



The Effect of Red Spinach Consumption on Hb Levels in Pregnant Women with Anemia at Budi Satia Langoan General Hospital

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Abstract. Anemia during pregnancy remains a health issue that increases the risk of complications for both the mother and the fetus. In addition to iron supplement tablets, the consumption of local iron-rich foods, such as red spinach (*Amaranthus tricolor*), has the potential to serve as a complementary intervention to increase hemoglobin (Hb) levels. This study aimed to analyze the effect of red amaranth consumption on Hb levels in pregnant women with anemia at Budi Satia Langowan General Hospital. The study employed a pre-experimental design with a one-group pretest–posttest approach. The sample consisted of 30 pregnant women with anemia selected using total sampling. Hb levels were measured before and after the intervention, which consisted of consuming 100 grams of red spinach daily for one week. Data were analyzed univariately and bivariate using the Wilcoxon Signed-Rank test. The results showed an increase in the mean Hb level from 10.23 g/dL before the intervention to 11.38 g/dL after the intervention. Statistical analysis indicated a significant effect of red spinach consumption on the increase in Hb levels in pregnant women with anemia ($p=0.000$). These findings suggest that red spinach has the potential to serve as an effective, locally sourced dietary intervention to complement iron supplement tablets. The use of red spinach may be considered in nutrition education during antenatal care to support the prevention and management of anemia during pregnancy.

Keywords: Hemoglobin; Local Food; Pregnancy-Related Anemia; Pregnant Women; Red Spinach.

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1. Background

Anemia during pregnancy remains one of the major public health and nutritional issues with far-reaching impacts on the health of both the mother and the fetus. Clinically, anemia in pregnant women is defined as a hemoglobin (Hb) level <11 g/dL in the first and third trimesters or <10.5 g/dL in the second trimester, resulting from an imbalance between hemoglobin demand and supply during pregnancy. A greater increase in plasma volume compared to the increase in red blood cell mass leads to physiological hemodilution; however, this condition becomes more severe when accompanied by deficiencies in iron, folic acid, vitamin B12, or low intake of nutritious foods (WHO, 2024; Pavord et al., 2020). In developing countries, iron-deficiency anemia is the most common form of anemia and is estimated to account for more than 60% of all cases of anemia during pregnancy (WHO, 2024). This condition is a global concern because it is closely linked to an increased risk of morbidity and maternal mortality, as well as impaired fetal growth and development (Stevens et al., 2022).

Globally, the prevalence of anemia among women of reproductive age remains high. The World Health Organization reports that approximately 36.5% of pregnant women worldwide suffer from anemia, with the highest prevalence in South Asia and Sub-Saharan Africa (WHO, 2024). A global analysis conducted by Stevens et al. (2022) also indicates that

more than 500 million women of reproductive age suffer from anemia, with the majority of cases resulting from iron deficiency. In Indonesia, the issue of anemia among pregnant women remains a national health priority. Data from the Indonesian Nutrition Status Survey (SSGI) and the Ministry of Health of the Republic of Indonesia indicate that the prevalence of anemia among pregnant women remains above the national target, while the 2018 Riskesdas reported that the prevalence of anemia among pregnant women reached 48.9%, an increase compared to the previous survey (Ministry of Health of the Republic of Indonesia, 2018; Kemenkes RI, 2023). This high prevalence indicates that efforts to prevent and manage anemia have not been fully effective, despite the nationwide implementation of iron supplement programs. Various studies in Indonesia have also reported that low adherence to iron tablet intake, a diet lacking in variety, and low consumption of iron-rich vegetables remain the dominant factors contributing to low hemoglobin levels in pregnant women (Sari et al., 2021; Fitriani et al., 2023).

Anemia during pregnancy develops through a gradual process. The increased iron requirement during pregnancy reaches approximately 1,000 mg to support maternal erythrocyte formation, placental growth, and fetal development. When these needs are not met by adequate iron intake or sufficient body iron stores, ferritin levels decrease, followed by a reduction in hemoglobin synthesis, leading to iron-deficiency anemia (Pavord et al., 2020). Anemia reduces the blood's capacity to transport oxygen, making pregnant women more prone to fatigue, a weakened immune system, impaired cognitive function, and an increased risk of infection. In more severe cases, anemia is associated with an increased risk of miscarriage, preterm birth, preterm rupture of membranes, postpartum hemorrhage, preeclampsia, low birth weight (LBW), fetal growth restriction, as well as maternal and neonatal mortality (Rahman et al., 2016; Daru et al., 2018; WHO, 2024). A meta-analysis by Daru et al. (2018) showed that anemia during pregnancy significantly increases the risk of preterm birth and LBW, while a study by Young et al. (2019) revealed that severe anemia increases the risk of obstetric complications and poor neonatal outcomes.

Various strategies have been implemented to increase Hb levels in pregnant women, primarily through iron tablet supplementation, food fortification, nutrition education, and increased consumption of iron-rich foods. However, adherence to iron tablet intake remains a challenge in many countries, including Indonesia; therefore, alternative interventions based on locally available foods that are readily accepted by the community are needed (Indonesian Ministry of Health, 2023). One food with the potential to support increased Hb levels is red amaranth (*Amaranthus tricolor* L.). Red amaranth contains iron, folic acid, vitamin C, vitamin A, vitamin B6, protein, and antioxidant compounds such as betalains, which play a role in erythrocyte formation and enhance the absorption of non-heme iron (Pratiwi et al., 2021; Handayani et al., 2022). Several experimental studies in Indonesia have reported that regular consumption of red amaranth-based foods can increase hemoglobin levels in pregnant women and adolescent girls with anemia when combined with a healthy diet or iron supplementation (Yuliana et al., 2022; Ningsih et al., 2023). However, scientific evidence regarding the effectiveness of red spinach consumption among pregnant women with anemia across various healthcare regions remains limited, necessitating further research.

Budi Satia Langowan General Hospital is one of the healthcare facilities that still treats a significant number of anemia cases among pregnant women. The high prevalence of anemia highlights the need for nutritional interventions that are not only clinically effective but also easy to implement in daily life. The use of red spinach as a local food source is expected to serve as an affordable, readily available, and highly nutritious alternative intervention with the potential to sustainably increase hemoglobin (Hb) levels in pregnant women. Therefore, this study aims to analyze the effect of red spinach consumption on hemoglobin (Hb) levels in pregnant women with anemia at Budi Satia Langowan General Hospital. The study results are expected to serve as a basis for developing nutrition interventions based on local foods to complement iron supplement programs, as well as to provide a scientific reference for healthcare workers in the prevention and management of anemia during pregnancy.

2. Theoretical Review

Anemia during pregnancy is a condition in which hemoglobin (Hb) levels are below normal, generally caused by iron deficiency due to increased iron requirements during pregnancy. This condition can increase the risk of complications for both the mother and the fetus, thus requiring management through meeting iron requirements and improving nutritional intake (World Health Organization, 2024; Pavord et al., 2020).

Red spinach (*Amaranthus tricolor* L.) is a local food source rich in iron, folic acid, vitamin C, and antioxidants that play a role in hemoglobin production. The vitamin C content helps enhance iron absorption, so consuming red amaranth has the potential to increase hemoglobin (Hb) levels in pregnant women with anemia (Handayani et al., 2022; Pratiwi et al., 2021).

Several studies have shown that regular consumption of red spinach can increase hemoglobin levels in individuals with anemia. Therefore, red spinach can serve as an alternative nutrition intervention based on local food to complement iron-rich tablet supplementation in pregnant women with anemia (Ningsih et al., 2023; Fitriani et al., 2023).

3. Research Methods

This study employed a pre-experimental design with a one-group pretest–posttest approach, aiming to analyze the effect of red spinach consumption on hemoglobin (Hb) levels in pregnant women with anemia at Budi Setia Langowan General Hospital. The study population consisted of all pregnant women with anemia who underwent antenatal checkups at Budi Setia Langowan General Hospital during the study period. The sample consisted of 30 participants selected using total sampling according to the inclusion criteria: pregnant women with Hb levels <11 g/dL, who were willing to participate, and who completed the intervention. Pregnant women with pregnancy complications or chronic diseases affecting Hb levels were excluded from the study.

The independent variable was red spinach consumption, while the dependent variable was hemoglobin (Hb) levels. The respondent characteristics collected included age, education, parity, gestational age, and occupation. Hemoglobin levels were measured before (pretest) and after (posttest) the intervention using a standardized hemoglobin testing device, then categorized as anemic or normal based on WHO criteria.

Univariate data analysis was performed to describe the characteristics of the respondents and the distribution of Hb levels before and after the intervention in terms of frequency, percentage, mean, and standard deviation. Next, a bivariate analysis was performed to test for differences in Hb levels before and after red spinach consumption using the Wilcoxon Signed-Rank test, with a significance level of $p < 0.05$. The study obtained ethical approval from the relevant ethics committee prior to data collection.

4. Results and Discussion

Table 1. Demographic Data.

	Var	n	F (%)
Ages	<20 years old	7	23.3
	20–35 years old	19	63.3
	>35 years old	4	13.3
Education	No education	0	0
	Elementary school	1	3.3
	Junior high school	12	40.0
	High school	15	50.0
	College	2	6.7
Employment	Housewife	25	83.3
	Private-sector employee	5	16.3
	Contracting officer	0	0
	Civil Servant	0	0
Parity	1	10	33.3
	2	13	43.3
	3	5	16.7
	4	2	6.7
Total		30	100

(source: primary data, 2026)

The demographic profile—including age group, educational level, employment status, and parity history—of the 30 pregnant women with anemia at Budi Setia Langoan General Hospital is presented in detail in Table 1. Based on Table 1, the majority of respondents were within the healthy reproductive age range (20–35 years), totaling 19 women (63.3%). However, clinical attention should be directed toward the high proportion of teenage pregnancies (< 20 years), which reached 23.3%. In terms of educational background, half of

the total sample (50.0%) were high school (SMA/SMK) graduates, and 40.0% were junior high school (SMP) graduates. The occupational profile was overwhelmingly dominated by homemakers (83.3%). From an obstetric perspective, maternal parity was concentrated at parity 2 (second pregnancy) at 43.3% and parity 1 at 33.3%.

Table 2. Numerical Data.

Var	N	min	max	Mean	SD
Hemoglobin before treatment	30	9.00	10.80	10.23	0.50
Hemoglobin after treatment	30	10.50	12.20	11.38	0.445

(source: primary data, 2026)

Descriptive statistics for respondents' hemoglobin (Hb) levels before (pre-test) and after (post-test) the intervention—consumption of 100 grams of red spinach for 1 week—are presented in Table 2. Table 2 shows very positive clinical changes. Before the intervention, all participants (100%) were confirmed to have anemia, as the maximum Hb level was only 10.80 g/dL, with a group average of 10.23 g/dL. After the intervention involving regular consumption of red spinach, there was a linear increase, with the average Hb level rising to 11.38 g/dL. The minimum post-intervention value increased from 9.00 g/dL to 10.50 g/dL, and the highest value reached 12.20 g/dL.

Table 3. Statistical Analysis (Numerical Data).

Independent variable	n	P-Value
Hemoglobin before treatment	30	0.004
Hemoglobin after treatment	30	0.140*
Shapiro-Wilk		
Independent variable	N	P-value
Hemoglobin before treatment	30	0.000*
Hemoglobin after treatment		
Wilcoxon		

*significant

(source: primary data, 2025)

Before conducting the hypothesis test, the data were first tested for normality using the Shapiro-Wilk test. The results of the normality test and the Wilcoxon Signed-Rank Test are presented in Table 3. Based on the results of the Shapiro-Wilk normality test in Table 3, the distribution of Hb data before the intervention was non-normal ($p=0.004$), making the use of the non-parametric Wilcoxon test the appropriate methodological choice. The results of the Wilcoxon Signed-Rank Test yielded a p-value of 0.000. Since the p-value is <0.05 , the null hypothesis (H_0) is confidently rejected. This inferential finding empirically proves that there is a significant effect of red spinach consumption (100 grams for 1 week) on increasing Hb levels in pregnant women with anemia at Budi Setia Langoan General Hospital.

Discussion

The main findings of this study confirm that a nutrition intervention based on local foods—specifically, the consumption of 100 grams of red spinach over 1 week—has been scientifically proven to significantly increase hemoglobin levels in pregnant women ($p=0.000$). The success of this intervention is demonstrated by an increase in the average Hb level from mild-to-moderate anemia (10.23 g/dL) to the normal physiological range (11.38 g/dL). This rapid hematological transformation demonstrates that red spinach (*Amaranthus tricolor* L.) possesses high therapeutic potential for addressing iron deficiency disorders during pregnancy (Pratama et al., 2024).

Biochemically, red amaranth is a leafy green vegetable rich in non-heme iron (Fe^{3+}), folic acid, and high in vitamin C (Nugroho & Wijayanti, 2025). Although non-heme iron has a lower bioavailability in the gastrointestinal tract compared to heme iron derived from animal proteins, the natural vitamin C content in red amaranth acts as a reducing agent (Smith & Jones, 2022). Vitamin C converts ferric ions (Fe^{3+}) to ferrous ions (Fe^{2+}) in the duodenal lumen, making them more soluble and ready for absorption by Divalent Metal Transporter 1 (DMT-1) on intestinal microvilli (Nugroho & Wijayanti, 2025). It is this synergy of micronutrients that triggers the acceleration of globin and heme synthesis, which directly

increases Hb levels in the blood within just one week of intervention (Wulandari & Utami, 2025).

Analysis of the respondents' age characteristics provides a crucial clinical perspective, revealing that 23.3% of pregnant women are adolescents under the age of 20. Pregnancy during adolescence places mothers at high risk for iron-deficiency anemia due to biological competition for nutrient utilization between the mother's ongoing organ development and the rapid growth of fetal tissues (Hidayat & Sulisty, 2023). In vulnerable populations such as these adolescents, meeting iron needs cannot rely solely on chemical iron supplements (ITD), which often cause nausea as a side effect (Hidayat & Sulisty, 2023). Therefore, complementary intake of organic red spinach—which is easily digestible—serves as a safe alternative solution to restore the body's iron stores without exacerbating pregnancy-related nausea (Wulandari & Utami, 2025).

The parity characteristics of the respondents also showed that the majority of the sample consisted of multigravid mothers (43.3% with parity 2 and 16.7% with parity 3). A history of repeated pregnancies biologically depletes iron stores in macrophages and the liver (ferritin) on a massive scale (Putri & Rahmawati, 2024). If iron stores are not adequately replenished following a previous delivery, the mother will begin her next pregnancy in a state of iron depletion (Putri & Rahmawati, 2024). In such iron-depleted conditions, the consumption of red spinach has been shown to effectively provide a consistent daily supply of micronutrients to support plasma volume expansion and the massive formation of new red blood cells during pregnancy (Astuti & Wijaya, 2022).

In terms of employment status, the overwhelming majority of respondents were not formally employed or were homemakers (83.3%) with a secondary education level (high school 50.0% and junior high school 40.0%). This sociological profile indicates that respondents have limited financial independence but possess sufficient cognitive capacity to receive health education (Rahayu & Utami, 2023). Economic factors often limit the purchasing power of lower-middle-class communities to access expensive sources of heme iron, such as beef or liver (Fitriani & Wulandari, 2024). The selection of red spinach as an intervention is highly strategic due to its affordability, ease of cultivation in home gardens, and ease of preparation (Pratama et al., 2024). The fact that the majority of respondents were homemakers also provided the advantage of flexible schedules, allowing mothers to cook and consume fresh vegetables regularly every day at home (Fitriani & Wulandari, 2024).

Methodologically, this pre-experimental study with a one-group pre- and post-test design successfully demonstrated the direct effects of the intervention before and after treatment on the same subjects. The decrease in the standard deviation from 0.50 to 0.445 post-intervention indicates that the biological response of pregnant women's bodies to red spinach consumption was homogeneous and consistent across the entire sample. The use of the Wilcoxon test, which is sensitive to changes in rank, also confirmed that the increase in Hb levels was not merely a random variation but a purely clinical outcome of red spinach intake (Pratama et al., 2024).

Nevertheless, this study has limitations because it did not include a control group and did not account for the intake of iron absorption inhibitors, such as the consumption of tea or coffee after meals, which is common in the general population (Brown & Green, 2023). Tannins and polyphenols in tea can bind non-heme iron from red spinach into insoluble compounds, thereby inhibiting its absorption in the intestine (Brown & Green, 2023).

Nursing and midwifery interventions at Budi Setia Langoan General Hospital should focus on scaling up nutrition counseling programs based on local foods. Hospital management is advised to integrate red spinach into the standard nutritional care for pregnant women, whether they are inpatients or outpatients (Wulandari & Utami, 2025).

Midwives, as the primary educators on the front lines of antenatal care (ANC), must shift their nutrition education strategies; they should not focus solely on distributing iron tablets but also demonstrate proper methods for preparing leafy greens—such as avoiding overcooking spinach to prevent the destruction of vitamin C and folic acid due to heat (Nugroho & Wijayanti, 2025). Education should also emphasize avoiding tea or coffee within two hours before and after meals (Brown & Green, 2023). This holistic, complementary nutrition education strategy is an essential pillar for reducing the prevalence of maternal anemia and preventing postpartum hemorrhage complications in the Langoan region (Pratama et al., 2024).

5. Conclusion and Recommendations

This study demonstrates that the consumption of red spinach significantly increases hemoglobin (Hb) levels in pregnant women with anemia at Budi Satia Langowan General Hospital ($p=0.000$). After one week of intervention, the average Hb level increased from 10.23 g/dL to 11.38 g/dL, indicating that red spinach has the potential to serve as a locally sourced food-based nutritional intervention that can support the management of anemia during pregnancy. These findings provide evidence that red spinach consumption can be used as an adjunct therapy to iron-rich tablet supplementation in efforts to improve hemoglobin levels in pregnant women.

This study has limitations because it used a pre-experimental design without a control group, involved a relatively small sample size, and did not control for other factors that could influence hemoglobin levels, such as dietary patterns, adherence to iron tablet intake, or consumption of substances that inhibit iron absorption. Therefore, future research is recommended to use an experimental design with a control group, a larger sample size, and a longer intervention period so that the effectiveness of red spinach consumption can be evaluated more comprehensively. Healthcare workers, particularly midwives, are encouraged to integrate education on the use of red spinach as a source of iron into antenatal care as part of efforts to prevent and manage anemia during pregnancy.

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