published: 22 April 2025
doi: 10.21070/midwiferia.v11i1.1717

The Effect of Beetroot Juice on Hemoglobin Levels in Female Adolescents at MA Jamilurrahman Bantul, Yogyakarta

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OPEN ACCESS
ISSN 2548-2246 (online)
ISSN 2442-9139 (print)
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Received: 18 Feb 2025
Accepted: 21 April 2025
Published: 22 April 2025
Citation:
Windarti Sari, Nidatul Khofiyah (2025) The Effect of Beetroot Juice on Hemoglobin Levels in Female Adolescents at MA Jamilurrahman Bantul, Yogyakarta
Midwiferia Jurnal Kebidanan.11:1. doi: 10.21070/midwiferia.v11i1.1717

Anemia is a significant global public health issue, particularly among children and adolescent girls, as it can lead to reduced physical endurance, lower fitness, and decreased cognitive agility, ultimately affecting academic performance. In Indonesia, the 2018 data revealed that 26.8% of children aged 5–14 and 32% of those aged 15–24 suffered from anemia. A survey by the Yogyakarta Health Service in the same year found that 19.3% of adolescent girls had hemoglobin levels below 12 g/dL, indicating anemia, and 46% were at risk of chronic energy deficiency based on upper arm circumference measurements below 23.5 cm. One of the non-pharmacological approaches to address anemia is beetroot, which is rich in folic acid (108 mg), making it a beneficial dietary option. This study aimed to evaluate the effect of beetroot juice on increasing hemoglobin levels in female adolescents at Madrasah Aliyah (MA) Jamilurrahman Bantul as a preventive measure for anemia. The research used a quantitative, pre-experimental one-group pretest-posttest design involving 21 adolescent girls with anemia, selected through total sampling. Data were analyzed using bivariate statistical methods, including the Shapiro-Wilk test for normality and a paired sample t-test using SPSS software. The results indicated a significant increase in average hemoglobin levels from 10.84 g/dL before intervention to 13.39 g/dL after 14 days of beetroot juice consumption. The statistical analysis yielded a p-value of 0.000 ($p < 0.05$), confirming that beetroot juice significantly improves hemoglobin levels. Thus, beetroot juice can be considered a viable alternative treatment for anemia in adolescents.

Keywords: Anemia, Beetroot, Hemoglobin, Female Adolescents.

INTRODUCTION

Adolescence is a time of transition between childhood and adulthood that is marked by quick changes in social, psychological, physical, and hormonal elements. These changes often occur unconsciously, making adolescents particularly vulnerable to anemia. Anemia among adolescents, especially adolescent girls, draws significant attention due to increased nutritional demands during growth, including the need for iron. The risk of anemia is higher among adolescent girls than boys due to blood loss during menstruation and dietary restrictions to maintain body shape, which may limit nutrient intake (Kumalasari et al., 2019).

Anemia is defined as a medical condition where hemoglobin levels are below normal limits, specifically <13.5 g/dl for males and <12.0 g/dl for females. Causes of anemia in adolescent girls include consumption of high-sugar or caffeine-rich foods, insufficient intake of energy, protein, iron, and vitamins, as well as inadequate parental understanding of balanced nutrition. Its impacts include fatigue, decreased concentration in learning, and reduced productivity (Azaria, 2018). Anemia also affects immune resilience, physical fitness, and cognitive abilities due to inadequate oxygen supply to muscles and the brain. These effects not only impair academic performance but may also persist into adulthood, increasing the risks of low birth weight (LBW), stunting, and maternal complications during pregnancy or childbirth (Ningtyias et al., 2022).

According to WHO, anemia is a serious global health issue, primarily affecting children, adolescent girls, pregnant women, and breastfeeding mothers. WHO data indicates that 40% of children aged 6-59 months, 37% of pregnant women, and 30% of women aged 15-49 years worldwide suffer from anemia (WHO, 2023). In Indonesia, the 2018 Riskesdas reported anemia prevalence at 26.8% among children aged 5-14 years and 32% among individuals aged 15-24 years. In Yogyakarta, 19.3% of adolescent girls were found to have anemia with Hb levels <12 g/dl, while 46% were at risk of chronic energy deficiency (Dinkes DIY, 2020). Data from Bantul Health Office in 2023 revealed that anemia affected various age groups, with the highest prevalence among individuals of productive age (Dinkes Bantul, 2023).

As healthcare professionals, midwives play a crucial role in preventing and managing anemia, particularly among adolescent girls. Anemia prevention programs include distributing iron tablets containing 60 mg of iron and 0.4 mg of folic acid to adolescent girls aged 12-18 years, accompanied by education on non-pharmacological therapies. These therapies promote the consumption of iron- and vitamin-rich foods, such as spinach, long beans, and beetroot (Wari Nurjanah, 2023). Beetroot is a nutrient-dense source of folic acid, iron, and vitamins that contribute to hemoglobin improvement. Previous studies have demonstrated that consuming 260 ml of beetroot juice daily for seven days significantly increases

hemoglobin levels (Ikawati et al., 2018).

A preliminary study at MA Jamilurrahman Bantul revealed that 36% of female students had anemia with Hb levels <11 g/dl. These findings motivated the researchers to investigate the effects of beetroot juice as an alternative non-pharmacological therapy to enhance hemoglobin levels in anemic adolescent girls. This study also aims to provide insights into combining pharmacological and non-pharmacological therapies for managing anemia in adolescent girls.

METHODS

The research employed a quantitative approach with a pre-experimental design. The study utilized a one-group pre-test and post-test approach, which observes differences before and after the intervention in a single experimental group. The population in this study comprised all adolescent girls at MA Jamilurrahman Bantul, totaling 100 students, distributed across grades X (33 students), XI (40 students), and XII (28 students). The sample size for the study was determined using total sampling, resulting in 23 adolescent girls with anemia at MA Jamilurrahman Bantul. Data collection involved hemoglobin level measurements conducted three times. Hemoglobin levels were assessed before administering beetroot juice, involving all 23 respondents. After the initial measurement, respondents consumed beetroot juice for 14 consecutive days, with hemoglobin levels re-measured every seven days. The pre-test and post-test results were recorded in an observation table prepared beforehand.

RESULTS AND DISCUSSION

This study was conducted at MA Jamilurrahman Bantul, located within the Jamilurrahman As-Salafy Islamic boarding school, Bantul, Yogyakarta. The school is situated in a peaceful and quiet environment conducive to effective learning, surrounded by a community that values religious education and morality.

Results

Table 1. Illustrates the Frequency Distribution of Respondent Characteristics Based on the age of Female Adolescents at MA Jamilurrahman Bantul

Characteristics	F	%
Age		
15 Years	7	3,4%
16 Years	8	8,1%
17 Years	6	8,5%
Total	21	00%

Table 1 illustrates the characteristics of the respondents. Out of a total of 21 participants, 7 respondents (33.4%) were 15 years old, 8 respondents (38.1%) were 16 years old, and 6 respondents (28.5%) were 17 years old.

Table 2. Presents the Classification of Anemia Levels Before and After the Administration of Beetroot Juice Over a 14-Day Period.

Anemia Classification	**Pretest**	**Postest**	
		Week 1	**Week 2**
No Anemia	0	0	21
Mild Anemia	19	21	0
Moderate Anemia	2	0	0

Table 2 illustrates the classification of anemia levels among 21 respondents in this study. This research exclusively monitored an experimental group without including a comparison group. Prior to the administration of beetroot juice, 19 respondents were categorized as having mild anemia, and 2 respondents had moderate anemia. After one week of consuming beetroot juice, 2 respondents showed improvement, transitioning from moderate to mild anemia. Following 14 days (2 weeks) of beetroot juice administration, all 21 respondents no longer experienced anemia, with hemoglobin levels recorded above 12 g/dL.

Table 3. presents the average hemoglobin (Hb) levels before and after administering beetroot juice in the experimental group.

Group	**Treatment**		**Increase**
	Pretest	**Postest**	
Average Hemoglobin Level	10,8429	13,3905	2,5619

Based on Table 3, the data from 21 respondents in the treatment group indicate that the average hemoglobin level before consuming beetroot juice for 14 days was 10.8429. After consuming beetroot juice for 14 days, the average hemoglobin level increased to 13.3905. This demonstrates a difference of 2.5619 between the pre- and post-consumption hemoglobin levels.

The normality test results for each variable in this study indicate that the data follows a normal distribution. This is evidenced by the p-value being greater than the significance level (0.091 > 0.05) in the group. Since the assumption of normality has been met, we can proceed with conducting parametric statistical tests, specifically the paired t-test, to assess the differences between pre-test and post-test

measurements.

Table 4. Results of Parametric Statistical Test using Paired T-test

Group	*p-value*	Mean	Result
Experiment	0,000	're-test (10,8429) 'ost-test (13,3905)	different

Based on Table 5, it is shown that in the experiment group with 21 respondents, the significance value or Asymp.Sig (2-tailed) is 0.000 < α (0.05). Therefore, it can be concluded that there is a significant change in the hemoglobin levels of adolescent girls before and after consuming beetroot juice. The increase was 2.5619, with the average hemoglobin level of adolescent girls before the intervention being 10.8429, and the average hemoglobin level after consuming beetroot juice for 14 days increasing to 13.3905.

Discussion

Respondent Characteristics

The sample in this study consisted of 23 respondents. Among them, 9 were 15 years old, 8 were 16 years old, and 6 were 17 years old. This study only monitored the experimental group without a control group. Two respondents dropped out due to irregular consumption of beetroot juice; one was frequently absent from school, and another only consumed the juice consistently during the first week, showing an increase in hemoglobin by 1.50. The remaining 21 respondents who consumed the juice regularly in the first week showed an increase in hemoglobin between 0.50–2.20, with the final measurement after two weeks showing an increase of 2.10–4.60. The average hemoglobin level of the 21 respondents in the experimental group before consuming beetroot juice was 10.8429, and after consuming the juice for 14 days, the average hemoglobin level increased to 13.3905.

This study is consistent with the research by Friska Armynia Subratha (2020) conducted at SMA Negeri 1 Marga Tabanan, which found that anemia in adolescents is influenced by factors such as knowledge level, age, and parental occupation. The high prevalence of iron-deficiency anemia in adolescents is due to inadequate nutrition caused by poor eating habits, irregular meals, and an imbalanced diet.

Levels of Anemia in Adolescents

This study was conducted on 21 female adolescents at MA Jamilurrahman. Before being given beetroot juice, the majority of the respondents were anemic: 19 experienced mild anemia, and 2 had moderate anemia. After 1 week of consuming beetroot juice, 2 respondents showed improvement from

moderate anemia to mild anemia. After 14 days of beetroot juice intake, all 21 respondents no longer had anemia, with hemoglobin levels exceeding 12 mg/dL.

This finding aligns with research by Sulistiana & Sari (2022) at MAN 2 Model Medan, involving 20 respondents. After 7 days of consuming 250 ml of beetroot juice daily, the hemoglobin levels of all respondents showed a significant increase. The study concluded that beetroot juice positively affects hemoglobin levels.

Effect of Beetroot on Hemoglobin Increase

The experimental group in this study was given beetroot juice, which was made from 250 grams of fresh beetroot, equivalent to 200 ml of pure beetroot juice per day for 14 consecutive days. Prior to consuming the beetroot juice, the average hemoglobin level was 10.8429, which increased to 13.3905 after 14 days of consumption. According to Luthfi Mutiara Fitri Mudhodfir et al. (2024), beetroot is a nutrient-dense food that contains several compounds that can help increase hemoglobin levels. These compounds include iron, folate, niacin, pyridoxine, vitamins A and C, sodium, potassium, magnesium, calcium, betaine, and zinc, all of which are crucial for blood hemoglobin formation. These nutrients activate the circulatory system and enhance red blood cell production due to the high levels of folic acid and vitamin B12, which are essential for proper cell metabolism and erythrocyte growth. Similarly, Nurrahmaton et al. (2023) explained that consuming beetroot stimulates blood circulation and assists in the production of red blood cells, with folic acid and vitamin B12 playing significant roles in erythrocyte development.

The results of this study align with research by Sulistiana & Sari (2022) conducted at MAN 2 Model Medan, which found that female adolescents with low hemoglobin levels showed a significant increase in hemoglobin after consuming beetroot juice for seven consecutive days. Furthermore, a study by Tinta Julianawati et al. (2023) investigating the effects of beetroot cookies on female adolescents found that the average hemoglobin level increased from 13.7 g/dL to 14.76 g/dL, indicating that beetroot had a positive effect on hemoglobin levels. Beetroot's anthocyanin flavonoids are beneficial in the process of red blood cell formation. Additionally, the iron, vitamin B12, and folic acid in beetroot support blood cell formation (Nurrahmaton et al., 2023).

Anemia in respondents was not solely due to menstrual blood loss but also contributed to unhealthy lifestyle habits, such as inadequate nutrition, irregular eating patterns, excessive caffeine and tannin consumption, and frequent late nights. According to Adiyani et al. (2020), causes of anemia include low iron levels, vitamin B12 deficiency, folic acid deficiency, excessive bleeding, leukemia, parasitic infections, and chronic diseases. In adolescents, anemia often results from inadequate micronutrient

intake, particularly iron, iodine, and vitamins, which are essential for red blood cell (hemoglobin) formation. Iron deficiency disrupts hemoglobin production, impairing red blood cell formation.

As Djannah & Wisudawati (2023) noted, many adolescent girls reduce their food intake due to concerns about their body image, leading them to neglect essential micronutrients, resulting in malnutrition and eventually anemia, along with weakened immune systems. The results of the paired t-test showed a significant difference in hemoglobin levels ($p = 0.000$, $p < 0.05$), indicating that beetroot juice consumption significantly affected hemoglobin levels in female adolescents at MA Jamilurrahman Bantul. According to Maimunah et al. (2021), beetroot is a highly beneficial vegetable, rich in nutrients, and serves as a natural food dye due to its red pigment. It is also known for its health benefits, such as increasing hemoglobin levels in people with anemia, preventing cancer, and lowering blood pressure due to its potassium content.

A similar study conducted by Zuhraini et al. (2021) at SMAN 14 Bandar Lampung found that the average hemoglobin level of female adolescents increased from 10.682 g/dL to 11.088 g/dL after consuming beetroot juice (250 ml daily for 7 days), with statistical significance ($p = 0.001$, $p < 0.05$). Beetroot is rich in folic acid, iron, and vitamin C, which are essential for new red blood cell formation. Beetroot contains 34% folic acid, 7.4% iron, and 10.2% vitamin C, all of which support growth and help replace damaged cells (Paramitha & Lufar, 2024). In conclusion, drinking beetroot juice significantly increases hemoglobin levels due to its content of iron, vitamin C, folic acid, magnesium, and other minerals. Beetroot juice is a useful intervention to address iron deficiency anemia, particularly among female adolescents. The Qur'an mentions in Surah An-Nahl (16:69) the healing properties of various fruits, emphasizing their beneficial effects on human health. Similarly, in Surah Ar-Ra'd (13:11), it is stated that change comes from human effort, implying that improving one's health requires active efforts, such as incorporating nutritious foods like beetroot into one's diet.

CONCLUSION

Based on the results of the study above, it can be concluded that giving beetroot juice is effective in increasing hemoglobin levels in adolescents with anemia at MA Jamilaturahmah, so it is recommended that beetroot juice can be used as a non-pharmacological alternative in treating and preventing anemia in students.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my friends for their moral support and assistance

throughout the research process. I also extend my thanks to my advisors for their invaluable guidance and direction, as well as to the examiners for their constructive feedback, which greatly contributed to the improvement of this research.

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