EFFECTIVENESS OF BEETROOT EXTRACT (Beta vulgaris) ON INCREASING HEMOGLOBIN (Hb) IN THIRD-TRIMESTER PREGNANT WOMEN WITH ANEMIA IN BENGKULU CITY

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ABSTRACT
Background: Anemia in pregnancy occurs due to physiological changes during pregnancy. Pregnant women are advised to take Fe tablets during pregnancy, and to support their absorption, they are recommended to consume vitamin C. Beetroot extract contains vitamin C, iron, and zinc.
Purpose: This study aims to determine the effectiveness of administering beetroot extract (Beta vulgaris) in increasing hemoglobin (Hb) in third-trimester pregnant women with anemia in Bengkulu City.
Methods: The research sample consisted of 20 respondents, with 10 respondents each in the intervention and control groups. The research method used a quasi-experimental design with a two-group pretest-posttest design. Sampling used an accidental sampling technique. Data analysis used the Wilcoxon test and paired sample t-test. Before the intervention was given, the average Hb level was 9,6 gr/dL, and after beetroot extract was administered, the average Hb level increased to 10,3 gr/dL. The average difference between the two groups was 0,82.
Results: The results of the bivariate analysis showed that the p-value = 0.041 < α = 0.05, so it can be concluded that administering beetroot extract (Beta vulgaris) is more effective than the control group in increasing hemoglobin (Hb) in third-trimester pregnant women in Bengkulu City.
Conslusion: Therefore, it can be an option for pregnant women in preventing and treating anemia.

Keywords: Anemia; Beetroot; Pregnant women.

Received April 1st, 2026; Revised July 3rd, 2026; Accepted July 3rd, 2026
DOI:https://doi.org/10.36720/nhjk.v15i1.762

BACKGROUND

The global prevalence of low Hb levels in 2019 was 29,9% (95% uncertainty interval (UI): 27,0%, 32,8%) among women of reproductive age aged 15-49 years. The prevalence of low Hb levels among pregnant women was 36,5%. In Indonesia, cases of pregnant women with Hb levels below the normal limit have increased from year to year, starting with 1.306 cases in 2016 and 1.321 cases in 2019 (WHO, 2019).

According to the Basic Health Research (Riskesdas), the prevalence of low Hb levels among pregnant women in Indonesia was 48,9%, occurring in both urban and rural areas. This has become a concern for the government in developing strategies to reduce maternal mortality rates in Indonesia and globally. Indonesia is also among the countries contributing to the highest maternal mortality rates in the world (Ministry of Health of the Republic of Indonesia, 2018). Based on data from the Bengkulu Provincial Health Office in 2020, the Maternal Mortality Rate (MMR) was still relatively high among women aged 20 to 35 years and above, with causes of maternal death including bleeding 67,34%, hypertension 0%, infection 0%, and anemia 16,8% (Bengkulu City Health Office, 2021).

The causes of maternal death include the triad of bleeding 40-60%, preeclampsia and eclampsia 20-30%, and infection 20-30%; among these three factors, bleeding ranks first. Bleeding during pregnancy can cause anemia because of the loss of red blood cells due to gastrointestinal bleeding injuries, uterine bleeding, or bleeding caused by surgery. Losing a large amount of blood will certainly reduce the amount of blood in the body, resulting in anemia (Astutik & Ertiana, 2018).

Anemia is a problem characterized by low hemoglobin levels in the blood or a decrease in red blood cells, marked by insufficient oxygen-carrying capacity to meet the physiological needs of the human body. Hemoglobin is a blood protein needed by humans that contains a large amount of iron, binds to oxygen, and forms oxyhemoglobin in red blood cells. Through this function, oxygen (O2) is transported from the lungs to tissues throughout the body. WHO states that hemoglobin levels <12 gr/dL are classified as anemia (Shubham et al., 2020).

Anemia has side effects that greatly affect the health of both mother and baby. The causes of the high prevalence of anemia among pregnant women include increased iron requirements due to physiological and metabolic changes. Pregnant women with anemia are at risk of miscarriage, prematurity, low birth weight, increased frequency of pregnancy complications, maternal mortality risk, increased perinatal mortality, and bleeding before, during, and after childbirth (Winarni, Lestari & Wibisono, 2020).

Anemia in third-trimester pregnant women tends to occur more frequently because the need for iron increases with gestational age, while iron stores in the body are insufficient. As a result, many third-trimester pregnant women experience iron-deficiency anemia unless they are given iron supplements. According to the study by Sikoway, Mewo & Assa (2020), the average hemoglobin level of third-trimester pregnant women was below normal because of increased iron needs during pregnancy. Iron functions in hemoglobin formation, and low hemoglobin levels during pregnancy can have negative effects on the mother and fetus. Therefore, hemoglobin levels during pregnancy must be continuously maintained and monitored to prevent undesirable outcomes by regularly consuming iron preparations and other food sources that contain iron (Sikoway, Mewo & Assa, 2020).

Anemia in pregnant women can be managed through pharmacological and non-pharmacological treatment. Pharmacological treatment that can increase hemoglobin in pregnant women involves consuming at least one Fe tablet daily up to 90 tablets. This method is often disliked because it causes nausea and vomiting due to the smell of iron. Therefore, a healthy and safe breakthrough through non-pharmacological therapy is needed, one of which is consuming beetroot extract, a fruit high in folic acid, calcium, phosphorus, vitamin C, magnesium, carbohydrates, and iron. Beetroot contains copper and folic acid, which are very beneficial in supporting fetal brain development and addressing anemia problems (Setyiyaningsih, Widayati & Kritiningrum, 2020).

A study by Stephana (2018) found that the intervention of administering 30 grams of beetroot extract brewed with 200 ml of hot water and consumed once daily for 7 days could increase hemoglobin levels. Another method is to prepare 250 ml/day of beetroot juice for 7 days, which can increase hemoglobin levels in pregnant women with anemia. The average hemoglobin level of pregnant women before receiving beetroot was 9.50 gr/dL in the experimental group and 9.18 gr/dL in the control group; after receiving beetroot for 7 days, it became 11.27 gr/dL in the experimental group and 9.22 gr/dL in the control group that did not receive the beetroot intervention. Based on these averages, there was an increase of 1.77 gr/dL.

Based on research findings regarding the effect of administering beetroot extract on hemoglobin levels in pregnant women, the average hemoglobin level before beetroot extract administration was 9.50 gr/dL, and after beetroot extract administration it was 11.27 gr/dL. Thus, the average difference in Hb levels before and after beetroot extract administration was 1,77 gr/dL, and it can be concluded that in this study there was an effect of beetroot extract administration on hemoglobin levels in pregnant women (Putri, Astuti & Puspasari, 2020).

Data from the Bengkulu City Health Office showed that there were 6.865 pregnant women in 2022. There were three public health centers with the highest number of pregnant women among all public health centers in Bengkulu City: Telaga Dewa Public Health Center with 732 people, followed by Jembatan Kecil Public Health Center with 563 people, and Nusa Indah Public Health Center with 491 people (Bengkulu City Health Office, 2022).

Based on the description above, the authors were interested in conducting a study entitled Effectiveness of Administering Beetroot Extract (Beta vulgaris) on Increasing Hemoglobin (Hb) in Third-Trimester Pregnant Women with Anemia in Bengkulu City.

METHODS

Methodology

This research used a quasi-experimental design with a two-group pretest-posttest design. The research location was three public health centers in Bengkulu City with the highest number of pregnant women among the 25 public health centers in Bengkulu City, namely Telaga Dewa, Jembatan Kecil, and Nusa Indah Public Health Centers.

Sample/ Participants

The sample used consisted of 20 respondents divided into 2 groups, namely the intervention group and the control group, each with 10 respondents who met the criteria of being third-trimester pregnant women. The sampling technique used was random sampling...

Instrument

The researchers tested the effectiveness of beetroot extract on increasing hemoglobin in third-trimester pregnant women. The intervention group was then given a combination of beetroot extract and Fe tablets, while the control group consumed only Fe tablets.

RESULTS

The results of the study showed the characteristics of pregnant women, namely maternal age, gestational age, occupation, and pretest and posttest Hb levels.

Table 1. Frequency distribution of characteristics based on respondent age and gestational age

No	Variable	N	Min	Max	Mean
1.	Respondent Age				
	Intervention	10	16	32	25,93
	Control	10	19	32	26,8
2.	Gestational Age				
	Intervention	10	28	35	30,9
	Control	10	28	35	33,2

Based on Table 1 above, the average age of respondents in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 33 weeks.

Table 2. Frequency distribution of characteristics based on occupation

No	Group	N	Not Working	%	Working	%	Total
	Intervention	10	8	80	2	20	100
	Control	10	9	90	1	10	100

Based on Table 2 above, almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working.

Table 3. Frequency distribution of pretest and posttest Hb levels

Group	N	Min	Max	Mean
Intervention				
Pre	10	8,6	10,9	9,65
Post	10	9,3	11,7	10,3
Control				
Pre	10	8,6	10,8	9,41
Post	10	8,5	11	9,49

Based on Table 3 above, in the intervention group the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest.

Table 4. Data normality test

	Group	p-value
Hb Pre	Intervention	0,29
	Control	0,368
Hb Post	Intervention	0,71
	Control	0,689

Based on Table 4.4 above, it can be seen that in the intervention group, the normality test for pretest Hb data was 0,29, while the normality test for posttest Hb data in the intervention group was 0,71. In the control group, the normality test for pretest Hb data was 0,368, while for posttest Hb data in the control group it was 0,689.

Table 5. Effect of administering beetroot extract and Fe tablets in the intervention group

Intervention	Mean Rank	p-value
Pre	0,00	0,005
Post	0,55	

Based on Table 4.5 above, it can be seen that the p-value = 0,000 < α = 0,05; therefore, the research hypothesis (Ha) is accepted, so it can be concluded that there is an effect of administering beetroot extract and Fe tablets (TTD) on Hb levels in the intervention group.

Table 6. Effect of administering Fe tablets in the control group

Control	Mean	Diff.	t-value	df	p-value
Pre	9,41	0,80	-1,922	9	0,087
Post	9,49				

Based on Table 4.6 above, it can be seen that the p-value = 0,87 or > 0,005, which means that there was no effect or difference in Hb levels before and after treatment (administration of Fe tablets) in the control group. This can also be seen from the calculated t-value (-1.922) < t-table at df 9 and a 95% confidence level (2.262). Nevertheless, when viewed from the average value (-0,08), the negative value may indicate a difference of 0,08, where the average posttest value was higher than the pretest value. However, there was no significant difference.

Table 7. Difference in Hb levels between the two groups after the intervention

Variable	Group		Mean difference	*t*	p-value
	Intervention (*mean rank*)	Control (*mean rank*)			
Hb Level	10,3	9,49	0,82	2,206	0,041

Based on Table 4.7 above, it can be seen that the p-value = 0,041 < 0,005, which means that there was a significant difference between the intervention and control groups. There was an average difference of 0,82 between the two groups, with the average posttest Hb level in the intervention group (10,31) compared with the average Hb level in the control group

(9,49). The results of this statistical test showed that administering beetroot extract was more effective in increasing Hb levels than the control group. When comparing the t-value with the t-table for df 18, it was also found that the calculated t-value (2,206) > the t-table (2,101), meaning that there was a difference in the average posttest results between the intervention and control groups.

DISCUSSION

1. Frequency distribution of age, gestational age, and occupation among third-trimester pregnant women in Bengkulu City.

The statistical results showed that the average age of respondents in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 32 weeks.

According to theory, age is viewed as a condition that forms the basis of individual maturity and can be observed subjectively through age periods, so that various processes, experiences, knowledge, skills, and independence develop along with increasing age. The more mature a person is, the better their level of maturity and strength in thinking and working (Dai, 2021). According to Saifuddin (2020), the safest age range for pregnancy is >20 to <35 years. According to the researchers, the respondents in this study were within the safe age range for pregnancy and were in the third trimester, namely 28 to 35 weeks of gestation.

The frequency distribution of characteristics based on occupation showed that almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working. According to theory, work is an activity carried out primarily to support the family economy. Women's work is closely related to health status. Several factors underlie and directly or indirectly cause maternal death, including contextual or distal determinants (women's status in the family, family status in society, and community status). One factor that affects women's status is employment, where mothers working in the formal sector have better access to various types of information, including health information. This empowerment enables women to be more active in determining attitudes and more independent in making the best decisions for themselves, including decisions related to health and pregnancy (Dai, 2021).

2. Frequency distribution of hemoglobin levels before the administration of beetroot extract (Beta vulgaris) in Bengkulu City.

The analysis results showed that in the intervention group, the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group, the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest. According to the theory of Saifuddin (2020) and Astutik & Ertiana (2018), Hb levels are used to determine whether pregnant women have anemia. The degree of anemia based on Hb level is as follows: very mild: Hb 10 gr/dL to the normal limit; mild: Hb 8 gr/dL-9,9 gr/dL; moderate: 6 gr/dL-7.9 gr/dL; and severe: Hb <5 gr/dL. According to the researchers' assumption, in this study, respondents in the intervention and control groups were within the categories of mild and very mild anemia.

3. Effectiveness of beetroot extract (Beta vulgaris) in increasing hemoglobin levels among third-trimester pregnant women in Bengkulu City.

The analysis results to determine the effect of beetroot extract (Beta vulgaris) on increasing hemoglobin levels among third-trimester pregnant women in Bengkulu City

showed that the p-value = 0,000 < α = 0,05; therefore, the research hypothesis (Ha) is accepted, and it can be concluded that there is an effect of administering beetroot extract and Fe tablets (TTD) on hemoglobin levels among third-trimester pregnant women in Bengkulu City. In the control group, the p-value = 0,87 or > 0,005, which means that there was no effect or difference in Hb levels before and after treatment in the control group. There was an average difference of 0,82 between the two groups. The analysis results showed a p-value = 0,041 < 0,005, which means that there was a significant difference between the intervention and control groups.

The management and prevention of anemia can be carried out by consuming Fe tablets or blood supplement tablets (TTD), at least 90 tablets during pregnancy, and to support absorption, vitamin C found in fruits can be added. Beetroot (Beta vulgaris) is one fruit that is often used as a natural coloring agent for various foods and is rich in folate, which is effective in preventing heart disease and anemia. Beetroot contains relatively high levels of folic acid and iron, both of which are essential for the formation of red blood cells and new hemoglobin in the body. Its high iron content reactivates and regenerates red blood cells and supplies oxygen that is useful for the health of red blood cells. Beetroot also contains vitamin C, which helps the body absorb iron, meaning that if iron can be absorbed properly, the formation of new red blood cells will also occur properly and smoothly (Novita & Joseph, 2018).

Beetroot (Beta vulgaris) also contains vitamins A, B, and C, carbohydrates, protein, fat, and minerals such as iron, calcium, and phosphorus. Beetroot has a high folic acid content compared with other fruits. This fruit can help the iron absorption process and help reduce anemia problems. Beta vulgaris is an alternative treatment that contains iron and can increase Hb levels in the blood (Utaminingtyas, 2017).

Beetroot extract contains folic acid and iron, which can increase hemoglobin levels in pregnant women; red blood cells increase after beetroot extract is administered. The nutritional content of red beetroot per 100 g is vitamin A 20 IU, thiamine 0,02 mg, riboflavin 0,05 mg, niacin 0,4 mg, vitamin C 10 mg, calcium 27 mg, iron 1,0 mg, phosphorus 43 mg, fiber 87,4 g, fat 1 g, carbohydrates 9,6 g, protein 1,6 g, and calories 42 kcal per 100 g. In addition, red beet leaves are not inferior to red beetroot because they also have nutritional value, although the leaves are rarely consumed (Babarykin et al., 2019).

Red beetroot extract has been proven to increase hemoglobin levels. The data obtained showed that in the treatment group given red beetroot extract, the average hemoglobin level at pre-test was 10,033 gr/dL and at post-test was 11,507, with a difference of 1,474. This means that hemoglobin levels increased by 1,474 gr/dL after the red beetroot intervention. After testing using the paired t-test, a significant value of 0,000 (<0,05) was obtained, indicating an effect of red beetroot administration on hemoglobin in anemic mothers (Dewita & Henniwati, 2020).

This is also supported by the findings of Zuiatna et al. (2023), which showed that before being given beetroot juice, the average Hb level of pregnant women was 10,0, and after being given beetroot, it increased to 11,5. The analysis results showed a p-value = 0,000 <0,05, which means that there was an effect of beetroot juice administration on increasing Hb levels among pregnant women with anemia in Sipaku Area Village, Simpang Empat District, North Sumatra Province.

Similar findings were also reported by Liananiar et al. (2019), who proved that before beetroot juice was given, Hb levels were 10,1-11,00 gr/dL, and after beetroot juice was given, they increased to an average of 12 gr/dL. The study by Liesmayani et al. (2022) showed that the analysis results had a p-value = 0,000 <0,05, meaning that there was an effect of beetroot

juice administration on increasing Hb levels among pregnant women with anemia in the UPTD Peulumat Public Health Center area.

CONCLUSION

Based on the research results and discussion described in the previous chapter, it can be concluded that:

1. The results from 20 respondents showed that the average age in the intervention group was 25,93 years, and the average age in the control group was 26,8 years. The average gestational age in the intervention group was 31 weeks, and in the control group it was 32 weeks. Almost all respondents in the intervention and control groups (80% and 90%) were housewives or not working.
2. The results from 20 respondents showed that in the intervention group, the average pretest Hb level was 9,65 gr/dL and increased to 10,3 gr/dL in the posttest, while in the control group, the average pretest Hb level was 9,41 gr/dL and increased to 9,49 gr/dL in the posttest.

There was an effect of administering beetroot extract (Beta vulgaris) on hemoglobin levels among third-trimester pregnant women in Bengkulu City, with a p-value of 0,000 < α = 0,05.

ACKNOWLEDGMENT

Thank you to all parties who helped carry out this research.

DECLARATION OF CONFLICTING INTEREST

The limitation of this study was the difficulty of obtaining the research material (beetroot) directly, as it had to be ordered in advance. Future researchers are expected to use a larger sample and different methods.

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