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The Effect of Red Spinach Pudding on Increasing Haemoglobin Levels in Adolescent Girls

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Anemia merupakan salah satu masalah kesehatan global yang menjadi perhatian utama di negara berkembang khususnya Indonesia. 1/3 penduduk dunia diperkirakan mengalami anemia dimana kondisi tersebut paling banyak terjadi pada Remaja putri. Salah satu upaya penanganan anemia non farmakologis dapat dilakukan melalui peningkatan asupan makanan tinggi zat besi, seperti bayam merah. Bayam merah (*Amaranthus tricolor L.*) mengandung zat besi, vitamin C, dan antioksidan yang berperan dalam meningkatkan pembentukan hemoglobin. Penelitian ini bertujuan untuk menganalisis pengaruh puding bayam merah dalam peningkatan kadar Hemoglobin pada Remaja Putri. Penelitian Quasy eksperimental dengan rancangan penelitian one group pretest posttest, sampel berjumlah 26 responden dengan tehnik total sampling, didapatkan data normal sehingga dianalisis dengan uji paired simple t test. Hasil penelitian menunjukkan bahwa ada perbedaan yang sangat signifikan antara kadar Hb sebelum dan sesudah diberikan puding bayam merah dengan p value = 0,000 (< 0,05) dengan selisih mean sebesar 1,42 g/dl dan selisih Standar Deviation (SD) sebesar 0,69. Penelitian ini menujukkan bahwa puding bayam merah dapat meningkatkan kadar hemoglobin pada remaja putri, sehingga dapat dijadikan solusi pilihan dalam upaya pencegahan dan penanganan anemia pada remaja putri.

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Anemia is one of the major global health problems and a primary concern in developing countries, particularly in Indonesia. An estimated one-third of the world's population experiences anemia, with adolescent girls representing one of the most vulnerable group. One non-pharmacological way to treat anemia is by increasing the intake of foods high in iron, such as red spinach. Red spinach (Amaranthus tricolor L.) contains iron, vitamin C, and antioxidants that play a role in increasing hemoglobin formation. This study aims to analyze the effect of red spinach pudding on increasing hemoglobin levels among adolescent girls. This research employed a quasi-experimental design with a one-group pretest–posttest. The sample consisted of 26 respondents selected total sampling technique, normal data was obtained that used the paired simple t-test analysis. The results showed a highly significant difference between hemoglobin levels before and after the administration of red spinach pudding, with p value = 0.000 (< 0.05), a mean difference of 1.42, and a Standard Deviation (SD) difference of 0.69. The study findings that red spinach pudding effectively increases hemoglobin levels among adolescent girls and may serve as a promising nutritional intervention for the prevention and management of anemia in this population.

Introduction

Anemia in adolescent girls is a health problem that is still commonly found in Indonesia. Adolescent girls are considered a high-risk group because their iron requirements increase during growth and they lose blood every month during menstruation. Anemia is a condition in which there is a decrease in the number of red blood cells in the blood or low hemoglobin levels. The normal hemoglobin level for girls is 11-15 g/dl, while the anemia threshold for teenage boys is 13-17 g/dl. The degree of anemia in teenage girls is categorized into three types, namely severe anemia (Hb <7 g/dl), moderate anemia (Hb 7-8 g/dl), and mild anemia (Hb 9-10 g/dl) (De~si Fadila and Inne~ I, 2023). Anemia in adolescent girls is caused by factors such as the menstrual cycle, inadequate intake of nutritious food, and the prevalence of fast food, which leads to poor eating habits among adolescent girls. Among the poor eating habits of adolescent girls is the consumption of fast food or junk food, which is low in iron (Sulistyoningtyas, 2020). Insufficient intake of nutrients and other substances, especially iron, can increase the risk of anemia. (Sholicha & Muniroh, 2019). Iron can be found in vegetables such as spinach, mustard greens, katuk leaves, and kale. Cooked spinach contains 8.3 mg of iron per 100 grams. The iron found in spinach is useful for the formation of hemoglobin in the blood.

Recorded in the report Kementerian Kesehatan (2022) which states that 59% of adolescents in Indonesia suffer from anemia, indicating that this issue is a pressing public health issue that needs to be addressed (Kementerian Kesehatan, 2022). At the provincial level, the prevalence of anemia among adolescent girls also remains high. Based on data from the East Java Provincial Health Office (2022), It is known that 42% of adolescent girls suffer from anemia, and 25% of these cases occur in Jombang Regency (Dinas Kesehatan Jawa Timur, 2022). This figure illustrates that anemia in adolescent girls is a significant problem in East Java and requires more effective intervention efforts to reduce its prevalence. The cause of anemia in adolescent girls is due to monthly menstruation and an imbalance in nutritional intake (Pibriyanti, 2023). Adolescent girls experience menstruation every month, which causes a loss of approximately 12-15 mg of iron per cycle. If this iron loss is not balanced with adequate nutritional intake, especially iron-rich foods, there will be a decrease in hemoglobin levels in the blood. The signs and symptoms of anemia vary depending on the condition of each individual, including general symptoms of anemia such as experiencing 5L (weakness, fatigue,

lethargy, sluggishness, limpness), frequent drowsiness, dizziness, headaches, pale skin, pale conjunctiva, pale nail beds, decreased appetite, nausea, and vomiting (Kusnadi, 2021).

The cognitive and academic impact of anemia in adolescent girls causes concentration disorders, memory loss, and decreased thinking and academic abilities. Iron deficiency anemia affects neurotransmitter function and brain metabolism, thereby directly impacting adolescent intellectual development (WHO, 2017). In addition, the long-term effects of anemia in adolescent girls also put them at risk of anemia during pregnancy, which will have a negative impact on the growth and development of the fetus in the womb, and can lead to a number of complications during pregnancy and childbirth (Kusuma, 2022).

Efforts to prevent anemia in adolescent girls with pharmacological treatment through the administration of iron tablets, implementation of iron supplement administration with a dose of 1 (one) tablet daily for one week during menstruation (Ministry of Health of the Republic of Indonesia, 2020). In addition, adolescent girls need to limit their intake of beverages such as tea and coffee, which contain tannins, as tannins are known to interfere with the absorption of iron in the digestive tract. One non-pharmacological treatment for anemia is to increase the intake of foods high in iron, such as red spinach. Red amaranth (Amaranthus tricolor L.) contains iron, vitamin C, and antioxidants that play a role in increasing hemoglobin formation. Based on the results of research conducted by Yetri Mailis (2025) in the city of Batam on 32 people using t-test statistical data analysis with a result of ρ volue~ = 0.00 < 0.05, it was concluded that there was an effect of red spinach and iron tablets on increasing hemoglobin levels. In line with the results of research conducted by Saputri (2019), which showed that the hemoglobin levels of adolescent girls after being given red spinach pudding and sunkist orange juice were mostly in the normal range for 20 people (83.3%) with an average total of 12.76 ± 1.26 g/dl. Red spinach can be used as an alternative ingredient for the prevention of iron deficiency anemia. A different approach is needed in processing red spinach so that the community, especially adolescents, are willing to consume red spinach in different forms (Mardahlia, 2017).

Processing red spinach into pudding is an effective food innovation to increase interest in vegetable consumption among adolescents, especially adolescent girls. Adolescents tend to prefer foods with a sweet taste, soft texture, and attractive appearance, so vegetables in

conventional processed forms are often less appealing. Modifying red spinach into pudding can increase acceptability without compromising the nutritional goals (Almatsier, 2019).

Based on the results of interviews and Hb level checks conducted by the author at MA Albayruni, data was obtained showing that 26 students had anemia, with 18 students having mild anemia (Hb 9–10 g/dl) and 8 students with moderate anemia (Hb 7–8 g/dl). This condition indicates that the prevalence of anemia in the school environment is quite high, so that simple and attractive nutritional interventions are needed, such as red spinach pudding to help increase hemoglobin levels in adolescent girls. The innovation of processing red spinach into pudding is expected to increase consumption among adolescents because the taste is more palatable and it is easy to consume regularly. Red spinach (Amaranthus tricolor) plays a role in increasing hemoglobin levels through several interrelated mechanisms, mainly through its iron, folic acid, vitamin C, and vegetable protein content. Iron is a major component in the formation of hemoglobin, a protein in red blood cells that functions to transport oxygen throughout the body's tissues. Adequate iron intake supports the process of erythropoiesis (red blood cell formation) in the bone marrow, thereby increasing hemoglobin levels (Almatsier, 2019). This mechanism describes how the biological consumption of red spinach, including in processed forms such as pudding, has the potential to increase hemoglobin levels in adolescent girls. The challenge in the effectiveness of red spinach pudding lies in the processing and storage of red spinach pudding in maintaining the consistency of its nutritional content. Vitamin C, which functions to increase iron absorption, is sensitive to heat and prolonged storage, so it has the potential to decrease during the cooking and distribution of pudding (WHO, 2017). This condition has the potential to cause variations in the iron content absorbed by the respondents' bodies.

The purpose of this study was to analyze the effect of red spinach pudding on increasing hemoglobin levels in adolescent girls at MA Albayruni Jombang. This study is expected to serve as a basis for developing nutrition interventions based on local foods, such as red spinach pudding, which are effective, safe, and easy to implement. This research is important to determine the effect of red spinach pudding consumption on hemoglobin levels in adolescent girls, given the high prevalence of anemia and the need for alternative nutritional interventions that are easy to implement in school environments.

Method

This study used a quasi-experimental method with a one-group pretest and posttest design. The data used were primary data obtained from measuring the hemoglobin levels of respondents before and after the intervention. Hemoglobin levels were measured using a standardized digital device through a finger prick method. The population consisted of 93 people, and the sample consisted of 26 people who met the inclusion criteria using total sampling technique. Data analysis included univariate and bivariate analysis. Data normality was tested using Shapiro-Wilk, and because the data were normally distributed, the analysis was continued with a paired t-test.

Research Results

Table 1. Frequency distribution of Hemoglobin (Hb) levels before giving red spinach pudding to adolescent girls at MA Al Bayruni Jombang in 2025

Yes	Hemoglobin Up	Frequency	%
1.	Normal (11-15 g/dl)	0	0.00
2.	Mild (Hb 9–10 g/dl)	18	69.23
3.	Se~dang (Hb 7–8 g/dl)	8	30.77
4.	Be~rat (Hb <7 g/dl)	0	0.00
	Total	26	100.0

Based on the frequency distribution table before the administration of red spinach pudding, it shows that half of the respondents experienced mild anemia (Hb 9–10 g/dl) with a total of 18 respondents (69.23%), moderate anemia (Hb 7–8 g/dl) with a total of 8 students (30.77%).

Table 2. Frequency distribution of Hemoglobin (Hb) levels after being given red spinach pudding to adolescent girls at MA Al Bayruni Jombang in 2025

No	Hemoglobin Up	Frequency	%
1.	Normal (11-15 g/dl)	19	73.08
2.	Mild (Hb 9–10 g/dl)	7	26.92
3.	Se~dang (Hb 7–8 g/dl)	0	0.00
4.	Be~rat (Hb <7 g/dl)	0	0.00
	Total	26	100.0

Based on Table 2, it can be seen that of the 26 respondents who were given red spinach pudding, the majority did not have anemia with normal hemoglobin levels (11-15 g/dl), totaling 19 respondents (73.08%). mild anemia (Hb 9–10 g/dl) in 7 respondents (26.92%).

Table 3. Differences in Hemoglobin (Hb) Levels Before and After the Intervention

	Pre-test	Post-test	Differences
N	26	26	26
Mean	9.52	10.94	1.4
Median	9.45	11	1.2

Min	8.0	9.7	0.4
Max	10.7	12.1	2.5
Std. Deviation	0.74	0.67	0.66

Based on Table 3, it can be seen that the average hemoglobin level was initially 9.52 g/dl before the intervention. The hemoglobin level increased to 10.94 g/dl after the red spinach pudding intervention, recording an average increase in hemoglobin of 1.4 g/dl. This proves that the administration of red spinach pudding has a positive effect on increasing the hemoglobin levels of female students with anemia.

Table 4. Results of Analysis of changes in Hemoglobin (Hb) levels before and after being given red spinach pudding to adolescent girls at MA Al Bayruni Jombang in 2025

Intervention	Up to Hb	Mean	Hours of deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Puding Bayam me~rah	Pre~te~st - Postte~st	-1.4231	0.6895	0.1352	-1.7016	-1.1446	-10.524	25	0.000

Based on the results of the paired samples test above, it is known that the Sig. (2-tailed) value is 0.000 <0.05, so H0 is rejected and Ha is accepted. Therefore, it can be concluded that there is a difference in the average Hb levels between the pre-test and post-test, which means that the consumption of red spinach pudding has an effect on increasing the Hb levels of female students in Class XI MA Al-Bairuny Jombang in 2025.

Discussion

Hemoglobin (Hb) Level Before Giving Red Spinach Pudding

From the results of the study, the hemoglobin levels of female students before the intervention of red spinach pudding administration showed that on average they had mild anemia with hemoglobin levels of 9.52 g/dL. This indicates that adolescents experience iron deficiency. This value also became the baseline for measuring changes that occurred after the administration of red spinach pudding. Adolescence is a phase of development from childhood to adulthood characterized by extensive changes in physical, emotional, and psychological maturity. Adolescence is defined as beginning at around 10-13 years of age and ending between 18 and 20 years of age (Some~rville~ et al., 2019).

In line with the research by Putra et al., according to age characteristics, most respondents aged 13 years (69.7%) had a high risk of anemia due to iron deficiency. This age is

a critical period marked by rapid physical growth and significant hormonal changes, resulting in increased iron requirements.

Researchers assume that adolescents are a group that is vulnerable to anemia, especially iron deficiency anemia, because during this period there is rapid physical growth, increased iron requirements, and in adolescent girls there is iron loss through menstruation. If iron requirements are not optimally met, hemoglobin levels tend to decrease. Therefore, researchers used red spinach pudding as a nutritional intervention, as red spinach is a source of iron that is expected to help increase hemoglobin levels in adolescents with anemia.

Hemoglobin (Hb) Levels After Giving Red Spinach Pudding

The results of hemoglobin level tests after the red spinach pudding intervention showed an average of 10.94 g/dL. This indicates an increase in the hemoglobin levels of the students after the intervention. Red spinach is a plant that has many benefits and nutrients, including vitamin C, folic acid, and iron, which are good for preventing anemia in adolescents. In line with the research conducted by Paurina Risma, the administration of a combination of spinach and chicken liver to 29 respondents with an initial Hb level of 11.276 g/dl resulted in a level of 12.476 g/dl or a mean difference of 1.200 g/dl after the intervention. Most respondents experienced an improvement in their anemia status to the normal category.

The results of this study on 26 respondents showed that the initial Hb level of 9.52 g/dl increased to 10.94 g/dl, an average increase of 1.4 g/dl, indicating a significant increase in Hb levels after the intervention. The iron content in red spinach is around 7 mg/100 grams, which is higher than other vegetables (Zulmi et al., 2022). Red spinach pudding is an innovative food product that is easily accepted, practical, and has the potential to increase consumption compliance among adolescent girls, especially those who dislike vegetables in their conventional form. Therefore, red spinach pudding can be used as a non-pharmacological intervention or supplement to overcome iron deficiency anemia, especially for adolescents who rarely or never consume iron tablets.

The Effect of Giving Red Spinach Pudding in Increasing Hemoglobin Levels in Adolescent Girls

The results of the study involving 26 respondents with anemia and an average hemoglobin (Hb) level of 10.94 g/dl after being given spinach pudding for 2 weeks showed a significant increase. Based on the results of the paired sample t-test, the average increase in Hb was 1.42 g/dl, with a Sig. (2-tailed) of 0.000 (< 0.05), which means that there was a very significant difference between hemoglobin levels before and after the administration of red spinach pudding.

Efforts to prevent and treat anemia are carried out by providing sufficient iron intake to the body to increase hemoglobin production. This is done by increasing the intake of iron-rich foods, which consist of a variety of food sources, especially animal-based foods (heme iron) and plant-based foods that are rich in iron (non-heme iron) such as vegetables including spinach, mustard greens, and nuts (Ministry of Health of the Republic of Indonesia, 2018). The benefits obtained from spinach, which is rich in iron, can help increase hemoglobin coagulation and red blood cells. In addition to being rich in iron, red spinach also contains vitamin A, vitamin C, folate, and antioxidants such as beta cyanin, which function to increase iron absorption and help in the formation of red blood cells (He~rnawati & Sari, 2021). This may be the reason why consumption of red spinach pudding in this study resulted in a significant increase in Hb.

This study is consistent with the study conducted by Lestari et al. (2021), which reported that administering red spinach for 14 days resulted in an average increase in hemoglobin of 1–1.5 g/dl in adolescent girls with anemia. This mechanism is influenced by the phytonutrient content of red spinach, which supports the hematopoiesis process. In addition, the texture of pudding as a delivery medium allows nutrients to be more easily consumed and absorbed by the body, especially in adolescents who tend to choose sweet and practical foods.

Similar research by Pratiwi and Nurhayati (2022) also shows that consumption of green and red vegetable puddings rich in iron is effective in significantly increasing hemoglobin levels. The bioavailability of iron in plant-based foods will increase if combined with processing methods that minimize nutrient loss, such as pudding processing at moderate temperatures. From the statistical analysis of this study, a p-value of 0.000 indicates that the red spinach pudding intervention had a real impact on increasing hemoglobin levels, rather than being due

to chance. This reinforces that red spinach can be used as an effective and inexpensive non-pharmacological alternative intervention in the treatment of anemia in adolescent girls, as recommended by the World Health Organization (WHO, 2021), which encourages the use of local foods rich in iron in efforts to combat anemia.

Conclusion

The results of this study show that 26 respondents experienced anemia with an average hemoglobin level before intervention of 9. After two weeks of consuming red spinach pudding, the respondents' hemoglobin levels increased to 11.08 g/dl. The paired sample t-test showed a significance value of 0.000, which is less than 0.05, indicating that there was a very significant difference between hemoglobin levels before and after the administration of red spinach pudding. Based on these analysis results, it can be concluded that the administration of red spinach pudding has a significant effect on increasing hemoglobin levels in female adolescents at MA Al Bayruni Jombang.

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