THE COMPARISON OF THE EFFECTIVENESS OF MANGO AND WHITE AMBON BANANA ON HEMOGLOBIN LEVELS IN TRIMESTER II PREGNANT WOMEN WITH ANEMIA

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Abstract

Background: Anemia is a condition in which circulating erythrocytes and/or hemoglobin (Hb) cannot fulfill their function of providing oxygen to body tissues. More than 50% of anemia casesspread throughout the world are directly caused by insufficient iron intake.

Purpose: To determine the comparison of the effectiveness of Mango and White Ambon Banana on Hemoglobin Levels in Anemic Pregnant Women in the Second Trimester at the Ciater Community Health Center, South Tangerang.

Method: This research is a quasi-experimental research design with a two group pre and posttestdesign, a sampling technique using cluster sampling, a total sample of 30 respondents divided intotwo treatment groups. This research was conducted in the Ciater Community Health Center area, South Tangerang City in October 2023. The instruments used were mango fruit and white Ambon banana, observation sheet, Easy Touch Blood Hemoglobin. Data analysis used paired sample t- test and Independent T-Test

Results: There is an effect of giving mangoes and white Ambon banana on hemoglobin levels inpregnant women in the second trimester at the Ciater Health Center with a p-value of 0.000. The results of the study showed that there was no difference in the average hemoglobin levels in pregnant women in the second trimester between the consumption of mangoes and white Ambon banana with a p-value of 0.292.

Conclusion: The results of the study show that there is no difference in the average effect of mangoes and white Ambon banana on the hemoglobin levels of pregnant women.

Suggestion: The results of this research can be put into practice independently, especially for consuming mangoes and Ambon banana to increase Hemoglobin levels

Keywords: Anemia, Mango, Pregnant Women, White Ambon Banana.

Background

Anemia is a condition in which erythrocytes and/or circulating hemoglobin (Hb) cannot fulfill their function to provide oxygen for body tissues. The cause of the high prevalence of anemia in women is due to many factors, including insufficient iron consumption and low iron absorption, bleeding, malaria, worm infections and other infections and adolescent girls experience menstrual cycles every month, but more than 50% of anemia cases spread around the world are directly caused by insufficient iron intake.

The World Health Organization (WHO) in the *worldwide prevalence of anemia* in 2015 shows that the prevalence of anemia in the world ranges from 40 to 88%. In Southeast Asia, 25-40% of adolescent girls experience mild and severe anemia. The number of people of reproductive age (10-19 years) in Indonesia is 26.2% consisting of 50.9% men and 49.1% women.[1]

The Maternal Mortality Rate (MMR) in Indonesia nationally until 2020 is still high, namely 305 per 100,000 live births (KH), while the 2024 RPJMN AKI target is 183 per 100,000 KH and the Golbal SDGs AKI target is 70 per 100,000 KH. The highest causes of maternal mortality in Indonesia include bleeding 30.3%, hypertension 27.1%, infection 7.3% and old partus 1.8%.[2]

According to the Banten Provincial Health Office, in 2021 one of the largest contributors to AKI was bleeding during childbirth, around 37%. According to data from the Banten Health Office (2021), the high number of cases of maternal mortality in Banten Province can reach up to 135 cases of maternal mortality per 100,000 live births with the highest case of maternal mortality in 2018 in the Tangerang City area of 77 cases, followed by South Tangerang with a maternal mortality rate of 13 cases per 100,000 live births. Based on the prevalence of anemia in pregnant women in 2019 in the Ciater Health Center Work Area, which was 44.4%, it shows that there is a serious problem.[3]

The impact of anemia on the health and safety of the pregnant mother and her fetus includes postpartum depression is depression experienced by the mother after childbirth, a fatal risk if bleeding occurs during childbirth and causes the pregnant woman's body to fight more difficult infections, babies born with a low weight especially if anemia occurs in the first trimester of pregnancy, babies are born premature and are at risk of growth and development

disorders, babies born with anemia so that they experience health problems and growth and development disorders, fetal death before and after childbirth.[4]

There are several factors that cause anemia in pregnant women, including compliance with the consumption of blood supplement tablets and diet. Compliance with the consumption of blood supplement tablets is one of the health behaviors carried out by pregnant women. A high level of compliance can reduce the incidence of anemia in pregnant women. Compliance with taking Fe tablets is defined as the accuracy of pregnant women in consuming Fe tablets, namely 1 tablet routinely for at least 90 days during pregnancy.[4] Supported by previous research conducted by Izzati *et al* (2021) showed that there was a relationship between the level of compliance with the consumption of Fe tablets in pregnant women in the second trimester of anemia in pregnant women in the second trimester at the Margasari Health Center.[5]

Banana is one of the non-pharmacological therapies consumed as a staple food in the tropics and this banana is enriched with iron which is effective in controlling iron deficiency and can be absorbed by the body almost entirely. Ambon banana also contain vitamin C which can help increase iron absorption and can reduce iron in the form of ferri to ferro. Vitamin C increases iron absorption from food through the formation of ferro-ascorbate complexes. Ascorbic acid with iron salts can increase iron absorption by 25%−50%. The administration of iron (Fe) tablets and banana (*Musa Paradisiaca var Sapientum Linn*) is more effective in increasing Hb levels in pregnant women than just giving Fe tablets alone.[6]

A study conducted by Siregar *et al* (2022) showed that there was an effect of consumption of banana (*Musa Paradisiaca var Sapientum Linn*) on increasing Hb levels in pregnant women with anemia in the Kayamanya Health Center Working Area.[7] The study is in line with a study conducted by Tuju *et al* (2019) with the results that there is an effect of giving a combination of banana and Fe tablets on hemoglobin levels in pregnant women in the second trimester at the Pinolosian Health Center, South Bolaang Mongondow Regency.[8]

Another non-pharmacological therapy to treat anemia in pregnant women is by consuming mango fruit (*Mangifera indica L.*) Mango fruit (*Mangifera indica L.*) is one of the most important tropical fruits consumed worldwide, which is an excellent source of fiber, bioactive compounds such as provitamin A carotenoids, vitamin C and phenolic compounds. Mango is a common fruit and is considered an important source of micronutrients such as

vitamins and other phytochemicals. Mangoes provide energy, carbohydrates, proteins, fats, dietary fiber, phenolic compounds and omega-3 and -6 polyunsaturated fatty acids, which are essential for human health, growth and development. Up to 25 different carotenoids have been found in the flesh of mangoes, most of which are beta-carotene. Mangoes are used in weak conditions, hemoptysis, bleeding, and anemia.[9]

According to a study conducted by Abdulmaguid (2018) entitled "*Ameliorative iron-deficiency anemia levels using natural orange juice and fortified with different concentrations of mango, strawberries and beetroot juices in male albino rats*" suggests that mango is an anemia-lowering food, and its juice can significantly increase hemoglobin if consumed regularly. Some medical studies show that iron deficiency causes shortness of breath, dizziness, menstrual disorders, muscle cramps, anxiety problems, stress, and heart-related diseases. [9]

Based on a preliminary study at the Ciater Health Center, the number of anemia in pregnant women in the period January – September 2023 was 282 cases. In September 2023 there were 14 cases with an Hb value of <11 mg/dL and in October 2023 there was an increase to 48 cases with an Hb value of <11 mg/dL. Based on the above background, anemia in pregnant women is a very serious problem, and on this basis, researchers are interested in doing research on "The Effectiveness of Comparison of Mango Fruit (Mangifera sp) with White Ambon Banana (Musa acuminata) on Increasing Hemoglobin Levels in Pregnant Women in the Second Trimester".

Method

1.   Research design

The design of this study is a *quasi-experimental design* research. The design used was a *two-group pretest and posttest design* to determine the effectiveness of the comparison of mangoes and white ambon bananas on changes in hemoglobin levels of pregnant women in the second trimester.

Group	Pre Test	Experiment	Post Test
Group A	O1 ⟶	X1	⟶ O2
Group B	O3 ⟶	X2	⟶ O4
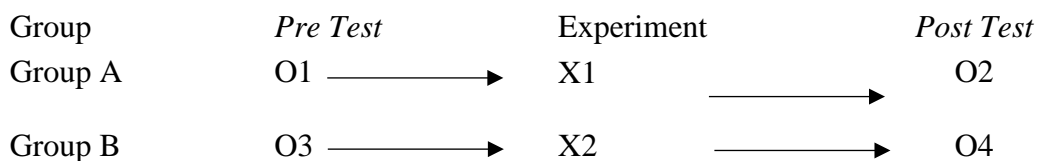
Information:

O1 and O2	:	*Pre-post test* group A with mango feeding
O3 and O4	:	*Pre-test-post test* group B with the administration of white ambon bananas
X1	:	Giving mangoes 1 time a day 250 grams for 14 consecutive days in the afternoon
X2	:	Giving white ambon bananas 1 time a day 250 grams for 14 consecutive days in the afternoon

2.   *Setting and samples*

The sample used in this study was pregnant women in the Working Area of the Ciater Health Center, South Tangerang City. The sample calculation in this study used *cluster random sampling*.

Table 1. Sample Calculation

No.	Cluster	Populasi	Sampel	
1	Posyandu 1	8	$\frac{8}{87}$ X30	3
2	Posyandu 2	4	$\frac{4}{87}$ X30	2
3	Posyandu 3	6	$\frac{6}{87}$ X30	2
4	Posyandu 4	7	$\frac{7}{87}$ X30	3
5	Posyandu 5	10	$\frac{10}{87}$ X30	4
6	Posyandu 6	4	$\frac{4}{87}$ X30	2
7	Posyandu 7	9	$\frac{9}{87}$ X30	2
8	Posyandu 8	6	$\frac{6}{87}$ X30	2
9	Posyandu 9	8	$\frac{8}{87}$ X30	3
10	Posyandu 10	5	$\frac{5}{87}$ X30	2
11	Posyandu 11	6	$\frac{6}{87}$ X30	2
12	Posyandu 12	5	$\frac{5}{87}$ X30	2
13	Posyandu 13	7	$\frac{7}{87}$ X30	3
	Jumlah	**85**		**30**

In this study, there are inclusion criteria, namely pregnant women entering the second trimester, with mild anemia (Hemoglobin levels 9.0-10 gr/dl), primipara and multipara pregnant women, and mothers who do not experience taboos or allergies to bananas and mangoes. The exclusion criteria are pregnant women who have a history of degenerative diseases (diabetes mellitus, hypertension, heart, etc.).

According to Sani (2018) explained that for experimental research, the sample was 15 elements per group. Based on the inclusion criteria and the statement, the researcher used 15 samples for group A and 15 samples for group B. From these results, the researcher determined the number of samples, which was 30 respondents.

3.   Intervention (applies to experimental studies)

This study uses an intervention in the form of giving white ambon bananas and mangoes. Giving pregnant women 2.5 grams (250 grams) of processed white ambon bananas once a day in the afternoon for 14 days. Meanwhile, the administration of mangoes is given in the form of processed mangoes to pregnant women once a day in the afternoon as much as 250 grams for 14 days.

4.   Measurement and data collection

The research instruments used in the study are SOP (Standard Operating Procedure) for giving white ambon bananas and mangoes as well as SOP for checking Hb levels with *Easy Touch Blood Hemoglobin* and tools used to make and check Hb levels. In the initial stage, the researcher prepared a Standard Operating Procedure (SOP) as a reference for research on white ambon bananas, mangoes and Hb level checks. After the SOP was available, then prepared an observation sheet as a record of hemoglobin levels before the intervention, the activity of giving white ambon bananas and mangoes and recording hemoglobin levels after the intervention. Then prepare a hemoglobin checker, namely using *Easy Touch Blood Hemoglobin.*

5.   Data analysis;

Hypothesis testing in this study is determined based on the results of the data normality test, so it will be possible to determine what test tool is most suitable to use. If the data is normally distributed, the parametric paired *sample t-test* and *T-Test Independent* are used, while for the data that is not normally distributed, the calculation uses non-parametric tests, namely *the wilcoxon* test and *the Mann Whitney* test.

Results

Average Hemoglobin of Pregnant Women in the Second Trimester Before and After Consumption of Mangoes and White Ambon Bananas at the Ciater Health Center

Table 2. Average Hemoglobin Level

Variable	Group	N	Mean	Mean Difference	Std. Deviation
Mango Fruit Juice (Group A)	Hb Pre Intervention	15	10,533	2,354	0,6321
	Hb Post Intervention	15	12,887		0,6209
White Ambon Banana (Group B)	Hb Pre Intervention	15	10,500	2.140	0,5964
	Hb Post Intervention	15	12,640		0,6379

From table 2 above, the average hemoglobin before the intervention was obtained in group A, namely those who consumed Mango Fruit (*Mangifera sp*) of 10.533 gr/dl which was classified as anemia. Meanwhile, the average hemoglobin obtained after intervention in group A, namely those who consumed Mango Fruit (*Mangifera sp*) of 12.887 gr/dl which was classified as non-anemia. The average difference in hemoglobin in group A is 2.354 gr/dl. So it can be concluded that there is an increase in hemoglobin in group A after the intervention.

The average hemoglobin before the intervention was carried out in group B, namely those who consumed White Ambon Banana (*Musa acuminata*) of 10,500 gr/dl which was classified as anemia. Meanwhile, the average hemoglobin obtained after intervention in group B, namely those who consumed White Ambon Banana (*Musa acuminata*) of 12,640 gr/dl which classified as not anemic. The average difference in hemoglobin in group B is 2,140 gr/dl. So it can be concluded that there is an increase in hemoglobin in group B after the intervention.

Normality Test

Before conducting a statistical test, a normality test is carried out first to find out whether the data obtained in the normal distribution is normal or not. Normalization can be done by looking descriptively from the data. The rule used to test normality is that the existing score of the Shapiro-Wilk connection is considered more accurate when the number of subjects we have is less than 50. If the Sig. number is greater than or equal to 0.05, the data is normally distributed, but if it is less than 0.05, the data is not normally distributed.[10]

The following is a normality test table using Shapiro – Wilk.

Table 3 Results of Shapiro-Wilk Normality Test

Variable	Group	Sig	α=0,05	Decision
Mango Fruit Juice (Group A)	Hb Pre Intervention	0,672	> 0,05	Usual
	Hb Post Intervention	0,323	> 0,05	Usual
White Ambon Banana (Group B)	Hb Pre Intervention	0,233	> 0,05	Usual
	Hb Post Intervention	0,288	> 0,05	Usual

Based on Table 3, the results of the normality test both before and after the consumption of Mango Fruit (*Mangifera sp*) with White Ambon Banana (*Musa acuminata*) on the hemoglobin level of pregnant women in the second trimester were more than 0.05. Knowing whether it is normal or not is a sig > 0.05, then normal and If the sig < 0.05, it can be said to be abnormal. Based on these results, all variables are normally distributed.

Bivariate Analysis

Increase hemoglobin after intervention consumption Fruit Mango (*Mangifera sp*) is presented in the following table:

Table 4. Test on the Effectiveness of Mango Consumption on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester

Group A (Mango)	n	Mean	Std.Dev	P-Value
Hb Pre Intervention	15	10,533	0,6321	0,000
Hb Post Intervention	15	12,887	0,6209	

Based on the results of the analysis using *the Paired Sample T-Test*, a p-value of 0.000 < α (0.05) was obtained, meaning that Ho was rejected and Ha was accepted, namely the Effectiveness of Mango Fruit Consumption (*Mangifera sp*) on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester.

Table 5. Test on the Effectiveness of White Ambon Banana Consumption on Increasing Hemoglobin Levels in Pregnant Women in the Second Trimester

Group B (White Ambon Banana)	n	Mean	Std.Dev	P-Value
Hb Pre Intervention	15	10,500	0,5964	0,000
Hb Post Intervention	15	12,640	0,6379	

Based on the results of the analysis using the *Paired Sample T-Test* , a p-value of 0.000 < α(0.05) was obtained, meaning that Ho was rejected and Ha was accepted, namely the Effectiveness of White Ambon Banana (*Musa acuminata*) on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester. Based on the value of t, the calculation has a negative value, which is -9.327. t calculates a negative value because the initial Hb value

is lower than the final Hb value. So a negative t-count value can mean positive. So that the value of t is calculated to be 9.327. The calculated value > the table value is 9,327> 2,086 so it can be concluded that H0 is rejected and Ha is accepted. So there is an average difference between the initial and late hb which means the Effectiveness of the Consumption of White Ambon Bananas (*Musa acuminata*) on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester.

Table 6. Comparison of Average Hemoglobin Levels in Group A (Mango Juice) and Group B (White Ambon Banana)

Variable	n	f	Sig	Sig 2 Tailed
Group A (Mango Juice)				
Group B (White Ambon Banana)	15	0,059	0,810	0,292

Based on the results of the analysis using *the Independent T-test* , it can be seen that t increase hemoglobin levels in group A and group B are 1.073. A *p-value* = 0.292 > α (0.05) was obtained, so Ha was accepted, which means that there was no difference in the average hemoglobin level in pregnant women in the second trimester between the consumption of Mango Fruit (*Mangifera sp*) and White Ambon Banana (*Musa acuminata*).

Discussion

Effect of Mango Feeding on Hemoglobin Levels in Pregnant Women in the Second Trimester

The results of the study showed that from the *Paired Sample T-Test,* a p-value of 0.000 < α(0.05) was obtained, meaning that Ho was rejected and Ha was accepted, namely the Effectiveness of Mango Consumption (*Mangifera sp*) on the increase in hemoglobin levels of pregnant women in the second trimester. Based on the t-value, the calculation has a negative value, which is -14.762. t calculate this negative value because the initial Hb value is lower than the final Hb value. So a negative t-count value can mean positive. So that the t-value is calculated to be 14.762. The calculated value > the table value is 14.762 > 2.086, so it can be concluded that H0 was rejected and Ha was accepted. So there is an average difference between the initial and late dates, which means that there is an Effectiveness of Mango Fruit Consumption (*Mangifera sp*) on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester.

The results of this study are in line with the theory that mangoes are widely used as a source of vitamins needed for the body. In addition to being a source of vitamins, mangoes can be useful as a laxative, as a medicine to stop bleeding in the uterus, lungs, intestines, irritability and anemia.[11]

The ethyl acetate fraction of mango leaves contains many phenolic compounds and flavonoids. Guillén *et al*., (2022) stated that the compounds contained in mangoes are lupeol, mangiferin, gallic acid, chlorogenic acid, vanilla acid, ferulic acid, ascorbic acid and carotenoid compounds. Some of the amino acids contained in mango seeds are leucine, isoleucine, methionine, lysine, valine, phenylalanine and threonine. The phenolic compounds contained include tannins, gallic acid, coumarin, vanillin, mangiferrin, ferulic acid and other unidentified compounds.[12]

According to a study conducted by Abdulmaguid (2018) entitled "*Ameliorative Iron-Deficiency Anemia Levels Using Natural Orange Juice And Fortified With Different Concentrations Of Mango, Strawberries And Beetroot Juices In Male Albino Rats*" stated that mango is an anemia-lowering food, and its juice can significantly increase hemoglobin if consumed regularly.[9] Several medical studies show that iron deficiency causes shortness of breath, dizziness, menstrual disorders, muscle cramps, anxiety problems, stress, and heart-related diseases According to researchers, the content contained in mangoes is able to increase hemoglobin levels in pregnant women. But There has been no previous research to support this truth.

Effect of White Ambon Banana Feeding on Hemoglobin Levels in Pregnant Women in the Second Trimester

The results of the study showed that from the Paired Sample T-Test, a p-value of $0.000 < \alpha(0.05)$ was obtained, meaning that Ho was rejected and Ha was accepted, namely the Effectiveness of White Ambon Banana (*Musa acuminata*) on the Increase in Hemoglobin Levels of Pregnant Women in the Second Trimester. Based on the t-value, the calculation has a negative value, which is -9.327. t calculate this negative value because the initial Hb value is lower than the final Hb value. So a negative t-count value can mean positive. So that the value of t is calculated to be 9.327. The calculation value > table value is 9,327>2.086 so it can be concluded that H0 is rejected and Ha is accepted. So there is an average difference between the initial and final dates, which means The effectiveness of the consumption of white Ambon bananas (Musa acuminata) on the increase in hemoglobin levels of pregnant women in the second trimester.

Based on the results of the analysis using the Independent T-test, it can be seen that t increase hemoglobin levels in group A and group B are 1.073. The p-value = 0.292 > α (0.05), so Ha was accepted, which means that there was no difference in the average hemoglobin level in pregnant women in the second trimester between the consumption of Mango Fruit (*Mangifera sp*) and White Ambon Banana (*Musa acuminata*).

Another intervention to increase Hb levels in pregnant women is consuming ambon bananas. Ambon bananas are a source of vitamin C which can increase the optimization of non-heme iron absorption so that absorption will be more in the intestines and potassium which regulates the delivery of nutrients to cells and facilitates the flow of oxygen to the brain. So hemoglobin is able to bind oxygen which causes the number of red blood cells and hemoglobin levels in the blood to increase.[13]

Another intervention to increase Hb levels in pregnant women is consuming ambon bananas. Ambon bananas are consumed as much as 320 grams (equivalent to 2 medium bananas) every day for 7 days. Consuming bananas regularly can increase hemoglobin levels in pregnant women with anemia p value 0.001. Ambon bananas contain potassium, magnesium, phosphorus, calcium, iron, vitamins, carbohydrates, fiber, protein and fat. In a ripe banana, there are 99 calories, 1.2 grams of protein, 0.2 grams of fat, 25.8 mg, carbohydrates, 0.7 grams of fiber, 8 mg of calcium, 28 mg of phosphorus, 0.5 mg of iron and 72 grams of water. The mineral of banana ambon can be absorbed almost entirely by the body, especially iron (in dry weight, iron content reaches 2 mg/100 gr, zinc 0.8 mg.11 Banana ambon is effective in increasing Hb levels in pregnant women. An increase in Hb levels of 3.5 gr/dL.[14]

According to the assumption of the researcher in conducting the study for 7 days of each subject in the Ciater Health Center Working Area, there was an increase in hemoglobin values because all subjects were very cooperative to follow the recommendations well. So that the results of research on potential hazard identification, assessment and control of anemia in pregnant women can be applied as one of the sciences in providing pregnancy care services to individuals, families, groups and communities.

Limitation

The limitation of this study is about time of research only for 14 days, and the increase in hemoglobin has not been very significant.

Conclusion

The average difference in hemoglobin before and after the intervention in group A (Mango Juice Intervention) was 2.354 gr/dL. The average difference in hemoglobin before and after the intervention in group B (White Ambon Banana Intervention) was 2,140 gr/dL. There is an effect of mango administration on hemoglobin levels in pregnant women in the second trimester at the Ciater Health Center (p-value 0.000). And there was an effect of giving white bananas on hemoglobin levels in pregnant women in the second trimester at the Ciater Health Center (p-value 0.000). There was no difference in the average hemoglobin level in pregnant women in the second trimester between the consumption of Mango Fruit (*Mangifera sp*) and White Ambon Banana (*Musa acuminata*) (p-value 0.292).

Ethical Considerations

This research has passed an ethical exemption from the Health Research Ethics Commission of the Universitas Indonesia Maju with number 517/Sket/Ka.Dept/RE/UIMA/II/2024 and has been declared ethically feasible in accordance with 7 Standards WHO 2011.

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