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Differences in hemoglobin levels in anemic pregnant women before and after administration of iron supplement tablets and dragon fruit

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Abstract

Pregnancy is a much-anticipated period for every married couple. The health of the mother during pregnancy is very important because there is a fetus that is growing and developing, and it is hoped that the baby will be born healthy and become a quality future generation. Based on the 2018 Basic Health Research (Riskesdas), the prevalence of anemia in pregnant women in Indonesia in 2018 increased by 48.9% from 37.1% in 2013. Iron supplementation (TTD) was provided to 73.2% of pregnant women, with 24% receiving 90 tablets or more and 76% receiving less than 90 tablets. The government has implemented an IFT program, but the prevalence of anemia remains high. The purpose of this study was to determine the difference in hemoglobin (Hb) levels in pregnant women with anemia before and after receiving iron tablets and dragon fruit in the working area of the Wajok Hulu Community Health Center. This study used a quasi-experimental research design with a non-equivalent control group or non-randomized control group pretest-posttest design. The study population consisted of pregnant women with anemia who were registered in the Wajok Hulu Community Health Center area from January to May 2019. The sampling technique used total sampling, with a sample size of 16 people. The statistical test used was the paired t-test, and the normality test used was the Shapiro-Wilk test. The results of the study showed that there was no difference in the effect of administering iron tablets and dragon fruit, and only iron tablets based on changes in hemoglobin levels in pregnant women in the working area of the Wajok Hulu Community Health Center in 2019 with a p-value of 0.766 and a difference value of 0.09.

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INTRODUCTION

Every woman has the right to receive comprehensive maternal health services to ensure a healthy life, give birth to a high-quality generation, and reduce maternal mortality rates. Pregnancy is a highly anticipated period for married couples, and maintaining maternal health is essential because the fetus grows and develops rapidly. However, pregnancy does not always progress smoothly, as several comorbid conditions including anemia, pulmonary tuberculosis, heart disease, diabetes mellitus, and sexually transmitted infections such as syphilis and HIV may increase maternal morbidity and mortality (Prawiroharjo, 2013). Among these conditions, anemia is recognized as a major global health problem, particularly in developing countries, with an estimated 30% of the world's population affected and a global prevalence ranging from 40% to 88% (Kementerian Kesehatan Republik Indonesia, 2013).

Anemia during pregnancy has severe consequences for both mothers and fetuses. Maternal complications may include miscarriage, premature birth, prolonged labor due to weak uterine contractions, postpartum hemorrhage, susceptibility to infections, and potential cardiac decompensation in cases with hemoglobin levels below 6 g%. Fetuses of anemic mothers are also at risk for miscarriage, high rates of preterm birth, low birth weight, and congenital defects (Manuaba, 2010). National data reinforce the significance of this issue: Based on the 2018 Basic Health Research (Riskesdas), the prevalence of anemia among pregnant women in Indonesia rose sharply to 48.9%, up from 37.1% in 2013. Although iron supplementation (TTD) reached 73.2% of pregnant women, only 24% consumed ≥90 tablets, while 76% consumed fewer than 90 tablets, indicating challenges in adherence and program effectiveness (Badan Penelitian dan Pengembangan Kesehatan, 2019).

At the regional level, the prevalence of anemia among pregnant women in West Kalimantan reached 10.732% in 2017 (Dinas Kesehatan Kalimantan Barat, 2017). Efforts to prevent anemia include pharmacological interventions through iron tablet supplementation and non-pharmacological approaches utilizing nutrient-rich foods. Dragon fruit is recognized as a promising non-pharmacological option due to its phytochemical content, particularly flavonoids including quercetin, kaemferol, and isorhamnetin which function as antioxidants. In addition, dragon fruit contains high levels of calcium, iron, and nutrients essential for blood formation and fetal development (Suryana, 2018). This fruit also provides vitamin C, which enhances the absorption of iron through the formation of ferrous ascorbate complexes, and 200 mg of ascorbic acid can increase iron absorption by 25%–50% (Ramayulis, 2015). The pharmacodynamics of iron supplementation further support the use of combined interventions, as hemoglobin levels typically increase significantly within 2–4 weeks (Almatsier, 2010).

Although dragon fruit shows nutritional potential, existing studies reveal inconsistencies. For example, Thamrin et al. (2018) reported that dragon fruit increased hemoglobin levels in adolescent girls, but the effect was not statistically significant. This indicates a research gap, as limited studies have examined the combined effects of iron tablets and dragon fruit particularly among pregnant women, who have different physiological needs and a higher risk of anemia. Moreover, previous studies have not explored this approach within the specific community health context of West Kalimantan, where anemia prevalence remains substantial despite ongoing supplementation programs. Therefore, there is a need to investigate integrative strategies that may optimize hemoglobin improvement in pregnant women with anemia.

A preliminary study at the Wajok Hulu Community Health Center showed that anemia affected 67 pregnant women in 2017 and 52 women in 2018. Iron tablet distribution reached 75.73% for Fe 3 tablets and 82.72% for Fe 1 tablets. These findings demonstrate persistent anemia despite supplementation, reinforcing the need for additional interventions. The novelty of this study lies in combining iron tablets with dragon fruit consumption to evaluate

their synergistic potential in increasing hemoglobin levels among anemic pregnant women an approach that has not been widely studied in Indonesia, particularly in West Kalimantan. Therefore, this research aims to determine the difference in hemoglobin (Hb) levels in pregnant women with anemia before and after the administration of iron tablets and dragon fruit in the Wajok Hulu Community Health Center area.

METHOD

This study employed a quantitative approach using a quasi-experimental design with a non-equivalent control group (non-randomized control group pretest–posttest design). The study population consisted of pregnant women with anemia registered at the Wajok Hulu Community Health Center from January to May 2019, totaling 16 individuals. A total sampling technique was applied with a 1:1 allocation ratio, resulting in 8 pregnant women who met the inclusion criteria set by the researchers.

Primary data were collected through direct observation of hemoglobin (Hb) levels in anemic pregnant women who received iron tablets (TTD) combined with dragon fruit and those who received iron tablets (TTD) alone. The data included categorical variables (age, gestational age, education, BMI, and MUAC/LILA) and numerical variables (hemoglobin levels).

Univariate analysis was performed to describe the characteristics of respondents, using proportion analysis for categorical variables and mean analysis for numerical variables. Bivariate analysis was conducted to assess differences in hemoglobin levels before and after the interventions. A paired t-test was used to analyze within-group differences in Hb levels before and after the administration of TTD with dragon fruit and TTD alone. Meanwhile, an independent t-test was used to compare Hb level changes between the two groups. Statistical significance was determined at a 5% level ($p = 0.05$) with a 95% confidence interval (CI).

RESULTS AND DISCUSSION

Table 1. Characteristics of Respondents in the Study at the Wajok Hulu Community Health Center.

Characteristics	N	%
Gestational Age		
TM 1	3	18.8
TM 2	6	37.5
TM 3	7	43.8
Education Level		
Elementary	5	31.2
Junior High School	4	25
Senior High School	5	31.2
University	2	12.5
LILA		
< 23.5 cm	4	25
≥ 23.5 cm	12	75
BMI		
Normal (25-29.9)	14	87.5
Obesity (>30)	2	12.5

Based on the table 1 above, it can be seen that the characteristics of respondents according to gestational age show that most respondents have a gestational age of TM 3, which is number 7 people (43.8%). The characteristics of respondents according to educational level show that most respondents had junior high school and high school education, totaling 5 people (31.2%). The characteristics of respondents based on Lila show

that most respondents had Lila ≥ 23.5 cm, totaling 12 people (75%). Characteristics of respondents based on BMI show that most respondents have a normal BMI, totaling 14 people (87.5%).

Table 2. Differences in HB Levels Before and After TTD Administration Intervention

Variable	Pretest	Posttest	Mean	p-value
	Mean (SD)	Mean (SD)	Difference	
Administration of TTD	10.20 (0.48)	11.72 (0.57)	1.52	0.000*

Based on the table 2 above, the paired t-test used shows a difference before and after TTD administration with a p-value of 0.000 < 0.05 and a difference of 1.52 g/dl, indicating a difference before and after TTD administration. Therefore, it can be concluded that Iron Supplement Tablets (TTD) can increase hemoglobin (Hb) levels in pregnant women.

This study is in line with research conducted by Haryadi Didik (2015), which found a significant increase from the beginning to the end of the test (1.09 g/dl). On the other hand, the average hemoglobin level of the control group at the beginning of the test was 10.17 g/dl, which was lower than at the end of the test (10.79 g/dl). The results indicate a significant increase in hemoglobin levels from the beginning to the end of the test (0.63 g/dL). The study findings suggest that iron supplements and vitamin C supplements have a significant effect in increasing hemoglobin levels in pregnant women who consumed iron supplements.

Anemia is a condition characterized by a decrease in hemoglobin levels, hematocrit, and red blood cell count below normal values. A person suffering from anemia, commonly referred to as low blood, has hemoglobin/Hb levels below normal. Anemia occurs due to a lack of iron for red blood cell formation, such as iron, folic acid, and vitamin B12 content. However, anemia is commonly caused by iron deficiency (Prawirohardjo, 2014). Anemia during pregnancy due to increased blood volume is mild anemia. More severe anemia can increase the risk of anemia in babies. If significant anemia occurs during the first trimester, there is a greater risk of having a premature baby or a low birth weight baby. Anemia in pregnant women also increases the risk of blood loss during childbirth and makes it more difficult to fight infection (Proverawati, 2011).

Iron tablets are iron supplements to address iron-deficiency anemia in pregnant women. Iron tablets contain ferrous sulfate ($FeSO_4$) 320 mg (iron 60 mg) and folic acid 500 mg. A minimum of 90 tablets should be taken during pregnancy. Iron tablets should be consumed with orange juice that has been processed into a cold or warm drink, as this will facilitate absorption (Saifudin, 2009).

This study is in line with research conducted by Ratih Hariani R (2017), which found that the average hemoglobin level of pregnant women with anemia before iron tablet administration was 8.81 g/dL, while after iron tablet administration it was 12.59 g/dL. The T-test yielded a p-value of 0.001. There was an effect of iron tablet (Fe) administration on increasing hemoglobin levels in pregnant women with anemia with a p-value < 0.05.

Therefore, the results of the study conducted at the Wajok Hulu Community Health Center show that the administration of iron tablets (TTD) can increase hemoglobin levels in pregnant women with anemia by administering TTD regularly, 90 tablets during pregnancy.

Table 3. Differences in HB Levels Before and After Intervention with TTD and Dragon Fruit Administration.

Variable	Pre-test	Posttest	Mean Difference	p-value
	Mean (SD)	Mean (SD)		
Administration of TTD and Dragon fruit	9.8 (0.57)	11.63 (0.58)	1.83	0.000

Based on the table 3 above, the paired t-test used shows a difference before and after administration of TTD and dragon fruit with a p-value of 0.000 < 0.05 and a difference of 1.83 g/dl, indicating that there is a difference before and after administration of TTD and dragon fruit. Therefore, it can be concluded that Iron Supplement Tablets (TTD) and dragon fruit can increase hemoglobin (Hb) levels in pregnant women.

This study is in line with research conducted by Usman Munadira (2017), where the results of the paired t-test showed that in the intervention group (dragon fruit juice administration), a p-value of 0.000 was obtained, where p < α (0.05). Meanwhile, for the control group, the p-value was 0.204, where p > α (0.05).It can be concluded that there is an effect between the administration of dragon fruit juice and the increase in hemoglobin levels in adolescent girls with anemia, and in the control group, there is no effect between the provision of nutrition education and the increase in hemoglobin in adolescent girls at SMAN 4 Pangkep. Adolescent girls are expected to pay more attention to their nutritional intake so that they can prevent anemia.

Anemia in pregnancy is defined as Hb levels < 11 g/dl in the first and third trimesters, and Hb < 10.5 g/dl in the second trimester. Physiological changes during pregnancy cause a relatively large expansion in plasma volume compared to the increase in red blood cell count. Plasma volume increases by 40-45%, with this disproportion being greatest in the second trimester. In the third trimester, plasma volume decreases and hemoglobin mass increases. It is estimated that during pregnancy, plasma volume increases three times more than the increase in erythrocytes. Anemia during pregnancy affects placental vascularization. Angiogenesis, which occurs in early pregnancy, becomes suboptimal.

Iron tablets are iron supplements used to treat iron-deficiency anemia in pregnant women. Iron tablets contain ferrous sulfate ($FeSO_4$) 320 mg (iron 60 mg) and folic acid 500 mg. A minimum of 90 tablets should be taken during pregnancy. Iron tablets should be consumed with orange juice that has been processed into a cold or warm drink, as this facilitates absorption (Saifudin, 2009).

Dragon fruit belongs to the cactus family, is oval-shaped like a pineapple with fins, and has a pinkish-red skin decorated with tendrils or scales like a dragon. The flesh of the fruit is red, purplish-red, or white, with small seeds similar to basil seeds and a sweet, refreshing taste. Compared to other fruits, there is nothing particularly special about its nutritional content. It contains vitamin C, calcium, magnesium, iron, and fiber. Dragon fruit has a high calcium and iron content, making it good for bones and blood. The FAO considers dragon fruit to be a fruit with high nutritional value due to its calcium content. One small fruit fulfills 1 percent of the daily value. Dragon fruit is a better sourceof iron, meeting 8 percent of the daily value. In addition to helping bone health, calcium is needed for proper muscle function and nerve transmission. Iron is needed to carry oxygen throughout the body. Dragon fruit is very high in vitamin C, which is very helpful in increasing the body's ability to absorb more iron (Suryana, 2018).

The results of a study conducted at the Wajok Hulu Health Center showed that administering Iron Supplement Tablets (TTD) and dragon fruit can increase hemoglobin levels in anemic pregnant women, by giving 1 TTD tablet and 100 grams of dragon fruit daily.

Table 4. Differences in the Administration of TTD and Dragon Fruit and TTD on the Increase in HB Levels

Variable	Mean	SD	Difference	p-value
Administration of TTD	11.72	0.57		
Administration of TTD and Dragon Fruit	11.63	0.58	0.09	0.766*

Based on the table above, the independent t-test used can be seen in the analysis of the comparison of HB levels after intervention in both groups with statistical calculations using a p-value of 0.766, which means that the value is greater than the significance value of 0.05 (p-value < 0.05) with a difference of 0.09 g/dl. It is concluded that there is no significant difference between TTD and TTD and Dragon Fruit.

According to Soebroto (2009), in the second trimester and beyond, the need for blood-forming substances, especially iron, increases sharply to twice that of when not pregnant. This is because the mother's blood volume increases due to the fetus's need for oxygen and nutrients carried by red blood cells. In this study, the pregnant women studied were in their second and third trimesters because the iron requirements of pregnant women in the second trimester and beyond increases to twice as much, it takes a long time to increase hemoglobin levels. In this study, only 14 days were used to observe the increase in hemoglobin. Therefore, it can be concluded that one of the reasons for the insignificant results of this study is the need for twice as much iron and the very short time used.

This study is in line with the research conducted by Thamrin, et al (2018). The results showed that there was an effect but no significant difference in the administration of dragon fruit (Hylocereus polyrhizus) on the increase in hemoglobin levels in adolescent girls (p>0.05).

Anemia is a condition in which the hemoglobin (Hb) level in the blood is below normal. According to the World Health Organization (WHO), anemia is defined as a hemoglobin level of < 11 g/dl in pregnant women. Various causes of anemia include iron deficiency, which is the main cause of anemia in pregnant women when compared to other nutritional deficiencies (World Health Organization, 2015). The most common type of anemia in pregnancy is anemia due to iron deficiency. This deficiency can be caused by insufficient iron intake through food, impaired absorption, impaired utilization, or excessive iron loss from the body, such as through bleeding. The need for iron increases during pregnancy, especially in the last trimester. If iron intake does not increase during pregnancy, iron deficiency anemia is likely to occur, especially in twin pregnancies.

The most effective way to treat anemia in the short term is through iron supplementation. Supplementation is typically targeted at pregnant women and breastfeeding mothers (Soebroto, 2009). For pregnant women, iron supplementationat a dose of 60mg/day is sufficient to prevent anemia (Sarwono, 2009). In addition, nutritional improvements to combat anemia can be made by consuming foods that are high in iron, such as tempeh, milk, vegetables (such as spinach, kale, cassava leaves), fruits (soybeans, red beans, oranges, dragon fruit, guava), and animal products (meat, eggs, liver, fish). Furthermore, reduce consumption of tea and coffee, as both can inhibit iron absorption (Soebroto, 2009).

The results of the study conducted at the Wajok Hulu Health Center showed that the administration of Iron Supplement Tablets (TTD) and dragon fruit, as well as Iron Supplement Tablets (TTD) alone, can both increase hemoglobin levels in anemic pregnant women.

CONCLUSION

There is a significant difference between hemoglobin (Hb) levels before and after administration of Iron Supplement Tablets (TTD) in anemic pregnant women. There is a significant difference between before and after administration of Iron Supplement Tablets (TTD) and dragon fruit on hemoglobin (Hb) levels in pregnant women with anemia. There is no significant difference in the effects of Iron Supplement Tablets (TTD) and Iron Supplement Tablets (TTD) combined with Dragon Fruit on hemoglobin (Hb) levels in anemic pregnant women. The results of this study can be used as a reference or comparison if similar methods are to be researched, and it is hoped that other factors that may influence

the increase in hemoglobin (Hb) levels in pregnant women can be calculated, such as daily food consumption, the regularity of taking iron supplements (minimum 90 tablets), and foods that may enhance or inhibit the absorption of iron supplements.

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