Frontiers of Nursing • 12(4) • 2025
DOI: 10.2478/FON-2025-0047

Frontiers of **Nursing**

Effectiveness of the combination of Fe tablets and beetroot juice in increasing Hb levels of pregnant women with anemia†

Review

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Received: 13 November 2024; Accepted: 26 January 2025; Published: 20 December 2025

Abstract: **Objective:** This study aims to determine the effectiveness of giving a combination of Fe tablets and beetroot juice in increasing hemoglobin (Hb) levels of pregnant women with anemia in the Mataram City area.
Methods: This study was designed with quasi-experimental design with pre-test and post-test with control design. The location of this study was conducted in the city of Mataram on pregnant women with anemia. The sample of this study was pregnant women with mild anemia based on inclusion and exclusion criteria, divided into 2 groups: a control group and a treatment group of 15 respondents each, bringing the total respondents to 30 people. Analysis of Hb level measurement results was carried out using the independent sample *t*-test.
Results: The results obtained in the treatment group (combination of beet juice and Fe tablets) were the mean pre-test of 9.93 mg/dL and post-test of 11.90 mg/dL (*P*-value = 0.000), which means there is effectiveness in increasing hemoglobin levels while in the control group. Comparison of increased Hb levels of the control group and significantly different treatments marked by a *P* value of 0.001.
Conclusions: the combination of Fe tablets and beetroot juice is effective in increasing Hb levels of pregnant women with anemia in the Mataram City area.

Keywords: *anemia • beet juice • effectiveness • Hb levels • pregnant women*

1. Introduction

Anemia is a condition in which the number of red blood cells or the concentration of oxygen carriers in the blood is insufficient for the physiological needs of the body. Anemia in pregnant women is a condition of mothers with hemoglobin (Hb) levels in their blood less than 12 g/dL. Anemia in pregnant women occurs due to an increase in plasma volume, which results in dilution of Hb levels without changing the shape of red blood cells.[1,2] The prevalence of pregnant women experiencing blood deficiency is 35%–75% where 52% of the data occurs in developing countries and the remaining 23% in developed countries.[2] Based on Riskesdas data in 2013,

†This project was supported by Muhammadiyah Research Grant (RisetMu) Batch VI (No. 1687.186/PD/I.3/D/2022).

How to cite this article: Amini A, Nurbaety B. Effectiveness of the combination of Fe tablets and beetroot juice in increasing Hb levels of pregnant women with anemia. *Front Nurs*. 2025;4:423–432.

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the prevalence of anemia occurred as much as 37.1% of pregnant women in Indonesia rose to 48.9% in 2018.[3]

According to Prawirohardjo[4] anemia can cause serious complications for pregnant women. Anemia due to iron deficiency is the main cause of anemia in pregnant women compared to other nutritional deficiencies. Iron is needed by pregnant women to prevent anemia and maintain optimal fetal growth. The World Health Organization (WHO) states that about 40% of maternal deaths in developing countries are related to anemia in pregnancy, which is generally caused by iron deficiency and acute bleeding, and not infrequently a combination of the 2.

The coverage of Fe-1 and Fe-3 tablets for pregnant women in West Nusa Tenggara (Nusa Tenggara Barat) (NTB) Province in 2017 shows that in NTB Province, the coverage of Fe-1 tablets reached 103.24% and Fe-3 tablets by 93.91% so that it can be interpreted that not all pregnant women have received 90 Fe-3 tablets. From the Health Profile of NTB Province in 2017, the coverage of Fe-1 and Fe-3 administration can be seen in the 3 lowest areas of Fe-1 and Fe-3 coverage, namely Sumbawa Regency (Fe-1 97.55% and Fe-3 83.84%), West Sumbawa Regency (Fe-1 100% and Fe-3 83.02%), and Mataram City (Fe-1 101.25% and Fe-3 91.5%).[5] In Mataram City alone, the total number of pregnant women who experience anemia from January to June 2018 is around 543 people (5.59%) of the total target of 9722 pregnant women spread across 11 Puskesmas located in Mataram City. Of the 11 existing Puskesmas, the highest prevalence of pregnant women who experience anemia in June 2018 is in Puskesmas Karang Pule (117 people), Ampenan (59 people), and Puskesmas Mataram (52 people).[5]

Beetroot (Beta Vulgaris) is one of the non-pharmacological alternative food sources containing iron, which can increase hemoglobin levels in pregnant women.[6] Minerals contained in beet tubers, such as Iron (Fe), Sodium (Na), Zinc (Zn), Calcium (Ca), Potassium (K), Magnesium (Mg), and Phosphorus (P). Red beets contain 10.2% vitamin C and 34% folic acid which serves to grow and replace damaged cells.[7,8] Beetroot works by stimulating the circulatory system and helps build red blood cells because the content of folic acid and B12 in beets is an important key in cellular metabolism and is needed in the normal development of erythrocytes.[8] Beetroot also cleanses and strengthens the blood so that the blood can carry nutrients throughout the body so that the number of red blood cells will not decrease.[9]

According to Suryandari research (2015) on the comparison of increased Hb levels in pregnant women given Fe with Fe and beets in the South Purwokerto Health Center Work Area stated that 500 mL beet juice for 7 days can increase hemoglobin levels between 0.6 g/dL and 0.8 g/dL.[10] The results of research conducted by Indumathi, on the benefits of beets given to experimental animals, showed a higher number of red blood cells in giving 400 mg/kg body weight of beet extract compared to giving 200 mg/kg and 100 mg/kg body weight. The results of mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration examinations also showed results in line with the increase in the dose of extracts given.[11]

Research conducted by Setyiyaningsih and Kritiningrum[12] to test the effectiveness of the combination of beet juice (Beta Vulgaris l) and lemon with fe tablets in increasing HB levels in pregnant women with anemia in Wonorejo Village, Pringapus Health Center work area with a one-group pretest–posttest design, showed hemoglobin levels in pregnant women with anemia before being given a combination of beet juice and lemon with FE tablets on average of 10.25 g/dL, After giving a combination of beet juice and lemon with Fe tablets an average of 11.35 g/dL, or an average increase of 1.1 g/dL. Increased Hb levels after analysis showed significant effectiveness with a *P*-value of 0.000.

Given the high number of pregnant women suffering from anemia in the Mataram City Area, as well as the dangers caused by anemia both for the mother and the fetus she is carrying, it is important to research the effectiveness of giving a combination of Fe tablets and Beetroot Juice in increasing Hb Levels of Pregnant Women with anemia. To get alternative therapies used to overcome anemia in pregnant women. Pregnant women need more blood cells to support fetal development. Anemia in pregnant women can cause oxygen delivery to the fetus to be limited due to lack of red blood cells. Pregnant women are unable to produce red blood cells if their iron intake is not enough. However, most pregnant women are not aware of the increased need for iron. In previous studies, only conducted in 1 puskesmas area with a small number of respondents; therefore, in this study, researchers intend to test on more samples and in a wider area.

This study aims to determine the effectiveness of giving a combination of Fe tablets and beetroot juice in increasing Hb levels of pregnant women with anemia in the Mataram City area.

2. Method

The research employed a quasi-experimental design with a pre-test and post-test setup, including control and treatment groups. A sample of 30 pregnant women with mild anemia, based on inclusion and exclusion criteria,

was selected and randomly divided into control (Fe tablets only) and treatment (combination of Fe tablets and beetroot juice) groups, each with 15 participants. Random grouping was achieved through a simple random sampling method, ensuring each participant had an equal chance of being placed in either group. The location of this study was conducted in the city of Mataram on pregnant women with anemia. The stages of the study are selecting samples to be used as respondents where respondents meet the inclusion and exclusion criteria, asking for respondents' consent, measuring Hb levels in respondents (pretest), giving 200 mL of Beetroot Juice every day for 7 days, measuring Hb levels again after 7 days given consumption of beet juice (posttest), and data analysis of increased Hb levels in pregnant women who have anemia.

The variables in this study were independent: administration of beet juice (*Beta vulgaris*), dependent variables: changes in Hb levels in pregnant women with anemia, and confounding variables: diet, administration procedures, and chronic diseases. Kriteria Inclusion in this study is the inclusion criteria for pregnant women who suffer from mild anemia, who are willing to maintain a healthy diet, do not smoke, are willing to be respondents, and are willing to consume Fe tablets during treatment, while the exclusion criteria in this study are pregnant women who are uncooperative, do not have chronic diseases, do blood transfusions, during the study time, Pregnant women are sick/hospitalized, and pregnant women who resign during data collection. The exclusion criterion "no chronic disease" was included to eliminate confounding variables that might impact hemoglobin levels, as chronic conditions like diabetes, hypertension, or chronic kidney disease can independently affect anemia management and outcomes. By excluding participants with such conditions, we aimed to isolate the effect of the Fe and beetroot intervention on hemoglobin levels.

Participants in the treatment group consumed 200 mL of beetroot juice daily for 7 days. Beetroot juice was freshly prepared to preserve its iron and folic acid content, and participants were instructed to drink it in the morning, allowing optimal iron absorption. Consumption of beetroot juice is supported by evidence suggesting its efficacy in raising Hb levels due to its iron, vitamin C, and folic acid content, which enhance iron absorption and red blood cell production. Data collection from primary data using data filling forms and measuring Hb levels using easy touch tools.

Data analysis used univariate and bivariate analysis. Bivariate analysis was carried out to see hemoglobin levels in pregnant women before and after in the control group and treatment group in the form of Fe tablets and Fe tablets in combination with beet juice using the SPSS program (IBM Corporation, Armonk, New York, United States), then a statistical test (paired *t*-test) was carried out with the conclusion that if the *P* value <0.05 then Ho was rejected meaning that there was a difference in changes in hemoglobin levels in the control group and the treatment group before and after the intervention. Free *t*-test analysis or independent sample *t*-test to determine the Hb levels of the control group and treatment group. The T-test is performed if the data are normally distributed; if the data are not normally distributed, the Wilcoxon test is used to determine the difference in Hb levels before and after treatment.

3. Results

The study was conducted on 30 respondents who were willing to become research respondents. Respondents were divided into 2 groups, namely 15 control respondents and 15 respondents who were given treatment. The control group consumed beetroot juice in combination with Fe tablets for 7 days. The results of the study were analyzed univariately and bivariately. Univariate analysis describes the characteristics of respondents. The bivariate analysis illustrates the mean difference test before and after in the control group with Fe tablet consumption and the treatment group with a combination of beetroot juice and Fe tablets.

3.1. Univariate analysis

3.1.1. Characteristics of respondents

The respondents in this study were pregnant women who were in regional health centers throughout Mataram City. Based on the data obtained, the characteristics of respondents are contained in the following table (Table 1).

Based on Table 1, it can be concluded that most respondents in the control group of productive age, namely between the ages of 20–35 years, as many as 10 respondents (67%). The education level of the control group was mostly secondary education, which was 11 respondents (73%). The work of mothers in the control group mostly worked as housewife (Ibu Rumah Tangga) (IRTs), which was 10 respondents (67%). Most of the reproductive age treatment group was between 20 years old and 35 years old as many as 11 respondents (73.3%). The education level of the treatment group was mostly in the secondary education level (60%) as many as 9 respondents. The work of mothers in the treatment group was mostly IRT as many as 11 respondents (73.3%).

Variable and category	Control group		Treatment group	
	F (n = 15)	%	*F* (n = 15)	%
Age (years old)				
<20	4	27	3	20
20–35	10	67	11	73.3
>35	1	7	1	6.7
Education				
Low	2	13	2	13.3
Intermediate	11	73	9	60
Tall	2	13	4	26.7
Work				
IRT	10	67	11	73.3
Private	2	13	2	13.3
Self-employed.	2	13	2	13.3
PNS	1	7	0	0

Note: Source: Primary data, 2023; IRT, housewife (Ibu Rumah Tangga); PNS, civil servant (Pegawai Negeri Sipil).

Table 1. Distribution of characteristics of respondents.

3.1.2. Average pretest and posttest hemoglobin levels in control group and treatment group

3.2. Bivariate analysis

The data analysis technique used in this study was a paired sample *t*-test to determine the difference in Hb levels before and after treatment. In addition, independent sample *t*-test analysis was conducted to determine the Hb levels of the control group and treatment group. The requirement for performing a *T-test* is that the data must be normally distributed.

3.2.1. Pre-test and post-test hemoglobin levels in the treatment group and control group

The mean pre-test and post-test hemoglobin levels in the control and treatment groups are shown in Table 2. Table 3 presents the results of paired *t*-tests performed in the treatment group and control group. The results obtained in the treatment group were mean pre-test of 9.93 and a post-test of 11.90 and *P* value = 0.000 (*P* > α), so it can be concluded that there is effectiveness in increasing hemoglobin levels in anemic pregnant women at the Mataram City Regional Health Center. In the control group, the results obtained were the mean pre-test of 10.14 and the mean post-test of 10.36 *P* value = 0.388 (*P* > α), so it can be concluded that there is effectiveness in increasing hemoglobin levels, but not significantly anemic pregnant women at the Mataram City Regional Health Center. Differences in hemoglobin levels between the treatment and control groups are shown in Table 4.

Variable	N	Minimum	Maximum	Mean
For the test of controls	15	8.90	10.90	10.14
Post-test control	15	8.90	12.00	10.36
Pre-test treatment	15	9.00	10.80	9.93
Post-test treatment	15	8.60	14.40	11.90

Note: Source: Primary data, 2023.

Table 2. Average hemoglobin levels of the control and treatment groups.

Group and variable	Mean ± SD	*P* value
Control		0.388
Pretest	10.14 ± 0.61156	
Posttest	10.36 ± 0.88301	
Treatment		0.000
Pretest	9.93 ± 0.63095	
Posttest	11.90 ± 1.141623	

Note: Source: Primary data, 2023; SD, standard deviation.

Table 3. Results of analysis of control group and treatment group.

Group	Mean ± SD	*P* value
Control group	10.36 ± 0.88301	0.001
Treatment group	11.90 ± 1.41623	

Note: Source: Primary data, 2023; SD, standard deviation.
Differences in hemoglobin levels in the treatment group and control group

Table 4. Analysis of differences in hemoglobin levels of the treatment group and control group.

4. Discussion

Anemia in pregnancy is associated with a range of obstetric complications that can adversely affect maternal and fetal outcomes. Anemia increases the risk of preterm labor, low birth weight, intrauterine growth restriction (IUGR), and perinatal mortality. In severe cases, anemia may lead to maternal morbidity and mortality due to hemorrhage, as the mother's body lacks sufficient red blood cell reserves needed during childbirth.[13] In this study, the use of beetroot juice combined with Fe tablets has shown promising results in improving hemoglobin levels in anemic pregnant women. This combination provides not only iron but also vitamin C, which enhances iron absorption, thereby maximizing the bioavailability of iron to support increased hemoglobin production. Beetroot is rich in folate and iron, essential for red blood cell formation and development, which

are crucial during pregnancy to meet the heightened demands of both the mother and fetus.

This study highlights the substantial impact of combining Fe tablets and beetroot juice on increasing hemoglobin (Hb) levels in pregnant women with anemia. The combination effectively improves Hb levels, aligning with the need for iron supplementation during pregnancy to mitigate anemia risks. As outlined in the introduction, anemia in pregnancy results from physiological changes, such as increased plasma volume, leading to Hb dilution without altering red blood cell morphology. This physiological anemia, compounded by nutritional deficiencies, particularly iron, poses significant health risks for both the mother and fetus, including increased chances of maternal mortality, IUGR, and preterm delivery.

The study's findings resonate with prior research, Setyiyaningsih and Kritiningrum[12] demonstrated a marked increase in Hb levels when beetroot juice was combined with Fe tablets, similar to our study results, where the treatment group exhibited a significant Hb increase (*P*-value = 0.000) compared to the control group. This supports the efficacy of non-pharmacological interventions like beetroot juice, rich in folic acid and vitamin C, to enhance iron absorption and support erythropoiesis.

Furthermore, this study reaffirms the critical need for an easily accessible, low-cost approach to managing anemia, especially in areas where anemia prevalence remains high. The beetroot juice intervention, combined with Fe tablets, offers a practical solution by enhancing iron bioavailability through vitamin C and folate. The increase in Hb levels among the treatment group compared to the control group also underscores the role of dietary interventions in addressing iron deficiency, especially for pregnant women. Enhanced awareness and education on nutritional needs during pregnancy are essential to reduce anemia prevalence.[14]

Characteristics are a description of the diversity of respondents studied. In this study, the characteristics of respondents were divided based on age, education, and occupation.

The comparison of demographic characteristics between the treatment and control groups reveals notable similarities that support the study's conclusions. Both groups predominantly comprised women aged 20–35 years, an age range associated with a higher risk of iron deficiency anemia due to increased iron demands during pregnancy. This age group's prevalence in both study and control groups (73.3% in the treatment group and 67% in the control group) ensures comparability across a key demographic factor.

Educational levels in both groups were also similar, with most participants holding secondary-level education (60% in the treatment group and 73% in the control group). Education level is significant, as previous studies indicate that higher educational attainment correlates with improved maternal awareness and anemia management, potentially impacting outcomes. Additionally, employment status was comparable, with the majority of respondents in both groups being housewives (73.3% in the treatment group and 67% in the control group). Employment can influence nutritional access and the ability to attend prenatal care, which are critical factors in anemia management.[15]

Clinically, both groups initially presented with mild anemia, though the treatment group (with Fe tablets and beetroot juice) showed a statistically significant improvement in hemoglobin (Hb) levels post-intervention, while the control group (Fe tablets only) showed a minimal, non-significant increase. The results suggest that beetroot juice contributes additional nutrients and bioactive compounds that enhance iron absorption and red blood cell regeneration. Beetroot's folic acid and vitamin C content likely facilitated iron uptake more effectively than Fe tablets alone, as vitamin C can significantly enhance non-heme iron absorption.

Risk factors for anemia were controlled across both groups, as participants with known chronic conditions, smoking habits, or those requiring blood transfusions were excluded. The standardization of lifestyle and diet factors reduced potential confounding variables, ensuring that the observed differences in Hb levels could be more confidently attributed to the beetroot and Fe tablet combination.[16]

This study's findings align with existing literature that supports the synergistic effects of vitamin C-rich foods on iron absorption. Thus, the treatment group's improvement underscores the importance of incorporating dietary sources like beetroot into anemia prevention strategies for pregnant women.[7] Education is needed to determine the level of maternal understanding of anemia in pregnant women to improve the quality of life. In accordance with research according to Mariza[17] that mothers from low education levels are more at risk for anemia than higher education levels. This finding is consistent with evidence that pregnant women who take Fe tablets at the recommended time have a lower risk of anemia. Education is often associated with the ability and opportunity to get a job to earn a better income.[18]

Based on the results of univariate analysis for the distribution of respondent work, it was found that the treatment group and control group mostly worked as IRT (housewives) as many as 11 respondents (73.3%) and the control group as many as 10 respondents (67%). According to Sanjaya's research (2018) that there is a significant relationship between mother's work and hemoglobin levels. The more active a person

is, the more nutritional intake is needed. Employment status is usually closely related to the income of a person or family. Non-working mothers are more likely to experience anemia compared to working mothers. The work of the mother is associated with the ability of the household to meet the needs of nutritionally balanced nutrition for nutritional adequacy during pregnancy and antenatal care visits that can be done. In non-working mothers (IRT), family income comes only from the husband, which can affect nutritional status and ability for antenatal visits.[19]

In pregnancy, there are changes in body systems in an effort to adapt to pregnancy, including the blood circulation system (Cardiovascular). Rapid dilution of blood (hemodilution) occurs in the second trimester of pregnancy and begins to decrease in the third trimester, resulting in pregnant women entering the third trimester who are still susceptible to anemia, especially iron deficiency anemia. Therefore, additional iron is needed to help the mother's daily iron adequacy.

In the control group, the mean result obtained from the pre-test was 10.14, and the mean post-test was 10.36. Based on these data, it can be seen that there was an increase in hemoglobin levels with *P*-results of 0.388 so that there was no difference between pre-test and post-test control groups, even though there was an increase in hemoglobin levels in anemic pregnant women at the Mataram Regional Health Center control group.

There are several factors that affect hemoglobin levels, including nutrition/food, age, gender, smoking habits, physical activity, and duration of work.[20] According to Asiyah's research (2014) that the increase in hemoglobin levels in pregnant women who only consume Fe tablets is an average of 0.01 mg/dL which does not provide a significant difference.[21] The iron needs of pregnant women are around 800 mg, in food, producing 8–10 mg of Fe so they must consume blood added tablets at least as much as 60 tablets during pregnancy and must consume vitamin C which helps the process of iron absorption in the body.[22] In line with Miller,[19] iron with vitamin C forms ascorbate iron complex which is soluble and easily absorbed by organs in the human body. The conversion of non-heme iron in the form of inorganic compounds Ferric (Fe3+) into Ferro (Fe2 +) will be greater when the pH in the stomach is more acidic. Vitamin C can increase the acidity of stomach pH so that it can help the absorption of iron in the stomach. Vitamin C can increase iron absorption by as much as 30%. There is no significant difference in hemoglobin levels in the control group can also occur due to the timeliness of consuming Fe tablets; in accordance that mothers who consume Fe tablets in the right time have a smaller risk of anemia. Taking Fe tablets alone is still less effective in raising hemoglobin levels if consumed at the wrong time.[4]

The physiological demands of pregnancy require increased iron intake to support fetal development and compensate for blood volume expansion. Inadequate iron levels can impair oxygen delivery to the fetus, which may lead to complications such as low birth weight, preterm delivery, and, in severe cases, perinatal mortality. Therefore, ensuring adequate iron intake, through Fe tablets and iron-rich dietary sources like beetroot juice, is crucial not only for the mother's health but also for fetal development.[19]

This study supports the effectiveness of combining Fe tablets with beetroot juice as a non-pharmacological approach to increasing hemoglobin levels among anemic pregnant women. Beetroot is rich in essential nutrients, including iron and vitamin C, which enhance iron absorption, thereby improving hematologic parameters more effectively than Fe tablets alone. This combination therapy provides a sustainable, affordable, and accessible solution, particularly in low-resource settings, to improve maternal and child health outcomes by addressing iron deficiency anemia in pregnancy.[21]

The amount of iron needed in pregnant women requires the mother to help the absorption of iron consumed. Because some foods and drinks can interfere with the absorption of iron. Based on the results of the analysis of the paired sample *t*-test in the treatment group, the *P*-value result was obtained as 0.000, so that there was an effect of giving beet juice and Fe tablets on increasing hemoglobin levels in anemic pregnant women at the Mataram Regional Health Center in the treatment group.

Iron content in beets has a high content of folic acid and iron, which reactivates and regenerates red blood cells and supplies oxygen that is useful for the health of red cells. Beetroot also contains vitamin C, which will make it easier for the body to absorb iron, which means if iron can be absorbed properly the formation of new red blood cells will also occur well and smoothly.[10] Beetroot has many advantages for health and medicine. The content of betasin in beets is useful as an anti-cancer because the substance can destroy tumor and cancer cells.[23] Beetroot (Beta Vulgaris) has a folic acid content of 109 mg, and vitamin C of 10.0 mg. Anemia that occurs in pregnant women can also endanger the fetus they are carrying. The threat posed by anemia in the fetus is the risk of intrauterine death, the risk of abortion, low birth weight, the risk of congenital defects, the increased risk of infection in infants, to perinatal death, or the level of infant intigency is low.[13] Nutrients that play a role in hemopoiesis are protein, various vitamins, and minerals. These vitamins are folic acid, vitamin B12,

vitamin C, and vitamin E, while the minerals needed are Fe, Cu.[24]

In Suryandari and Happinasari's[10] study on the comparison of the increase in Hb levels in pregnant women given Fe and beets, there was a difference after being given Fe and Fe + beets in the south Purwokerto Health Center area by consuming 500 mL for 7 consecutive days with the result of *P* value = 0.009. Research was also conducted by Wenda,[25] at the University of Riau Nursing Study Program about the effectiveness of giving beets on hemoglobin levels of anemic pregnant women. Based on research that has been conducted in the working area of the Pekanbaru City Health Center, statistical test results were obtained using independent *t*-tests obtained *P* (0, 000) < α (0.05).[26] It is said that there is a significant difference between the mean hemoglobin levels of pregnant women with anemia in the treatment group and the control group after being given beet juice, so that it can be concluded that the administration of beet juice is effective against hemoglobin levels of pregnant women with anemia. Treatment of anemia can be done in 2 ways, namely by pharmacological and non-pharmacological methods. The advantages of the non-pharmacological method itself are increasing patient knowledge about a disease, increasing client independence and skills in handling a disease, increasing client confidence, increasing patient compliance, and avoiding excessive use of drugs that have an impact on the kidneys.[26] This is in accordance with research conducted by Kenjale et al.[27] in America, which states that consumption of beets (which has been made juice) will increase plasma nitrate concentrations in patients with arterial abnormalities, where these patients experience failure to add blood supply and oxygen to tissues during work resulting in pain when walking. Patients who had consumed beetroot juice experienced an increase in plasma after 3 h and were able to walk longer than 18% before the appearance of pain. As in Rusmiati's[28] research that giving Fe tablets with vitamin C provides a significant increase in hemoglobin levels compared to only consuming Fe tablets. This is also supported by research by Manan[29], which states that there is an effect of giving dates on the increase in hemoglobin levels in pregnant women.

Anemia can be caused by malabsorption (disruption of digestibility of foodstuffs) iron, which can result in iron from blood-added tablets not being able to be absorbed optimally. This is in accordance with Pratiwi and Widari[30] that pregnant women who consume iron inhibitor foods 76.9% experience anemia. To improve this, it is highly recommended to consume vitamin C, which will help iron absorption so that anemia can be reduced or overcome.

Based on Nutrition Facts for Beets, beets contain vitamin C, iron, phosphorus, selenium, folate, and betaine, which can help raise hemoglobin levels. While dates contain vitamin C, iron, phosphorus, beta carotene, and selenium.[31] Based on the results of an independent sample test analysis, results were obtained for *P* = 0.001 (*P* < α), so that it can be concluded that there is an effectiveness of giving beet juice and Fe tablets to increase hemoglobin levels in anemic pregnant women at the Mataram Regional Health Center. This is in accordance with Puspita et al.)[32] that giving Fe tablets and foods containing iron can help the process of iron absorption, such as vitamin C, can increase blood hemoglobin levels in pregnant women. In a study, it was found that there was a significant relationship between giving beet juice to an increase in Hb levels of pregnant women with a *P*-value of 0.001. This is said to be a significant difference between the mean hemoglobin levels of pregnant women with anemia in the treatment group and the control group after being given beet juice.[33] With the addition of dates, it will further help increase the mother's hemoglobin level. This is in accordance with (Al-Shwyeh, 2019)[34] consuming 5 dates consumed every morning for 7 days can increase hemoglobin levels, which in every 5–7 dates (100 g) have a high iron content (1.02 mg) and can meet the body's daily iron needs.

The study's results indicate the effectiveness of combining Fe tablets with beetroot juice in raising hemoglobin (Hb) levels in pregnant women with anemia. Notably, it was the treatment group, not the control group that received Fe tablets combined with beetroot juice. The control group, conversely, only received standard Fe tablets without beetroot juice supplementation. The treatment group's significant improvement in Hb levels supports existing research on beetroot's benefits due to its high iron and folic acid content, which are essential for the production of red blood cells. Vitamin C in beetroot juice aids iron absorption, enhancing the body's ability to form new red blood cells effectively. This aligns with studies showing beetroot's positive impact on Hb levels when combined with Fe tablets compared to Fe tablets alone.

On the other hand, the control group showed a slight increase in Hb levels, though not statistically significant. This minor increase aligns with findings from studies where Fe tablets alone may result in minimal Hb improvement without additional iron absorption enhancers like vitamin C. Factors like diet, iron absorption inhibitors, and the timing of Fe tablet intake could further influence these results. In summary, the treatment combining Fe tablets with beetroot juice offers a practical approach to addressing anemia in pregnancy,

potentially reducing risks associated with low Hb levels for both the mother and fetus.

The role of midwives in providing health education, particularly regarding nutrition to increase hemoglobin levels in pregnant women with anemia, is crucial. A study by Othman et al.[35] showed that after attending a workshop or webinar on healthy eating education, midwives' knowledge and confidence in providing nutritional education to pregnant women increased significantly. The midwives in the study identified 3 key factors affecting the effectiveness of the nutritional education they provided: the role of midwives themselves, patient health literacy, and the model of care applied. Additionally, time and resource limitations were highlighted as major challenges when delivering healthy eating education to pregnant women.[35]

This study aligns with the findings in this article, where non-pharmacological interventions, such as providing iron-rich beetroot juice, are seen as effective alternatives for increasing Hb levels in pregnant women with anemia. Strengthening the role of midwives in delivering healthy eating education and understanding the nutritional needs of pregnant women is crucial for the success of such interventions. However, the time and resource challenges faced by midwives in providing education should also be addressed to ensure the sustainability and effectiveness of Hb improvement programs for pregnant women.

Limitations

One major limitation of this study is the relatively low number of cases, with only 30 participants in total, divided equally between the treatment and control groups. This small sample size may limit the generalizability of the findings, as results from such a limited population may not be fully representative of a larger, more diverse group of pregnant women with anemia. Future research with a larger sample size could provide a more robust understanding of the effectiveness of the combined intervention of Fe tablets and beetroot juice on hemoglobin levels in pregnant women with anemia. Furthermore, a larger sample may also help identify any potential variations in response among different subgroups, enhancing the applicability of the results.

5. Conclusions

Based on the results of the study, the effectiveness of giving a combination of beetroot juice and Fe tablets to pregnant women with anemia against increased hemoglobin levels at the Mataram Regional Health Center, it can be concluded that there are differences in the average hemoglobin levels of respondents in the control group and treatment group. The results obtained by comparing the posttest mean of the 2 groups with the result of *P*-value 0.001.

Ethical approval

Approval was obtained from the Ethics Committee of the Faculty of Medicine, Al-Azhar Islamic University, Mataram Indonesia (Letter number: 126/EC-04/FK-06/UNIZAR/I/2023).

Conflicts of interest

All contributing authors declare no conflicts of interest.

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