The Effect of Red Spinach Juice + Fe Tablets on Increased Hemoglobin Levels in Pregnant Women

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Abstract: Anemia during pregnancy is one of the most common abnormalities in pregnant women in Indonesia. The prevalence of anemia in pregnant women in Indonesia is 48.9%. The iron supplementation program is an effort that has been made by the Indonesian government to prevent anemia. To determine the effect of giving red spinach juice on increasing hemoglobin levels in third-trimester pregnant women. This type of research uses quantitative methods with quasi-experimental research with the two-group approach. The experimental group consumed red spinach juice + Fe tablets and the control group only drank Fe tablets. The results showed that there was an effect of giving red spinach juice + Fe tablets to increasing hemoglobin levels and there was a difference in increasing hemoglobin levels in the group given red spinach juice + Fe tablets and Fe tablets only. There is a relationship between parity and an increase in hemoglobin levels, but there is no relationship between age and education and an increase in hemoglobin levels. Intervention and parity variables were the most influential variables in increasing the hemoglobin level of pregnant women in PMB Bengkulu City. Results: There is an effect of giving red spinach juice + Fe tablets to the increase in hemoglobin levels of pregnant women.

Keywords: red spinach juice; iron tablets; hemoglobin level

Introduction

Anemia during pregnancy is one of the most common abnormalities in pregnant women in Indonesia (Sumiyati et al., 2021). Some 40 percent of maternal deaths are related to anemia. The prevalence of anemia in pregnant women in Indonesia is 48.9%, namely pregnant women with Hb levels of less than 11.0 gram/dl (Pusporini et al., 2021); . Even though the government has carried out a program to combat anemia in pregnant women, namely by giving 90 tablets of Fe to pregnant women during the gestation period to reduce the anemia rate of pregnant women, the incidence of anemia is still high (Aji et al., 2020).

Health data for Bengkulu province in 2018 found iron nutritional anemia in pregnant women of 45%. Cases of iron nutritional anemia in pregnant women in Bengkulu City in 2015 168 cases, in 2016 there were 279 cases, in 2017 there were 1.40 and in 2018 iron nutrition anemia was found in pregnant women as many as 1.16 cases. The iron supplementation program is an effort that has been made by the Indonesian government to prevent anemia in pregnancy which is given in the form of ferrous sulfate iron pills 200 mg every day for 90 days in the third trimester of pregnancy but the rate of anemia in pregnancy is still high (Marcus et al., 2021). This is because several factors facilitate and inhibit the absorption of iron in the body . Giving iron tablets together with other micronutrients is more effective in improving iron status than just giving iron supplementation in the form of a single dose. Therefore to increase the absorption of iron in the body it is necessary to provide it with a combination of micronutrients vitamin C (Ohanenye et al., 2021).

An alternative support for Fe tablets can be by using vegetables that are high in iron, namely red

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spinach. In every 100 grams of red spinach, there is 41.2 kcal of energy, 2.2 grams of protein, 0.8 grams of fat, 520 mg of calcium, 6.3 grams of carbohydrates, 2.2 grams of fiber, 2.2 grams of vitamin C. 62 mg, as well as iron as much as 7 mg so that red spinach is suitable for preventing anemia (Laurus et al., 2016)

Previous studies have shown that consuming red spinach juice can increase hemoglobin levels in mildly anemic pregnant women. Trimester III pregnant women who consume red spinach juice mixed with honey once a day for 7 days have an average increase in hemoglobin levels of 1.4 g% because red spinach and honey contain iron which functions to help improve blood oxygen circulation, vitamin C content helps the absorption of iron and the presence of vitamin B12 and folic acid which is an important combination for the formation of new cells, so that it can affect Fe in the blood and can increase hemoglobin (Al-Naseem et al., 2021). The purpose of this study was to determine the effect of red spinach juice on increasing hemoglobin levels in third-trimester pregnant women.

Method

The research design used in this study was quasi-experimental (Quasi Experiment) with a two-group approach, namely a research method by intervening in the experimental group by consuming 250 ml of red spinach juice or the equivalent of 1 glass every day for 14 days and nights. continued to take Fe tablets during the day and the control group only drank Fe tablets at night, then an evaluation was carried out.

The population in this study were third-trimester pregnant women, the sample in this study were third-trimester pregnant women with the experimental group being TM III pregnant women who were given iron supplements with the addition of red spinach juice, while the control group was TM III pregnant women. who visited and were only given iron supplementation. The number of samples was taken based on a formula of 60 people where the experimental group was 30 people and the control group was 30 people. The sampling technique in this study was accidental sampling, namely by taking cases or respondents who happened to be available or available somewhere according to the research context (Sugiyono, 2015).

This research was conducted in Bengkulu City starting in January 2023. The data collection technique that will be carried out in this study is primary data taken from pregnant women's records in the KIA room at the Bengkulu City Health Center with the following steps: Contract with the Bengkulu City Health Center to look for pregnant women as a research sample, determining respondents based on inclusion criteria that have been made, conducting research contracts and informing consent with respondents. Red spinach juice was consumed by the respondents in front of the researchers with the aim that the juice was consumed by the respondents. This intervention is given for 14 days in pregnant women who consume fe tablets

Univariate analysis was carried out to identify the characteristics of pregnant women and hemoglobin levels of pregnant women before and after treatment in the intervention and control groups using the percentage formula. Bivariate analysis is used to see the effect of the independent variable on the dependent variable. The analysis in this study used the dependent t-test to see changes in the hemoglobin level of pregnant women before and after the intervention. Then an Independent T-Test was carried out to see changes in the hemoglobin level of pregnant women between the intervention group and the control group.

Results and Discussion

Univariate Analysis

Based on the results of Table 1, it was found that almost all (76.70%) of the red spinach juice + Fe group were aged 20-35 years, most (66.70%) had tertiary education, and half (50%) were multiparous. Then, almost all of the Fe tablets group (86.70%) were aged 20-35 years, most (73.30%) had tertiary education, and most (60%) were multiparous. The results of age, parity, and education homogeneity tests in the group that was given the Red Spinach Juice + Fe Tablet and Fe Tablet intervention found that all characteristics were homogeneous because the p value > 0.05.

Table 2 shows that the average hemoglobin level in the intervention group that was given Red Spinach Juice + Fe Tablets, the average hemoglobin level of pregnant women before being given the intervention was 10.26, increasing to 11.32 after being given the intervention. Furthermore, in the control group given Fe tablets, the average hemoglobin level in pregnant women before being given Fe tablets was 10.24 to 10.87 after being given Fe tablets.

Table 1. Characteristics of Pregnant Women seen from age, parity, and education in Bengkulu City.

Variable			Red Spinach Juice + Fe Tablet	Fe tablets
	n	%	n	%
Age				
<20 and >35 years	7	23.30	4	13.30
20-35 years	23	76.70	26	86.70
Education				
Low	10	33.30	8	26.70
Tall	20	66.70	22	73.30
Parity				
Primipara	15	50	12	40
Multipara	15	50	18	60

Table 2. Average hemoglobin levels in pregnant women before and after being given Red Spinach Juice + Fe Tablets and Fe Tablets at PMB Bengkulu City.

Red Spinach Juice Fe Tablet	n	min	Max	Mean	Different Means	SD	95% CL
Before	30	9.4	11.0	10.26	1.06	0.427	10.10-10.42
After	30	9.9	12.1	11.32		0.589	11.10-11.54
Fe tablets							
Before	30	9.1	11.0	10.24	0.63	0.476	10.06-10.41
After	30	9.9	11.9	10.87		0.505	10.68-11.06

Bivariate Analysis

Based on Table 3, the results show that the p-value is 0.000 (<0.05), which means that there is an effect of Red Spinach Juice + Fe Tablets and Fe Tablets on hemoglobin levels in pregnant women at PMB Bengkulu City. Giving red spinach juice + Fe tablets can increase hemoglobin levels, namely before the intervention to 10.26 gr/dl and after the intervention to 11.32 gr/dl. Likewise, just giving Fe tablets can increase hemoglobin levels, namely before the intervention to 10.24 gr/dl and after the intervention to 10.87 gr/dl.

Table 3. Effect of Red Spinach Juice + Fe Tablets and Fe Tablets on hemoglobin levels in pregnant women at PMB Bengkulu City

Variable	N	Mean	Different Means	SD	*p-value*
Red Spinach Juice Fe Tablet					
Before	30	10.26	1.06	0.43	0.000
After	30	11.32		0.59	
Fe tablets					
Before	30	10.24	0.63	0.48	0.000
After	30	10.87		0.50	

Table 4. Differences in hemoglobin levels in groups given Red Spinach Juice + Fe Tablets and Fe Tablets to pregnant women at PMB Bengkulu City.

Variable	N	Mean	Different Means	SD	*p-value*
Red Spinach Juice Fe Tablet	30	11.32	0.4	0.59	0.002
Fe tablets	30	10.87		0.50	

Based on the results of Table 4, the p-value was 0.002 (<0.05) meaning that there was a significant difference between hemoglobin levels in the group of pregnant women who were given red spinach juice + Fe tablets and Fe tablets only at PMB Bengkulu City where the hemoglobin levels of pregnant women who received the juice red spinach + Fe tablets as much as 0.4 g/dl higher than pregnant women who received Fe tablets only.

The results of Table 5 show that there is no significant difference in hemoglobin levels between the ages of pregnant women who are <20->35 years and those aged 20-35 years (p-value = 0.34) and between pregnant women who have low and high education (p = 0.58), but there was a difference in hemoglobin levels between primigravida and multipara (p-value = 0.027).

Table 5. Effect of external variables on hemoglobin levels in pregnant women at PMB Bengkulu City.

Variable	Mean	SD	SE	*P-value*	N
Age					
<20 and >35 years	10.09	0.63	0.19	0.34	11
20-35 years	10.28	0.40	0.06		49
Education	10.37	0.51	0.10		
Low	10.30	0.38	0.09	0.58	18
Tall	10.22	0.48	0.07		42
Parity					
Primigravida	10.37	0.51	0.10	0.03	27
Multigravida	10.70	0.60	0.10		33

Multivariate Analysis

Table 6. Bivariate Selection Results.

Variable	*P-value*
Intervention (Juice+Fe and Fe)	0.00*
Age	0.11
Education	0.00*
parity	0.00*

From the selection results, it can be seen that the variables that are candidates for the multivariate model are intervention and parity variables because they have a p-value <0.25 so these variables will be included in the multivariate analysis.

From the Model Summary table above, the value of R2 = 352 means that the intervention and parity variables can predict the value of the dependent variable for hemoglobin levels by 35%.

Table 7. Results of Multivariate Analysis Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.594a	.352	.330	.4766

Table 8. ANOVA.

						ANOVAb
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.04	2	3.52	15.50	.000a
	Residual	12.95	57	.227		
	Total	19.99	59			

From the ANOVA table above, the F value is 15,499 with a significance test of 0.00 indicating that each variable simultaneously influences hemoglobin levels.

Table 9. Model Coefficients

	Understandardised Coefficients			Standardized Coefficients			Coefficients
Model	B	Std. Error		Model			
(Constant)	9.24	.261			35.39	.000	
intervention	.607	.124		.526	4.91	.000	
parity	.264	.124		.228	2.12	.038	

With this multivariate analysis, it was found that the intervention variables (Red Spinach Juice + Fe Tablets and Fe Tablets) and parity were the same variables that affected hemoglobin levels in pregnant women in PMB Bengkulu City with a p-value <0.05 (0.000 and 0.038). From the data above the intervention variables (Red Spinach Juice + Fe Tablets and Fe Tablets) have a regression coefficient of 0.607 and parity has a regression coefficient of 0.264. So the intervention (Red Spinach Juice + Fe Tablets and Fe Tablets) can increase hemoglobin levels by 0.6 gr/dl and with parity primigravidas hemoglobin levels higher by 0.3 gr/dl.

Discussion

Characteristics of pregnant women and average hemoglobin levels in pregnant women before and after being given Red Spinach Juice + Fe Tablets and Fe Tablets at PMB Bengkulu City

Based on the results of the study, it was found that almost all (76.70%) of the red spinach juice + Fe group were aged 20-35 years, most (66.70%) had tertiary education, and half (50%) were multiparous. Then, almost all of the Fe tablets group (86.70%) were aged 20-35 years, most (73.30%) had tertiary education, and most (60%) were multiparous. The results of the study also found that the average hemoglobin level in the group given Red Spinach Juice + Fe Tablets, the average hemoglobin level of pregnant women before being given the intervention was 10.26, increasing to 11.32 after being given the intervention.

Red Spinach leaves contain iron (Fe) of 8.30 mg per 100 grams. The function of iron is to form red blood cells so that if the production of red blood cells in the body is sufficient, the hemoglobin level will be normal. Red blood cells carry oxygen throughout the body so that it can prevent anemia (Rohmatika, 2017). The results of the study showed that the average hemoglobin level in the group given Fe Tablets, the average hemoglobin level in pregnant women before being given Fe Tablets was 10.24 to 10.87 after being given Fe Tablets.

Iron supplement tablets can prevent iron deficiency anemia and folic acid anemia. In pregnant women, it is recommended to consume iron tablets at least 90 tablets during pregnancy. This can help pregnant women to provide the iron reserves needed for mother and fetus. For this reason, pregnant women must consume Fe tablets promptly, in the right dosage, and with the right technique so that iron tablets can be absorbed properly by the body (Von Siebenthal et al., 2023).

Differences in hemoglobin levels before and after being given Red Spinach Juice + Fe Tablets and Fe Tablets to pregnant women at PMB Bengkulu City

Based on the results of the study it was found that there was a difference between before and after being given Red Spinach Juice + Fe Tablets to pregnant women at PMB Bengkulu City as evidenced by the results of the statistical test p-value was 0.000 <0.05. Likewise, there is also a difference between before and after being given Fe Tablets to pregnant women at PMB Bengkulu City as evidenced by the results of the statistical test p is 0.000 <0.05. Red spinach contains high levels of iron, where iron is an essential microelement for the body. This substance is primarily needed in hemopoiesis (blood formation), namely the synthesis of hemoglobin (Hb). Hemoglobin is oxygen that delivers erythrocytes' important functions for the body and prevents anemia (Mairbäurl, 2013). Red spinach contains lots of protein, fat, carbohydrates, potassium, calcium, manganese, phosphorus, iron, amarantine, rutin, purines, niacin, and vitamins (A, B1, B2, C), carotene, chlorophyll, and saponins (Rahman et al., 2023).

This research is in line with the research conducted (Surya Atmaja et al., 2022); (Mardiah et al., 2021), after giving red spinach juice to pregnant women it is very influential on increasing hemoglobin levels of pregnant women so that increased hemoglobin levels of pregnant women experience an increase from moderate anemia to mild anemia. This is obtained from the results of research with paired samples test where ρ = 0.000 means there is an influence giving red spinach juice to pregnant women who have anemia. This research is also in line with research (Nurbaety et al., 2022), which shows that there is a significant relationship between adherence to consuming Fe tablets and the incidence of anemia in pregnant women with a p-value of 0.020. Compliance with the consumption of Fe tablets with anemia in pregnant women at risk has a probability of 4.62 times.

The influence of external variables on hemoglobin levels in pregnant women at PMB Bengkulu City

From the results of the study, it was found that there was no difference in hemoglobin levels between the ages of pregnant women who were <20->35 years and those aged 20-35 years (p-value = 0.343) and between pregnant women who had low and high education (p = 0.576). but there was a difference in hemoglobin levels between primigravida and multipara (p-value = 0.027).

The results of this study are in line with research (Wu et al., 2020) which shows that the proportion of pregnant women at risk of anemia is 7.3% and the remaining 5.5% do not suffer from anemia. Meanwhile, the proportion of pregnant women who were not at risk for anemia was 29.1% and 58.2% did not suffer from anemia. The results of bivariate analysis using the Fisher's Exact alternative test showed a p-value of 0.242 (p-value> 0.05) indicating that there was no significant relationship between age and the incidence of anemia in pregnant women.

This research is also in line with research (Arnianti et al., 2022) that there is no significant relationship between recent education and the incidence of anemia in pregnant women in the Tegal Gundil Health Center area. The results of the hypothesis test with chi-square between the last education variable and the incidence of anemia in pregnant women show p-value = 0.33 <0.05, which means that Ha is rejected with an odds ratio = 3.93, which means pregnant women with low educational background have a 2.51 chance times more likely to have anemia during pregnancy.

Based on the theory, maternal parity or history of giving birth if it is too frequent there will be an increase in the amount of blood plasma to be more and this will cause more hemodilution as well (Al-Farsi et al., 2011); (Sanghavi & Rutherford, 2014); (Murphy et al., 2002). Mothers with a history of giving birth > 4 times will be at risk of facing serious complications, namely a kind of

bleeding, where this condition is affected by anemia throughout her pregnancy. In addition, this bleeding causes the mother to run out of hemoglobin and the supply of Fe (iron) to shrink so that in subsequent pregnancies you are more at risk of developing anemia again (Means, 2020); (Kumar et al., 2022).

This is also in line with research (El-Kholy et al., 2023), that the causes of the risk of pregnant women with anemia are mothers who give birth too often and lack of attention in consuming proper nutrition in subsequent pregnancies. This is caused by the division of nutrients between the mother and the fetus in the womb during pregnancy (Picciano, 2003).

The most influential variable on hemoglobin levels in pregnant women at PMB Bengkulu City

Based on the results of the study, it was found that the intervention variables (Red Spinach Juice + Fe Tablets and Fe Tablets) and parity were variables that had the same effect on hemoglobin levels in pregnant women at PMB Bengkulu City with a p-value <0.05 (0.000 and 0.038). Pregnant women who were given intervention (Red Spinach Juice + Fe Tablets and Fe Tablets) could increase their hemoglobin levels by 0.6 gr/dl and with primigravida parity the hemoglobin levels were higher by 0.3 gr/dl.

The results of this study are in line with research (Purba et al., 2021) which shows that giving red spinach juice has a significant impact on increasing hemoglobin levels. The average increase in hemoglobin levels in the intervention group reached 11.4 g/dL. The percentage increase in hemoglobin levels in the group that was given red spinach juice (28.1%) was also higher than the control group (10%). This is inseparable from the large amount of nutrients in red spinach which functions to increase the Hb of pregnant women. Red spinach has a function that can increase hemoglobin levels in pregnant women to treat anemia in pregnancy. Red spinach juice can be used to meet the daily nutritional needs of pregnant women as a prevention or as an alternative to increasing Hb during pregnancy (Siregar et al., 2019); (Aryunita & Doriani Harahap, 2022).

To overcome anemia pregnant women consume Fe tablets, at least 90 Fe tablets, in addition to consuming foods that can form red blood cells regularly. (DeLoughery, 2018). In line with research (Sulung et al., 2022) there is a relationship between the regular consumption of blood supplement tablets by respondents with the incidence of anemia with a p-value of 0.008. The PR value of this variable is 4.56, meaning that respondents who do not regularly consume iron tablets during pregnancy have a 4.56 times greater likelihood of anemia than respondents who adhere to iron tablets.

The research conducted showed that there was a statistically significant (significant) relationship between parity and the incidence of anemia in pregnant women at the Samarinda Trauma Center Health Center with p = 0.03 < α 0.05. Parity has a significant influence on the incidence of anemia where the more often a mother gives birth, the frequency of iron in the mother's body decreases so it has an impact on decreasing Hb levels which makes the mother affected by anemia in her pregnancy.

Conclusion

Based on the results of the study, the following conclusions were drawn: Almost all (76.7%) of the red spinach juice + Fe group were aged 20-35 years, most (66.7%) had tertiary education, and half (50%) were multiparous. Then, almost all of the Fe tablets group (86.7%) were aged 20-35 years, most (73.3%) had tertiary education, and most (60%) were multiparous. The average hemoglobin level in the intervention group that was given Red Spinach Juice + Fe 10.26 tablets increased to 11.32. Furthermore, the average hemoglobin level in the control group which was given 10.24 tablets became 10.87. There was a difference between hemoglobin levels in the group of pregnant women who were given red spinach juice + Fe tablets and Fe tablets only at PMB Bengkulu City. There were differences in the group of pregnant women who were given red spinach juice + Fe tablets and Fe tablets only. There was no difference in hemoglobin levels between pregnant women aged <20->35 years and those aged 20-35 years (p-value=0.343) and between pregnant women who had low and high education (p=0.576), but there were differences in hemoglobin levels between primigravida and multiparous women (p-value=0.027). Giving Red Spinach Juice + Fe Tablets had the most effect on increasing hemoglobin levels of pregnant women in PMB Bengkulu City.

Author Contributions
Conceptualization, M . M ., A. M ., and T . C.M.; methodology, A.M.; validation, M. M and T. C.M.; formal analysis, T. C. M.; investigation, M. M. and A. M., formal analysis, A . M.; investigation, M. M and A. M .; resources, M. M and T. C. M.; data curation, A.M.: writing—preparation of original drafts, M.M. and A.M.; writing—review and editing, A . M: visualization, M . M., and T. C . M. _; supervision, M.M.; project administration, T . C . M .; funding acquisitions, M . M .resources and A.M. All authors have read and agreed to the published version of the manuscript.

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