12 supplements to increase Hb levels and prevent or treat anemia. Changes to a healthy and balanced diet are also important to meet nutritional needs during pregnancy. Anemia in pregnancy can reduce the supply of oxygen to tissues and organs, including the developing fetus. This can exacerbate the risk of low birth weight, premature birth, and fetal growth disorders. Then anemia can also increase the risk of complications such as infection, severe bleeding during childbirth, and other health problems in the mother. (Chandra et al., 2019)

Fe Tablets Increase Hemoglobin Levels

Fe tablets, also known as iron tablets, are supplements used to increase hemoglobin (Hb) levels in the body. Hb can be understood as a protein from red blood cells with the responsibility of transporting oxygen to all parts of the body. Lack of iron will cause anemia, a condition where there are not enough red blood cells in the body to transport oxygen.

Consuming Fe tablets can help increase Hb levels. Iron is the most important component of Hb production. By consuming Fe tablets, the body gets enough iron supply to produce healthy red blood cells. This helps increase oxygen transport in the body, helps prevent anemia, and improves overall health. (Syahrina et al., 2020)

The absorption of iron from Fe tablets depends on several factors, such as the chemical form of iron in the tablet, interactions with food, and individual conditions. The iron in Fe tablets can be in the form of ferrous (Fe^{2+}) or ferric (Fe^{3+}), with the ferrous form being more easily absorbed by the body. Foods containing vitamin C can increase iron absorption, while foods containing calcium, tea, or coffee can inhibit iron absorption.

Regarding the increase in Hb levels when given Fe tablets, Sari (2020) in her study explained that the average Hb levels that pregnant women had in the second trimester after consuming 30 Fe tablets did not provide a difference (11.96 ± 0.67 grams / dl) compared to pregnant women who had not consumed Fe tablets (12.26 ± 0.99 grams / dl) through the acquisition of p of 0.079 (> 0.05), although there was no difference in statistical results, the range of maternal Hb levels was still within normal limits. (Sari, 2020) Meanwhile, according to Sunarti's research (2020), it was found that Hb levels were abnormal in up to 23 pregnant women (74.2%) before being given Fe tablets, while normal Hb levels were in 24 pregnant women (77.4%) after being given Fe tablets. Through an increase in the average Hb levels of pre and post pregnant women, namely 1.1 grams/dL. (Sunarti, 2020)

3. PROPOSED METHOD

The type of research used in this study is quantitative research with a correlational design and using a Cross Sectional approach. Correlational research is research that aims to detect the extent to which variables in a factor are related to other variables based on the correlation coefficient. (Notoatmodjo, 2018)

Population and Sample

The population of this study was pregnant women in the second trimester with anemia in the Ambal II Health Center work area, namely 30 pregnant women in the second trimester who experienced anemia in October-December. The sample used in this study was 30 pregnant women with anemia. The sample determined was pregnant women in the second trimester who suffered from anemia. Determination of the sample will be carried out through the use of total sampling, which uses the entire population as a sample. (Sugiyono, 2019) Researchers here will use two groups that will receive different treatments or interventions. The treatment in question is the addition of moringa leaf capsules to compare the increase in Hb levels during

pregnancy before and after treatment. The first group of 15 respondents will be given treatment in the form of consuming moringa leaf capsules and Fe tablets while the next group with 15 respondents is the control group only receiving treatment by consuming Fe tablets.

Data Collection Techniques

Research Instruments

Researchers here use Hb meters and observation sheets in the use of moringa leaf powder capsules consumed by pregnant women to increase Hb levels. Observation sheets are used to collect data on the phenomena observed in the study. This study used moringa capsules with the trademark Kapsul Daun Kelor produced by Sidomuncul with a total of 50 capsules. The composition in one capsule contains *Moringa oleifera* Folium 300 mg, registration number POM TR 132371791.

This is based on previous research according to (Yulastuti & Kurnia, 2021) showing that moringa leaf powder can be used to treat anemia and increase hemoglobin levels by giving 1x1 capsule of moringa leaf powder per day for 30 days, each capsule contains 200mg of moringa leaf powder. This is based on previous research according to (Yulastuti & Kurnia, 2021) showing that moringa leaf powder can be used to treat anemia and increase hemoglobin levels by giving 1x1 capsule of moringa leaf powder per day for 30 days, each capsule contains 200mg of moringa leaf powder.

Data Analysis Techniques

This analysis is a statistical technique used to provide a comparison of the differences between two measurements taken from the same subject before and after an intervention or treatment. In the context of research on the effectiveness of adding moringa leaf capsules to Hb levels of pregnant women in TM II who suffer from anemia. If the results of the normality test are normally distributed, the hypothesis test used is the paired t test, but if the distribution is not normal, then do data transformation and then if the results of the data distribution are still not normal, the hypothesis test uses Wilcoxon.

4. RESULTS AND DISCUSSION

Results

Sample Descriptive Based on Respondent Characteristics

The distribution of data from this study through 30 respondents provided data distribution in the form of:

Age of Pregnant Women**Tabel 1.** Age of Pregnant Women

Age	Level of anemia					
	mild	(%)	moderate	(%)	severe	(%)
< 20 Years	0	0	0	0	0	0
20-35 Years	11	37	15	50	0	0
> 35 Years	3	10	1	3	0	0
Total	14	47	16	53	0	0

Source: Primary Data, 2024

In the results of data distribution on the characteristics of pregnant women respondents based on age with the age category of 20-35 years who experienced mild anemia as many as 11 people (37%) and those who experienced moderate anemia as many as 15 people (50%). While based on the age category > 35 years who experienced mild anemia as many as 3 people (10%) and those who experienced moderate anemia as many as 1 person (3%).

Parity of Pregnant Women**Table 2.** Parity of Pregnant Women

Parity	Anemia level					
	mild	(%)	moderate	(%)	severe	(%)
Primipara	3	10	12	40	0	0
Multipara	10	33	5	17	0	0
grandemultipara	0	0	0	0	0	0
Total	13	43	17	57	0	0

Source: Primary Data, 2024

The results of the characteristics of respondents based on the parity of pregnant women show that in pregnant women with the primiparous category who experience anemia with mild anemia levels are 3 people (10%), moderate anemia is 12 people (40%). While in the characteristics of respondents in the multiparous category who experience anemia with mild levels are 10 people (33%) and moderate anemia is 5 people (17%).

Statistik Deskriptif

The distribution of data from this study through 30 respondents, who were divided into two groups, obtained data in the form of:

Data Distribution Based on Treatment Group

Table 3. Data Distribution Based on Treatment Group

	N	Min	Max	Mean	Std. Deviation
Treatment Group Pretest	15	8,40	10,50	9,4667	0,58391
Treatment Group Posttest	15	8,40	10,80	10,1333	0,59841

Source: Primary Data, 2024

Based on table 3 above shows that the Hemoglobin Level in the treatment group increased, in the pre-test the mean value was 9.4667, while the value in the post-test was 10.1333, at the minimum value the hemoglobin level was the same, which was 8.40, at the maximum value there was also an increase from the pre-test with a value of 10.50, in the post-test it became 10.80, and the standard deviation value in the pre-test was 0.58391, and in the post-test it became 0.59841.

Data Distribution Based on Control Group

Table 4. Data Distribution Based on Control Group

	N	Min	Max	Mean	Std. Deviation
Pretest Control Group	15	8,60	10,80	10,1133	0,68543
Posttest Control Group	15	8,40	10,60	9,6200	0,62929

Source: Primary Data, 2024

Based on table 4 above, it can be seen that the hemoglobin level in the results of the data distribution based on the control group decreased, in the pre-test the mean value obtained was 10.1133, while in the post-test the mean value was 9.6200, at the maximum value it decreased to 10.80 in the pre-test and in the post-test the maximum value became 10.60, at the minimum value there was a decrease in the pre-test with a value of 8.60, becoming 8.40 in the post-test. The standard deviation value in the pre-test was 0.68543 and in the post-test it became 0.62929.

Wilcoxon Test

In the results of the study in this study, the Wilcoxon test was carried out because the data distribution from the normality test after data transformation was still not normal. The results can be seen as follows:

1) Treatment Group

Table 5. Results of the Wilcoxon Test for the Treatment Group

		N	Mean Rank	Sum of Ranks
POST_KELOR -	Negative Ranks	1 ^a	13.50	13.50
PRE_KELOR	Positive Ranks	b 14	7.61	106.50
	Ties	c 0		
	Total	15		

Source: Primary Data, 2024

Based on table 5 above, it can be seen that the comparison of pre and post Hb levels in the treatment group. There was 1 person whose Hb level after treatment was lower than before treatment, and 14 people had Hb levels that were higher than before treatment.

Table 6. Statistical Test

	POST_ KELOR - PRE_KELOR
Z	a -2.647
Asymp. Sig. (2-tailed)	.008

Source: Primary Data, 2024

In the statistical test section (table 6) shows the results of the Wilcoxon test ($p = 0.008$). Because the p value < 0.05 statistically there is a significant difference in Hb levels between before and after giving moringa capsules.

2) Control Group

Table 7. Results of the Wilcoxon Test for the Control Group

		N	Mean Rank	Sum of Ranks
POST_KONTROL -	Negative Ranks	a 13	8.27	107.50
PRE_KONTROL	Positive Ranks	2 ^b	6.25	12.50
	Ties	c 0		
	Total	15		

Source: Primary Data, 2024

Table 7 shows a comparison of Hb levels in the control group before and after treatment. There were 13 people with lower Hb levels after treatment than before treatment, and 2 people had higher Hb levels than before administration of Fe tablets alone..

Tabel 8. Uji Statistik

	POST_ KONTROL -PRE_ KONTROL
Z	A -2.710
Asymp. Sig. (2-tailed)	.007

Source: Primary Data, 2024

In the statistical test section of the control group (table 8) shows the results of the Wilcoxon test in the control group, namely ($p = 0.007$). Because the p value < 0.05 statistically there is a difference in Hb levels between before and after giving Fe tablets only.

Discussion**Results of the Wilcoxon Analysis Test in the Treatment Group (Provision of Moringa Capsules and Fe Tablets)**

Moringa capsules and Fe tablets have an important role in increasing Hb levels in pregnant women. Then moringa leaves in capsule form are known to be rich in iron, where iron plays an important role in forming Hb as a protein that transports oxygen to the entire body in red blood cells. In this case, researchers also gave Fe tablets to pregnant women as a preventive

measure and treatment for anemia. Consumption of these Fe tablets has also been proven to be able to increase Hb levels. So that moringa capsules and Fe tablets play an important role as a booster for Hb levels during pregnancy while supporting the health of the fetus and mother during pregnancy. (Wahyuni et al., 2023)

These results are in line with research Rismawati (2021) which explains that giving moringa leaf capsules together with iron (Fe) supplements has been shown to have an important role in increasing Hb levels during pregnancy accompanied by anemia. Research conducted at the Sumanda Health Center showed that there was a significant difference between giving moringa leaf capsules and increasing Hb levels during pregnancy, through a p value of 0.000 which indicates statistically significant results. The average Hb level in the intervention group that received moringa leaf capsules and Fe increased from 9.907 grams/dl to 11.327 grams/dl after the intervention. This shows that the combination of moringa leaf capsules and Fe can be an alternative that has high effectiveness in increasing Hb levels in pregnant women with anemia.(Rismawati et al., 2021)

There are several aspects that need to be considered to increase Hb levels during pregnancy by using moringa capsules and Fe tablets, namely: 1) Dosage and Frequency. It is important to adhere to the dosage and frequency recommended by health professionals when consuming moringa capsules and Fe tablets. Overdose can cause side effects such as stomach ache and constipation. 2) Additional Nutrition. The absorption process of iron can be increased by consuming foods rich in vitamin C. Amino acids in protein also help the absorption of iron. 3) Consumption Time. Fe tablets should be taken on an empty stomach but if they cause stomach ache, they can be taken after meals. 4) Overall Health. Increased hemoglobin levels are also influenced by other health factors, such as adequate nutrition, adequate rest, and stress management. 5) Monitoring Hemoglobin Levels. It is important for health workers, especially midwives and nurses, to monitor hemoglobin levels regularly during pregnancy to ensure increased hemoglobin levels and make adjustments if necessary. 6) Consultation with Health Professionals. Always consult a doctor or midwife before starting to consume moringa capsules or Fe tablets or if you experience side effects.(Wirakhmi et al., 2023) Normal Hb levels during pregnancy are very important in preventing anemia and complications that can occur during pregnancy. An example of a step that can be taken to increase Hb levels is to consume moringa capsule tablets and Fe. These moringa capsules have a lot of iron, vitamin C, and antioxidants that can support the absorption of iron in the body, where Fe tablets will also provide important nutrients in the form of iron to support oxygen transport and the formation of red blood cells. (Nuraprilia et al., 2023)

The combination of using iron tablets and moringa capsules can provide better benefits in increasing Hb levels. Through regular consumption according to doctor's recommendations, pregnant women can reduce the risk of anemia and ensure the health of the fetus and mother during pregnancy. In addition, it is important to remember that the use of iron tablets and moringa capsules must be accompanied by a healthy diet that contains other sources of iron, such as green vegetables, red meat, and grains. Consumption of foods rich in iron can help increase overall Hb levels, the use of iron tablets and moringa capsules will play an important role as an effort to increase Hb levels during pregnancy. (Kemenkes RI, 2021)

Moringa itself is known as a plant with abundant nutrients and can provide health benefits, especially from its leaves. Some of these benefits can provide a positive contribution to increasing Hb levels. The leaves themselves contain iron, as the most important element for forming Hb. This iron is very important in overcoming or preventing anemia during pregnancy, which can cause a decrease in Hb levels. Folic acid or vitamin B9 is also found in moringa leaves. Folic acid plays an important role in helping to form red blood cells while supporting the prevention of neural tube defects in the fetus. (Kurniawati et al., 2018)

Results of the Wilcoxon Analysis Test in the Control Group (Fe Tablet Administration only)

Through data analysis using the Wilcoxon test for the control group with a sample of 15 respondents, a p value of 0.007 ($p < 0.05$) was obtained. So it can be stated that there is a difference in Hb levels between before and after Fe tablets were given to pregnant women. The number of pregnant women in the control group who experienced an increase in Hb levels was only 2 people, while those who experienced a decrease in Hb levels were 13 people.

Iron or Fe plays an important role, especially in forming Hb, as a protein that transports oxygen to the entire body in red blood cells, including the placenta and fetus. So that the addition of Fe can prevent and overcome anemia, as a condition where Hb levels are below normal limits. The need for iron increases during pregnancy to support fetal development. Iron is also important for the formation of the fetal brain. (Rishel, 2023)

In increasing iron absorption, it is recommended that **iron supplement tablets** be consumed with water, vitamin C fruits (papaya, oranges, guava, mango, and others), and animal protein (such as fish, liver, meat, and poultry).

Then do not consume **iron supplement tablets** with: a. Milk, because in general animal milk has a lot of calcium content which can cause decreased iron absorption in the intestinal

mucosa. b. Coffee and tea, because they contain tannins and phytates which will cause binding to iron, which then changes it into a complex compound that is difficult to absorb. c. High-dose calc (Calcium) tablets, which will inhibit iron absorption. d. Stomach ulcer medication, which will provide a layer for the surface of the stomach, which inhibits iron absorption, especially for stomach ulcer medication with calcium content. If you want to consume either drinks or foods that can inhibit the absorption process of this iron, it is better to do it two hours after or before consuming **iron supplement tablets**.(Kemenkes RI, 2016)

The causes of decreased Fe levels in pregnant women include mothers who have experienced several pregnancies (multiparous) may have a higher risk of experiencing iron deficiency because the iron supply in the upcoming pregnancy has been used for the previous pregnancy, so this is what has an impact on decreasing Fe levels in the body.(Setyianingsih et al., 2020)

The decrease in hemoglobin in the control group in this study could occur due to various factors including inhibited iron absorption. Beck (2000) explained that factors that influence iron absorption include: 1) The body's iron needs, where the body will basically absorb iron needs up to a certain limit, where if iron stores decrease, it means that absorption will increase. 2) Low hydrochloric acid in the stomach (alkaline conditions) can cause decreased absorption. Hydrochloric acid in this case is able to reduce Fe^{3+} as Fe^{2+} which will be absorbed by the intestinal mucosa more easily. 3) The presence of sulfur amino acids and vitamin C SH group (sulfidryl), which can increase absorption because it can provide reduction to iron into ferrous form. This vitamin C can increase the absorption of iron in food by forming a ferrous ascorbate complex. 4) Excess phosphate in the intestines, which will result in the formation of an iron complex, namely phosphate which is very difficult for the body to absorb. 5) The presence of oxalate and phytate in vegetables, then also tannin in tea which can reduce the availability of Fe. 6) Animal protein can increase the absorption of Fe. 7) Disruption of intestinal function, such as diarrhea which causes decreased absorption of Fe. Then 8) Infectious diseases that also interfere with the absorption of Fe. (Beck, 2000)

Meanwhile, The absorption rate of iron has been reported to be 25–30% in organ meats, 7–9% in green leafy vegetables, 4% in whole grains, and 2% in dried beans, indicating that the type of food or other dietary factors may affect the bioavailability of iron. For example, ascorbic acid is a well-known dietary factor that increases the bioavailability of iron; however, calcium, polyphenols, and phytate reduce the absorption of iron in the intestine. Therefore, we need to pay attention to the type of food in our diet to maintain the balance of iron in the body. Inadequate absorption of iron leads to iron deficiency anemia. Iron deficiency is the most

common nutritional deficiency worldwide. Iron deficiency negatively affects cognitive development in infants, children, and adolescents. Iron deficiency anemia in mothers can lead to low birth weight and premature birth. A report from the World Health Organization shows that more than 27% of the world's population suffers from iron deficiency anemia. Therefore, prevention of iron deficiency is very important for this group.(Piskin et al., 2022)

5. COMPARISON

The findings of this study are consistent with previous research by Rismawati (2021), which found that the average Hb level of the intervention group after being given moringa capsules + Fe was 11.327 grams/dl while for the control group it was 10.700 grams/dl. However, the previous study used 200mg moringa capsules while this study used 300mg moringa capsules.

6. CONCLUSIONS

Administration of moringa capsules and Fe tablets had a better effect in increasing Hb levels compared to only Fe tablets, this is in accordance with the results of the treatment group with an increase in Hb levels of 14 people, with the results of the Wilcoxon test in the treatment group obtained $p = 0.008$ which shows that there is a significant difference in the Hb levels of pregnant women.

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