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Effectiveness of orange fruit and dragon fruit combined with iron tablets on hemoglobin levels in pregnant women with anemia

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Abstract

The prevalence of anemia among pregnant women at the Mandor Community Health Center is quite high, reaching 27.4% of 575 targets, with 147 cases of mild anemia (9-10 g/dl) and 11 cases of moderate anemia (7-8 g/dl). Preventive measures were taken pharmacologically by administering 90 Fe tablets, as well as non-pharmacologically by consuming citrus fruits or dragon fruit combined with Fe tablets. This study aimed to analyze the effectiveness of the combination of citrus fruits and Fe tablets compared to the combination of dragon fruit and Fe tablets in increasing hemoglobin levels in pregnant women with anemia at the Mandor Community Health Center. Using a quasi-experimental design with a pretest-posttest two-group design, this study involved 44 samples from a population of 158, divided into two groups of 22 respondents each for the citrus fruit and dragon fruit interventions. The analysis results showed an increase in hemoglobin levels in both groups, with a median value of 10.750-11.750 for the citrus group and 10.070-11.150 for the dragon fruit group. The Mann Whitney test produced a p-value of 0.019 (<0.05), indicating that the combination of citrus fruit and iron tablets was more effective in increasing hemoglobin levels in pregnant women with anemia than the combination of dragon fruit and iron tablets at the Mandor Community Health Center.

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INTRODUCTION

During pregnancy, women experience physiological changes such as increased blood volume and plasma levels, along with decreased hematocrit and plasma protein levels (Gangakhedkar & Kulkarni, 2021; Melaku, 2022; Saleem et al., 2022). These changes affect hemoglobin levels in pregnant women. The imbalance in blood circulation caused by these natural physiological changes is indicated by a decrease in hemoglobin levels (Claassen et al., 2021; Orrico et al., 2023). Pregnant women therefore require additional nutrients such as iron, protein, and vitamins to prevent anemia. Before pharmacological treatment is administered, it is important to ensure adequate intake of iron-rich foods. There are two forms of iron: heme and non-heme. Heme iron is found in animal-based foods such as meat, poultry, and seafood, while non-heme iron is found in plant-based foods such as green vegetables, cocoa, and fruits. Hemoglobin is a complex protein that binds iron (Fe) and is found in erythrocytes. Its main function is to transport oxygen (O_2) from the lungs throughout the body and exchange it with carbon dioxide (CO_2) from the tissues to be exhaled through the lungs. A condition in which hemoglobin levels are below normal is called anemia (Harlinah et al. 2022).

According to the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), pregnant women with hemoglobin levels below 11 g/dL are considered anemic. Anemia is classified as severe if the hemoglobin level is less than 7.0 g/dL, moderate if between 7.0–9.9 g/dL, and mild if between 10.0–10.9 g/dL (Wardani, Asih, and Solihin 2023). Anemia in pregnant women is defined as a decrease in hemoglobin levels below 11 g/dL in the first and third trimesters or below 10.5 g/dL in the second trimester, which can interfere with the blood's ability to transport oxygen. Anemia is an indicator of poor nutrition and health. It is closely associated with maternal and infant morbidity and mortality, including the risk of miscarriage, prematurity, and low birth weight. Moreover, anemia increases the likelihood of complications during pregnancy and childbirth. The risk of maternal death, low birth weight, and perinatal mortality also increases. Antepartum and postpartum bleeding occur more frequently in anemic women and are often fatal because such women cannot tolerate significant blood loss.

Globally, the prevalence of anemia remains a major public health problem. From 1990 to 2019, anemia was reported in 204 countries, and the total number of cases rose from 1.42 billion in 1990 to 1.74 billion in 2019. In Indonesia, the prevalence of anemia among women of reproductive age (15–49 years) in 2019 was 31.2%, with the highest prevalence occurring in those aged 20–44 years (Ningrum, Rosita, and Pitaloka, 2023). The incidence of anemia among pregnant women in Indonesia is still relatively high at 48.9% (Indonesian Ministry of Health, 2022). Data from the Indonesian Basic Health Research (Riskesdas) in 2018 showed that the prevalence of anemia in pregnant women increased from 37.1% in 2013 to 48.9% in 2018. Anemia in pregnancy is therefore a problem that requires special attention due to its persistently high prevalence in various regions, including Indonesia (Febriyanto et al. 2023). Data from the Landak District Health Office in 2023 showed that out of 2,690 pregnant women examined for hemoglobin levels, 277 (10.3%) were anemic. In the Mandor Community Health Center area, 47 of 575 pregnant women (27.4%) were found to have anemia between January and April 2024. Among them, 147 had mild anemia (9–10 g/dL) and 11 had moderate anemia (7–8 g/dL).

The anemia prevention program currently implemented includes the administration of iron tablets, which aims to increase hemoglobin levels by giving 90 tablets at a dose of one tablet per day during pregnancy. Iron or Fe is an essential micronutrient required for hemoglobin synthesis and can also be found in food sources such as red meat, spinach, and nuts. The distribution of iron tablets in Indonesia reached 85% in 2015, an increase from 83.3% in 2014 (Febriyanto et al. 2023). In addition to pharmacological interventions, non-

pharmacological approaches such as consuming iron- and vitamin C–rich fruits are also beneficial in increasing hemoglobin levels in pregnant women. Oranges contain nutrients such as iron, vitamin C, vitamin B6, calcium, folic acid, magnesium, phosphorus, and carbohydrates, making orange juice effective in increasing hemoglobin levels in anemic pregnant women (Simatupang and Simanjutak 2022). Similarly, red dragon fruit serves as an alternative nutritional source that can increase hemoglobin and erythrocyte levels in pregnant women with anemia. It contains vitamin C, B vitamins, protein, antioxidants, fiber, and iron, which optimize iron absorption from the digestive tract (Desmariyenti, Zurhayati, & Hidayah, 2023).

Oranges (Citrus sinensis L.) are fruits rich in vitamin C and beneficial compounds such as vitamin B6, calcium, folic acid, magnesium, phosphorus, and carbohydrates. One medium orange contains 82.7 mg of vitamin C, fulfilling about 91% of an adult's daily requirement. Honey oranges also contain antioxidants, including vitamin C, organic acids, enzymes, phenolic acids, flavonoids, and beta-carotene, which help neutralize free radicals (Indrayani et al. 2023). Dragon fruit contains high levels of organic acids, proteins, and minerals such as potassium, magnesium, calcium, iron, and vitamin C. These components can improve iron absorption by reducing ferric iron to ferrous iron, thereby enhancing efficiency (Astriana, Rosa, & Puspitasari, 2023). In 100 grams of red dragon fruit (Hylocereus polyrhizus), there are 0.55–0.65 mg of iron and 8.0–9.0 mg of vitamin C, which help promote red blood cell formation (Mardiana, Meldawati, and Hidayah 2023).

Although previous studies have reported the benefits of oranges and dragon fruit in improving hemoglobin levels, most of these studies examined their effects separately. There is limited research directly comparing the effectiveness of orange and red dragon fruit consumption on hemoglobin levels in anemic pregnant women, especially in rural or community health settings such as the Mandor Community Health Center. Furthermore, few studies have explored the comparative nutritional impact of these fruits as complementary therapies alongside iron supplementation programs. The novelty of this research lies in its direct comparison of oranges and red dragon fruit as non-pharmacological interventions to improve hemoglobin levels among pregnant women with anemia. The study is expected to provide new evidence-based insights that support the integration of locally available fruits into maternal anemia prevention programs. Therefore, the objective of this study is to determine the effectiveness of oranges and dragon fruit in increasing hemoglobin levels among pregnant women with anemia at the Mandor Health Center.

METHOD

This study employed a quantitative research method with a quasi-experimental design, specifically using a pretest-posttest two-group design, to determine the effectiveness of orange fruit combined with iron tablets and dragon fruit combined with iron tablets in increasing hemoglobin levels among pregnant women with anemia. The study sample consisted of 44 respondents, divided into two groups: 22 respondents who received orange fruit combined with iron tablets, and 22 respondents who received dragon fruit combined with iron tablets. The sampling technique used in this study was consecutive sampling.

Primary data were collected by measuring the hemoglobin levels of pregnant women with anemia through direct observation. During the intervention, respondents were given oranges or dragon fruit in combination with iron tablets as part of efforts to increase hemoglobin levels.

The data obtained were analyzed using univariate and bivariate analyses. Univariate analysis was conducted to describe the frequency distribution and percentage of the dependent variable, namely hemoglobin levels in pregnant women who received oranges and dragon fruit. Bivariate analysis was carried out to examine the relationship between the independent and dependent variables, with the aim of analyzing the effectiveness of orange

and dragon fruit interventions on hemoglobin levels among pregnant women with anemia at the Mandor Community Health Center in Landak Regency.

This study obtained ethical approval from the Ethics Committee of the Pontianak Ministry of Health Polytechnic, with the ethical clearance number 139/KEPK-PK.PKP/IV/2024.

RESULTS AND DISCUSSION

Table 1. Comparison of Respondent Characteristics.

Characteristics	Orange Fruit Group Iron Tablet Combination		Dragon Fruit Group with Iron Tablet Combination	
	n	%	n	%
Age				
20 years	-	-	2	9.1
20-35 years	20	90.9	18	81.8
>35 years old	2	9.1	2	9.1
Parity				
Primipara	4	18.2	10	45.5
Multipara	12	54.5	7	31.8
Grandemultipara	6	27.3	5	22.7
Education				
Basic	9	40.9	8	36.4
Intermediate	11	50	12	54.5
High	2	9.1	2	9.1
Total	22	100	22	100

Table 1 above, it can be seen that in the group given orange fruit combined with iron tablets, the age characteristic shows that almost all respondents were aged 20-35 years, totaling 20 people (90.9%). while the parity characteristic showed that most respondents were multiparous, totaling 12 people (54.5%), and the education characteristic showed that half of the respondents had a secondary education, totaling 11 people (50.0%). Meanwhile, in the group given dragon fruit combined with iron tablets, it can be seen that the age characteristic had a frequency of almost all respondents aged 20-35 years, totaling 18 people (81.8%). while in terms of parity, almost half of the respondents were primiparous, totaling 10 people (45.5%), and in terms of education, most of the respondents had a secondary education, totaling 12 people (54.5%).

Table 2. Hemoglobin Levels Before and After Administration of Orange Fruit Combined with Iron Tablets and Dragon Fruit Combined with Iron Tablets.

Treatment	Median	(Min-Max)	(S.D)
Administration before intervention of orange juice combined with iron tablets	10.750	9.3 - 11.1	0.4471
Administration after intervention with orange juice combined with iron tablets	11.750	10.1 - 13.1	0.9200
Administration before intervention of dragon fruit combined with Fe tablets	10,700	9.1 - 10.9	0.5510
Administration after dragon fruit combined with iron tablet intervention	11.15	9.6 - 11.9	0.5895

Table 2 above, it is known that respondents who had hemoglobin levels before being given the combination of citrus fruit and iron tablets had a median value of 10.750 with a standard deviation of 0.4471, while respondents who had hemoglobin levels after being given the combination of citrus fruit and iron tablets had a median value of 11.750 with a

standard deviation of 0.9200. In addition, it is known that respondents who had hemoglobin levels before being given dragon fruit combined with iron tablets had a median value of 10.700 with a standard deviation of 0.5510, and respondents who had hemoglobin levels after being given dragon fruit combined with iron tablets had a median value of 11.150 with a standard deviation of 0.5895.

Table 3. Relationship between knowledge level and decision-making regarding MR immunization.

Treatment	Pre-test	Posttest
Orange fruit combined with iron tablets	0.001	0.443
Dragon fruit combined with iron tablets	0.001	0.268
Difference in Orange Fruit and Iron Tablet Combination Administration		0.268
Difference in dragon fruit administration combined with iron tablets		0.001

Table 3, the normality test of the paired sample data shows that the normality value before giving the combination of citrus fruit and iron tablets was 0.001 (< 0.05 = not normal), while the normality value after giving the combination of citrus fruit and iron tablets was 0.443 (> 0.05 = normal). Meanwhile, the normality value before administering dragon fruit combined with iron tablets was 0.001 (< 0.05 = not normal), while the normality value after administering dragon fruit combined with iron tablets was 0.268 (> 0.05 = normal). From the two data sets tested for normality using Shapiro-Wilk, it was found that there were normally distributed and non-normally distributed data, so it was concluded that the data were not normally distributed. In addition, the results of the normality test of unpaired sample data showed that the normality value of the difference between orange fruit and iron tablet combination administration was 0.268 (>0.05 = normal), while the normality value of the difference between dragon fruit and iron tablet combination administration was 0.001 (< 0.05 = abnormal). From the two data sets tested for normality using Shapiro-Wilk, it was found that there were normally distributed and non-normally distributed data, so it was concluded that the data were not normally distributed.

Table 4. Wilcoxon Test Results for Hemoglobin Levels Before and After Administration of Orange Fruit Combined with Iron Tablets

Treatment	Median	Min-Max	Difference	p-value
Administration Before Intervention Orange Fruit combined with Iron Tablets	10.750	9.3-11.1	1.000	0.00
Administration After Intervention Orange Fruit combined with Iron Tablets	11.750	10.1-13.1		

Table 4, it can be seen that the output shows a difference in the median value of hemoglobin levels before and after the intervention with orange fruit combined with iron tablets of 1,000 with a p-value = 0.000, meaning that the intervention using orange fruit combined with iron tablets given to respondents was very effective in increasing hemoglobin levels in pregnant women with anemia.

Table 5. Results of the Wilcoxon Test for Hemoglobin Levels Before and After Administration of Dragon Fruit Combined with Iron Tablets

Treatment	Median	Min-Max	Difference	p-value
Administration Before intervention Dragon fruit combined with iron tablets	10.700	9.1-10.9	0.450	0.00
Post-intervention administration of dragon fruit combined with iron tablets	11.15	9.6-11.9		

Table 5, it can be seen that the output shows a difference in the median value of hemoglobin levels before and after the intervention with dragon fruit combined with iron tablets of 0.450 with a p-value = 0.000, meaning that the intervention using dragon fruit combined with iron tablets given to respondents was very effective in increasing hemoglobin levels in pregnant women with anemia.

Table 6. Mann-Whitney Test

Treatment	Median	Min-Max	S.D	p-value
Difference in Orange Fruit Administration Combined with Iron Tablets	0.900	0.5-2.2	0.7817	0.019
Difference in Dragon Fruit Administration Combined with Iron Tablets	0.4	0.0-1.8	0.3747	

Table 6, the output results show that the difference between the orange fruit and iron tablet combination group and the dragon fruit and iron tablet combination group is 0.019. Therefore, it can be concluded that orange fruit and dragon fruit are effective in increasing hemoglobin levels in pregnant women with anemia. Therefore, the intervention provided to respondents using orange fruit combined with iron tablets is highly effective compared to dragon fruit combined with iron tablets in increasing hemoglobin levels in pregnant women with anemia.

DISCUSSION

The effectiveness of orange fruit combined with iron tablets on hemoglobin levels in pregnant women with anemia at the Mandor Community Health Center.

Anemia in pregnant women is defined as a decrease in hemoglobin levels below 11 g%, which reduces the blood's ability to transport oxygen throughout the body. This condition serves as an indicator of poor nutritional status and is closely associated with increased maternal and infant morbidity and mortality. The adverse outcomes linked to anemia during pregnancy include a higher risk of miscarriage, preterm birth, and low birth weight (Winarni et al., 2020).

Oranges are rich in fiber, vitamin C, vitamin B1, folate, antioxidants, and iron, which are essential for preventing and overcoming anemia. Vitamin C, in particular, plays an important role in enhancing iron absorption in the digestive tract, thereby improving hemoglobin synthesis and increasing blood volume. Regular consumption of orange juice alongside iron supplementation can therefore enhance the effectiveness of anemia management in pregnant women.

Based on Table 4, the study results showed a significant difference in hemoglobin levels before and after the administration of orange juice combined with iron tablets, with a p-value of 0.000. These findings indicate that giving orange juice in combination with iron tablets is highly effective in increasing hemoglobin levels among pregnant women with anemia at the Mandor Community Health Center, Landak Regency.

This finding is consistent with research by Mayunita and Avriliatin (2024), who reported that the mean Hb level before receiving Fe + sweet orange tablet intervention was 9.629 g%, which increased to 11.441 g% after the intervention. The paired t-test yielded a significance value of 0.000 ($p < 0.05$), indicating that iron tablets combined with sweet orange significantly improved hemoglobin levels in anemic pregnant women.

Similarly, research conducted by Danefi and Apriasih (2020) demonstrated that in the intervention group receiving orange juice combined with iron, the initial mean Hb level was 11.62 g%, which increased to 11.79 g% after the intervention, with the lowest and highest posttest Hb values being 10.1 g% and 14.9 g%, respectively. This confirms that consuming

orange juice together with iron tablets contributes to a measurable improvement in hemoglobin levels in pregnant women with anemia.

The effectiveness of dragon fruit combined with iron tablets on hemoglobin levels in pregnant women with anemia at the Mandor Community Health Center.

Dragon fruit contains 1.9 mg of iron, 1.1 g of protein, and 20.5 mg of vitamin C. It is an excellent fruit for fulfilling iron requirements and also contains folic acid, which plays an essential role in the formation of red blood cells in pregnant women. The vitamin C content in dragon fruit further enhances iron absorption, supporting the increase in hemoglobin levels.

Based on Table 4, the study results showed that hemoglobin levels before and after the administration of dragon fruit combined with iron tablets had a p-value of 0.000. This indicates that the combination of dragon fruit and iron tablets is highly effective in increasing hemoglobin levels among pregnant women with anemia at the Mandor Health Center in Landak Regency.

These findings are consistent with research conducted by Nurhayati and Fitriani (2024), which involved 30 pregnant women with anemia. Before being given dragon fruit, their hemoglobin levels ranged from 7.0 g% to 9.8 g%, while after the intervention, the levels increased to between 7.3 g% and 11.4 g%. The statistical test results obtained a p-value of 0.004, indicating a significant difference in the average hemoglobin levels before and after the intervention.

Similar results were reported by Fahranisari, Rohmatika, and Dwi (2023), who studied 30 anemic pregnant women in their second trimester. The participants were divided into an intervention group (given dragon fruit juice and honey) and a control group. In the intervention group, the mean hemoglobin level before the intervention was 10.38 g%, which increased to 11.30 g% after the intervention, with a p-value of 0.000. This demonstrates that the administration of dragon fruit juice effectively increases hemoglobin levels in anemic pregnant women during the second trimester.

The effectiveness of orange juice combined with iron tablets and dragon fruit combined with iron tablets on hemoglobin levels in pregnant women with anemia at the Mandor Community Health Center.

Based on the results of the statistical analysis using the chi-square test, the relationship between parental support and MR immunization decision-making in Sungai Ambawang Kuala Village Kindergarten obtained a p-value of 0.006, which is smaller than the significance level ($\alpha = 0.05$). This indicates a significant relationship between parental support and MR immunization decision-making. The odds ratio value of 26 shows that parents who do not support MR immunization are 26 times more likely not to have their children immunized compared to those who are supportive.

Furthermore, based on the paired sample test results, the difference in hemoglobin levels before and after the administration of orange fruit combined with iron tablets was 1.000, while the difference after the administration of dragon fruit combined with iron tablets was 0.450. These findings indicate that the combination of orange fruit and iron tablets is more effective in increasing hemoglobin levels among pregnant women with anemia.

Oranges are known to contain high levels of vitamin C, which plays a key role in enhancing iron absorption. Every 100 grams of orange provides approximately 49 mg of vitamin C. Since iron is a nutrient that is relatively difficult for the body to absorb, the presence of vitamin C helps optimize its absorption (Fadhli, & Yanti, 2024). In addition to being rich in nutrients, oranges are also a readily available and palatable source of natural vitamin C for pregnant women.

The results of this study also showed a difference in the effectiveness between the two interventions. Based on the Mann–Whitney statistical test, a p-value of 0.019 was obtained, indicating that the administration of orange fruit combined with iron tablets was significantly more effective in increasing hemoglobin levels among pregnant women with anemia compared to the combination of dragon fruit and iron tablets.

CONCLUSION

This study shows that both orange fruit combined with iron tablets and dragon fruit combined with iron tablets are effective in increasing hemoglobin levels in pregnant women il who are anemic at the Mandor Community Health Center. However, specifically, orange fruit combined with iron tablets proved to be more effective in increasing hemoglobin levels than dragon fruit.

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