

Enhancing Maternal Health : IT Solutions for Monitoring Anemia in Pregnancy

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Abstract

Background: Anemia is a condition in which a deficiency of red blood cells (erythrocytes) in the blood cycle or mass of hemoglobin is so unable to fulfill its function as a carrier of oxygen in the entire tissue. Handling to increase hemoglobin levels by using pharmacological and non-pharmacological management, one of the non-pharmacological management is by giving vitamin C so that the process of absorption and formation of hemoglobin is faster such as consuming red guava juice every day 2 x 1 together with Fe. the study was to determine the effect of giving Fe tablets and red guava juice on increasing hemoglobin levels in third trimester pregnant women. This pre-post experimental research design uses a design pretest-posttest with control group design. The sample in this study 36 respondents consisting of 18 experimental respondents and 18 control respondents with purposive sampling technique. The research instrument used the measurement tool HB Family Dr. Test Strip and observation for 2 weeks. Data were analyzed using paired t-test to determine changes before and after and independent T-Test to determine the difference between the experimental group and the control group. The results of the pre-post study in the experimental group were p values of 0,000 ($p < 0.05$) and in the control group were 0.01 ($p < 0,05$). The results of the pre-post study in the experimental and control group p value 0,000. There is an effect of giving red guava juice and Fe tablets to increase hemoglobin levels of pregnant women in the third trimester who have mild anemia. Therefore, it is hoped that PMB (Praktek Mandiri Midwives) can pay attention to the handling of anemia in pregnant women in Kedaung, Pamulang, Tangerang. South with outreach programs and supplementation such as giving red guava juice.

Keywords — Anemia, Fe Table, Red Guava Juice

1. INTRODUCTION

The World Health Organization (WHO) reported in 2019 that Maternal Mortality Rates (MMR) in developing countries are related to pregnancy-related anemia caused by iron deficiency by 40.3%. In Asia, the countries with the highest prevalence of maternal anemia are Laos (57.1%) and the Philippines (56.2%), while in European countries, the highest prevalence of anemia is in Spain (18.3%) and Portugal (16.9%). Complications that are the majority cause of maternal deaths, about 75% of total maternal deaths, include hemorrhage, infections, high blood pressure during pregnancy, complications during childbirth, and unsafe abortions (WHO, 2019)(2). Maternal mortality rates in ASEAN are among the highest in the world. WHO estimates the total MMR and Maternal Mortality Ratio (MMR) in ASEAN to be around 170 thousand and 1.3 million per year. 98% of all MMR and MMR in this region occur in

Indonesia, Bangladesh, Nepal, and Myanmar. Indonesia, as a developing country, still has a relatively high maternal mortality rate (WHO, 2012)(3). Maternal Mortality Rates (MMR) in Indonesia nationally until 2020 are still high at 305 per 100,000 live births (LB), while the MMR target for the 2024 RPJMN is 183 per 100,000 LB and the Global SDGs MMR target is 70 per 100,000 LB. The leading causes of maternal death in Indonesia include bleeding 30.3%, hypertension 27.1%, infections 7.3%, and prolonged labor 1.8% (Ministry of Health, 2020). The Maternal Mortality Rate (MMR) target in the Sustainable Development Goals (SDGs), which must be achieved by 2030, is 70/100,000 live births, while Indonesia's MMR in 2015 shows a figure of 305/100,000 live births (Ministry of Health, 2015).

The number of MMR in Banten Province in the last three years has fluctuated, with 226 cases in 2017, 135 cases in 2018, and 215 cases in 2019. The districts/cities with the highest MMR in 2019 were Serang District with 66 cases, followed by Lebak with 38 cases and Pandeglang with 34 cases. The districts/cities with the lowest MMR were Tangerang City with 6 cases and South Tangerang City with 10 cases. The direct causes of maternal death in the Banten region are about 37% due to hemorrhage, 22% infection, and 14% hypertension, while the rest are due to other factors such as the lack of family responsiveness to mothers who are about to give birth. This becomes very ironic considering that various causes of maternal death should be preventable if handled properly (Banten Health Office, 2020). The Maternal Mortality Rate (MMR) in Tangerang Regency recorded, in 2014 there were 47 mothers who died. Meanwhile, in 2015, the number increased to 51 mothers who died. Maternal mortality can be classified into direct obstetric and indirect causes.

Direct obstetric deaths are caused by pregnancy complications including bleeding 28%, infection 11%, eclampsia 24.5%, and prolonged labor 5.2%. Indirect deaths are caused by diseases or other complications that existed before pregnancy/delivery, accounting for 5-10%, including anemia, chronic energy deficiency (Tangerang District Health Office, 2016). According to WHO, the prevalence of pregnancy anemia worldwide ranges from 20% to 89% with Hb <11g/dl. The incidence of pregnancy anemia is 3.8% in trimester I, 13.6% in trimester II, and 24.8% in trimester III (Manuaba, 2012). According to the Ministry of Health (2018), 48.9% of pregnant women in Indonesia suffer from anemia. The percentage of pregnant women with anemia in Indonesia increased compared to Riskesdas 2013 data, which was 37.1%. In Indonesia, the prevalence of anemia during pregnancy is still high around the year 2013 (42%), 2014 (39%), 2015 (60%), and 2018 (48.9%) pregnant women suffer from anemia (Riskesdas, 2018). Further observations by the Banten Provincial Central Bureau of Statistics (BPS) show that most anemia suffered by the public is due to iron deficiency, which can be addressed through regular iron supplementation and improved nutrition. The prevalence of iron-deficiency anemia in Banten Province in pregnant women is (27.6%). While the prevalence of anemia in Tangerang District in 2015 was (48.3%) (Tangerang District Health Office, 2015). The number of pregnant women at PMB Bidan Sutrisni Kedaung Pamulang in October 2021 - December 2021 was 98 people, Pregnant women who experienced mild anemia were 36 people. The total sample of third-trimester pregnant women studied was 36 respondents, 18 respondents were given Fe tablets 2 x 1 and red guava juice (*Psidium Guajava*) 2 x 1, and 18 respondents were only given Fe tablets 2 x 1. The study was conducted for 2 weeks. Anemia is a condition in which the hemoglobin (Hb) level in the body is below the normal value according to certain groups of people (Irianto, 2014). Anemia in pregnant

women has adverse effects on both the mother and the fetus. The potential adverse effects on pregnant women are the prolonged labor process resulting in bleeding and shock due to contractions. The adverse effects on the fetus include prematurity, low birth weight, disabilities, and even infant death (Fikawati, 2015).

Anemia occurring during pregnancy can be caused by many women starting pregnancy with inadequate food reserves or already experiencing anemia before pregnancy. Pregnant women need more iron intake than before pregnancy. Inadequate food intake causes the available iron to be insufficient for hemoglobin synthesis due to iron deficiency in food. Iron deficiency will result in decreased hemoglobin formation speed and concentration in the bloodstream (Nurhidayati, 2013). The government's anemia control program is to provide additional blood tablets, namely Fe preparations aimed at reducing anemia rates in toddlers, pregnant women, postpartum women, adolescent girls, and Women of Childbearing Age (WUS). Anemia control in pregnant women is carried out by providing 90 Fe tablets to pregnant women during their pregnancy period. The Fe tablet distribution target of 90 tablets did not reach 100%, because in 2016 the availability of additional blood tablets decreased from 100% to 97%. This is due to the lack of additional blood tablet supplies that should be allocated from the Center (Ministry of Health) (Tangerang District Health Office, 2015). According to the research results of Fitriani Yulia et al (2017), For the frequency of gravid respondents, it can be known that 42.9% of respondents were primigravida and 57.1% of respondents were Multigravida in trimester III, it can be known that before giving red guava juice 57.1% (8 respondents) had Hb levels ≥ 11 gr% and 42.9% (6 respondents) had Hb levels 9 - 10.9 gr%, After giving red guava juice, 250 ml per day for 7 consecutive days consumed before consuming iron tablets, it shows that 100% (14 respondents) had Hb levels ≥ 11 gr%. From the above journal research results, what distinguishes is a total sample of 36 third-trimester pregnant women, 18 respondents were given Fe 2 x 1 and red guava juice (*Psidium Guajava*), while 18 respondents were only given Fe, research was conducted for 2 weeks, after 2 weeks a recheck of hemoglobin was performed, respondents before being given Fe and red guava juice (*Psidium Guajava*) had an average Hemoglobin level of 7-9 gr/dl after being given Fe and red guava juice (*Psidium Guajava*) increased to 11-12 gr/dl. Whereas respondents who were only given Fe, hemoglobin only increased by 0.3 gr/dl, it can be concluded that giving Fe and Red Guava Juice (*Psidium Guajava*) is more effective in increasing Hemoglobin levels in Third Trimester Pregnant Women compared to Fe alone without red guava juice (*Psidium Guajava*). Pregnant women in the third trimester who experienced anemia in 2020 were found to be 15%, and in 2021, 23% at PMB midwife Sutrisni, so researchers were interested in conducting research on the "Effectiveness of Fe Tablet Administration and Red Guava Juice (*Psidium Guajava*) on Hemoglobin Levels in Third Trimester Pregnant Women with mild anemia at PMB Midwife Sutrisni in 2021. Research Objectives The general objective of this study is to determine the effectiveness of giving Fe and Red Guava Juice (*Psidium Guajava*) in increasing the hemoglobin levels of third-trimester pregnant women with mild anemia at PMB Midwife Sutrisni in 2021. To determine the difference in hemoglobin levels of the experimental group before and after being given Fe tablets and red guava juice (*Psidium Guajava*) in third-trimester pregnant women with mild anemia at PMB Midwife Sutrisni in 2021. To determine the difference in hemoglobin levels of the control group before and after being given Fe tablets in third-trimester pregnant women with mild anemia at PMB Midwife Sutrisni in 2021. To determine the difference in hemoglobin levels between the experimental

group given Fe 2 x 1 and red guava juice (*Psidium Guajava*) 2 x 1 with the control group only given Fe 2 x 1 without red guava juice (*Psidium Guajava*) 2 x 1 in third-trimester pregnant women with mild anemia at PMB Bidan Sutrisni 2021.

2. LITERATURE REVIEW

Iron Deficiency Anemia (IDA) is anemia that arises due to a decreased supply of iron for erythropoiesis, caused by depleted iron stores, which ultimately leads to reduced hemoglobin formation. Iron deficiency anemia is the most commonly encountered type of anemia, especially in tropical countries or third world countries, and therefore is closely related to economics (Bakta et al, 2009).

The most commonly encountered type of anemia in pregnancy is iron deficiency anemia. Iron deficiency anemia is one of the nutritional problems in Indonesia. Anemia in pregnant women often occurs due to iron deficiency in the blood, which adversely affects the fetus (Prawirodharjo, 2009). The symptoms of anemia depend largely on its severity. Typically, symptoms include fatigue, weakness, lethargy, lassitude, dizziness, blurred vision, decreased appetite, nausea, and vomiting. Further symptoms include pale conjunctiva, lips, tongue, skin, and palms (Manuaba, 2010).

Anemia Classification According to Manuaba (2010), anemia is classified as follows: Normal: > Hb 11 g%, Mild: Hb 9 g% - 10 g%, Moderate: Hb 7 g% - 8 g%, Severe: Hb < 7 g%. Pathophysiology of Pregnancy Anemia Blood volume increases during pregnancy, known as hydration or hypervolemia. However, the increase in red blood cells is less than the increase in blood plasma, resulting in blood dilution. The ratio is approximately 30% plasma, 18% red blood cells, and 19% hemoglobin.

Blood dilution (Hemodilution) during pregnancy begins around the 10th week of pregnancy and peaks between weeks 31 and 36. Physiologically, this blood dilution helps alleviate the increased workload on the heart during pregnancy. Hematological changes during pregnancy are due to increased circulation to the placenta and breast growth, with plasma volume increasing by 45% starting in the second trimester and reaching its maximum in the ninth month, increasing by about 1,000 ml, decreasing slightly before term, and returning to normal three months after delivery (Prawirohardjo, 2016).

Etiology According to Tarwoto (2013), the causes of anemia include: 1. Genetic: hemoglobinopathies, thalassemia, abnormal glycolytic enzymes, and Fanconi anemia, 2. Nutrition: iron deficiency, folate deficiency, cobalamin deficiency / vitamin B12, and alcoholism, nutritional deficiency / malnutrition, 3. Bleeding, 4. Immunological, 5. Infections: hepatitis, cytomegalovirus, parvovirus, clostridia, gram-negative sepsis, malaria, and toxoplasmosis, 6. Drugs and chemicals: chemotherapeutic agents, anticonvulsants, antimetabolites, contraceptives, and toxic chemicals, 7. Thrombotic thrombocytopenic purpura and hemolytic uremic syndrome, 8. Physical effects: trauma, burns, and snake bites, 9. Chronic and malignant diseases: kidney disease, liver disease, chronic infections, and neoplasms.

The amount of iron needed during pregnancy is much higher than when not pregnant. In the first trimester of pregnancy, iron needs are lower than before pregnancy because menstruation does not occur, and the amount of iron transferred to the fetus is still low. In the second to third trimesters, fetal consumption increases. This condition is balanced by a decrease in Hb levels of about 10%, physiologically caused by increased plasma volume exceeding the increase in red blood cell count. Iron needs by trimester are 1 mg/day in the first trimester, 5 mg/day in the second trimester, and 5 mg/day in the third trimester. Because iron in the second and third trimesters cannot be met by food alone, pregnant women in these trimesters need to be given iron supplement preparations.

The maternal requirement during pregnancy is 800 mg/iron, including 300 mg for the fetus and placenta and 500 mg for maternal erythrocyte growth. Iron preparations, such as ferrous sulfate, ferrous gluconate, or naferobisitate, are given. Giving 60 mg/day preparations can increase Hb levels by 1 g% per month. The national program now recommends a combination of 60 mg of iron and 50 mg of folic acid for anemia prophylaxis (Prawirohardjo, 2016). Prevention efforts for iron-deficiency anemia in pregnant women are carried out by giving 1 blood supplement tablet every day during pregnancy for a minimum of 90 tablets, starting as early as possible and continuing until the postpartum period.

Treatment of anemia in pregnant women:

- a. First trimester: Given 2x1 blood supplement tablets and Hb levels checked every month until normal. If there is no change, refer to the hospital,
- b. Second and third trimesters: Given 2x1 blood supplement tablets and Hb levels checked every 2 weeks until normal. If there is no change, refer to the hospital, c. If Hb levels do not change, immediately refer to higher-level healthcare services. If Hb levels do not change after regular blood supplement tablet consumption, the possibility of anemia is not due to iron deficiency.

3. RESEARCH METHOD

The type of research in this study is quantitative because it is presented with numbers. This is in line with Arikunto's opinion (2016), which states that quantitative research is an approach that heavily relies on numbers, starting from data collection, interpretation of the data, to presenting the results. This research uses a quasi-experimental approach, which is an experimental activity aimed at determining a phenomenon or effect resulting from a specific intervention or treatment. The design used is a pretest and posttest with control group design, where this design measures the difference between before and after the intervention using a control group. The difference between before and after the intervention is assumed to be the effect of the intervention.

Univariate Analysis

1. The Difference in Mean Hemoglobin (Hb) Levels Before and After Being Given Iron Tablets and Red Guava Juice (Intervention Group)

The Difference in Hb Levels Before and After Being Given Iron Tablets and Red Guava Juice at PMB Midwife Sutrisni

Table 1. Shows the Average Values of Hb Measurements Before the Intervention

Variable	Measurement	N	Mean	St. Deviasi	P Value
Hb	Before Intervention	18	9,733	0,2326	0,000
	After Intervention		11,789	0,2349	

Table 1 shows the average values of Hb measurements before the intervention were 9.733 g/dL with a standard deviation of 0.2326. In the measurements after the intervention, the average Hb was 11.789 g/dL with a standard deviation of 0.23491. The mean difference value between the initial Hb measurement and the first week is 2.056 g/dL. The statistical test results indicate a P Value of 0.000 (less than 0.05), thus it can be concluded that there is a significant difference between the average Hb measurements before and after the intervention

2. The Difference in Mean Hemoglobin (Hb) Levels Before and After Administration of Fe Tablets (Control Group)

The Difference in Hb Levels Before and After Administering Fe Tablets at PMB Midwife Sutrisni.

Table 2. Shows that the Average Initial Hb Measurement Result

Variable	Measurement	N	Mean	St. Deviasi	P Value
Hb	Beginning	18	9,694	0,4608	0,01
	The 15th day		9,728	0,4599	

Table 2 shows that the average initial Hb measurement result is 9.694 g/dL with a standard deviation of 0.4608. On the 15th day of measurement, the average Hb is 9.728 g/dL with a standard deviation of 0.4599. The mean difference value between the initial and the 15th-day Hb measurements is 0.034 g/dL. The statistical test results indicate a P-value of 0.01 < 0.05, therefore, it can be concluded that there is a significant difference between the average initial Hb measurement and the 15th-day measurement (after being given Fe tablets).

3. The Difference in Mean Results between the Intervention Group and the Control Group Regarding the Increase in Hemoglobin (Hb) Levels at PMB Midwife Sutrisni in 2021.

The Difference in Mean Results between the Intervention Group And the Control Group.

Table 3. Shows the Results of the Independent Samples T-Test

Variable	Measurement	Mean (N=18)	St. Deviasi	P Value
Hb	Intervention	11,789	0,2349	0,000
	Control	9,728	0,4599	

Table 3 shows the results of the independent samples t-test, indicating that in the group given red guava juice and Fe tablets, the average hemoglobin level did not experience anemia (normal) with a mean of 11.789 g/dL (Standard Deviation = 0.2349), while in the group only given Fe tablets without red guava juice, the average experienced mild anemia with a mean hemoglobin level of 9.728 g/dL (St. Deviation 0.4599). The results of the independent t-test obtained a p-value of $0.000 < \alpha (0.05)$, indicating that at a 95% confidence level, H_0 is rejected, meaning there is an influence of giving red guava juice and Fe tablets on increasing the hemoglobin levels of pregnant women at Bidan Sutrisni.

4. RESULTS AND DISCUSSION

The Effectiveness of Fe Tablet and Red Guava Juice (*Psidium Guajava*) Administration on Hemoglobin Levels in Third Trimester Pregnant Women with Mild Anemia in Kedaung Pamulang, South Tangerang, 2021 Based on the univariate analysis results, the research respondents were divided into 2 groups: a group of pregnant women with anemia who consumed Fe tablets and red guava juice, totaling 18 individuals (100%), and a group of pregnant women with anemia who only consumed Fe tablets, also totaling 18 individuals (100%). According to Saifuddin (2009), anemia during pregnancy is a condition where the mother's hemoglobin level is below 11 g% in trimesters 1 and 3, and 10.5 g% in trimester 2.

Iron Deficiency Anemia (IDA) is anemia that occurs due to a reduced supply of iron for erythropoiesis, caused by depleted iron stores, ultimately resulting in reduced hemoglobin formation. Iron deficiency anemia is the most common type of anemia, especially in tropical countries or third world countries, and is closely related to the economy (Bakta et al, 2009). The research results are in line with the study conducted by Fitriani Yulia et al (2017) regarding the effect of Fe and red guava juice on hemoglobin levels in third-trimester pregnant women. The study involved 36 samples divided into 2 groups: an intervention group of 18 individuals (100%) and a control group of 18 individuals (100%).

According to the researcher, the samples were divided into 2 groups with equal numbers to obtain results with evenly distributed and comparable ratios, thus leading to accurate conclusions about the effectiveness of red guava juice on the increase in hemoglobin levels in third-trimester pregnant women with Fe tablet consumption.

From the above journal research results, the key difference lies in the total sample of 36 third- trimester pregnant women. Of these, 18 respondents were given Fe 2 x 1 and red guava juice, while 18 respondents were only given Fe tablets. The research lasted for 2 weeks. After this period, a reevaluation of hemoglobin levels was conducted. The respondents who received Fe and red guava juice showed an average hemoglobin level increase from 9 - < 11 g/dl to >11-12 g/dl, while respondents who only received Fe tablets experienced a slight increase of 0.034 g%. The prevention efforts for iron deficiency anemia in pregnant women involve taking 1 additional blood tablet daily during pregnancy, totaling at least 90 tablets, starting as early as possible and continuing until the postpartum period. This research is in accordance with the theory proposed by Prawirohardjo (2016), which states that the iron requirement during pregnancy is 1 mg/day in trimester I, 5 mg/day in trimester II, and 5 mg/day in trimester III.

Since the iron needs in trimesters II and III cannot be met solely through food intake, pregnant women in these trimesters need to be supplemented with iron preparations.

According to Guyton (2013), iron is difficult for the body to absorb. Therefore, Fe tablet administration alone is less effective in increasing hemoglobin levels, especially if pregnant women are not compliant with Fe tablet consumption. Hence, assistance is needed for iron absorption. Vitamin C is one of the good combinations to aid in iron absorption.

The results of this study are consistent with the research conducted by Fitriani Yulia et al (2017), which is related to the pharmacokinetics of iron stating that Fe is more easily absorbed in the form of ferrous. One of the substances that help in the absorption of Fe in the body is vitamin C, contained in red guava juice. This is because vitamin C reduces ferric ions to ferrous ions, allowing maximum absorption of iron by the body. Vitamin C (ascorbic acid) is one of the substances that significantly aids in iron absorption. Ascorbic acid can be obtained from vitamin C tablets or naturally found in fruits and vegetables. Vitamin C can increase non-heme iron absorption by four times, and in red guava fruit with a dose of 200 mg, iron absorption from supplements increases by at least 30% (Goodman & Gilman, 2008).

5. CONCLUSION

Based on the research results regarding the administration of Fe tablets and red guava juice (*Psidium Guajava*) on the increase of hemoglobin levels in third-trimester pregnant women with mild anemia at PMB Bidan Sutrisni 2021, the author draws the following conclusions: The frequency distribution of hemoglobin levels in the experimental group at Bidan Sutrisni in 2021 shows that most respondents experienced mild anemia. After being given Fe and red guava juice, most hemoglobin levels became normal.

The frequency distribution of hemoglobin levels in the control group at Bidan Sutrisni in 2021 shows that before being given Fe, most respondents experienced mild anemia. After being given Fe, most hemoglobin levels increased but did not become normal. There was a significant change before and after the intervention in the experimental group given Fe and red guava juice (*Psidium Guajava*) concerning the increase in hemoglobin levels in third-trimester pregnant women with mild anemia at PMB Bidan Sutrisni in 2021, with a P-value of 0.000.

There was a significant change before and after the intervention in the control group given Fe with a difference value of 0.034 gr/dL but did not change to normal anemia, with a P-value of $0.01 < 0.05$. There was a significant change after the intervention in both the experimental and control groups at PMB Bidan Sutrisni in 2021, with the Independent t-test resulting in a P-value of $0.000 < \alpha (0.05)$.

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