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The Effect of Moringa Leaf-Based Innovation on Hemoglobin Levels of Pregnant Women in Penyengat Olak Village, Muaro Jambi Regency

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ABSTRACT

Anemia in pregnancy remains a major global health problem, with the highest prevalence occurring in developing countries, including Indonesia. The prevalence of anemia among pregnant women in Indonesia reached 37.1% in 2023 and rose to 48.9% in 2024. Despite the government's efforts to provide iron-folic acid (IFA) tablets, compliance among pregnant women is still low due to side effects, highlighting the need for alternative interventions. Moringa leaves (*Moringa oleifera*) are rich in iron and vitamin C, making them a potential complementary therapy for anemia in pregnancy. This study aimed to analyze the effect of Moringa leaf tea consumption on hemoglobin levels of pregnant women in Penyengat Olak Village, Muaro Jambi Regency. This quantitative study employed a pre-experimental one-group pretest–posttest design. The population consisted of all third-trimester pregnant women in Penyengat Olak Village, with a total of 64 respondents selected through total sampling. The intervention involved consuming Moringa leaf tea (2.5 g dried leaves brewed in 250 ml hot water, twice daily for seven consecutive days). Hemoglobin levels were measured using a digital Hb meter before and after the intervention. Data were analyzed using the Wilcoxon Signed Rank Test with $p < 0.05$ considered significant. The mean hemoglobin level before the intervention was 10.33 g/dL, increasing to 12.46 g/dL after the intervention. The median hemoglobin level increased from 10.75 g/dL (min–max: 10.0–13.5) to 11.75 g/dL (min–max: 11.1–15.4). Statistical analysis showed a significant difference between pretest and posttest hemoglobin levels ($p = 0.000$). Consumption of Moringa leaf tea significantly increased hemoglobin levels in pregnant women. Moringa leaf tea can serve as a promising complementary non-pharmacological intervention to prevent and manage anemia in pregnancy, supporting government programs to reduce maternal anemia prevalence and improve maternal and fetal health.

Keywords: Anemia In Pregnancy, Hemoglobin, Moringa Leaf Tea, Complementary Therapy, Maternal Health

INTRODUCTION

The phenomenon of anemia in pregnant women remains a serious global health problem. Anemia in pregnancy is defined as a hemoglobin level below 11 g/dL, and the majority of cases are caused by iron deficiency (Bizuneh & Azeze, 2022; Irawan, 2024; Wang et al., 2025). The World Health Organization (WHO) estimates that anemia accounts for more than 115,000 maternal deaths and 591,000

perinatal deaths each year worldwide, with the highest prevalence occurring in developing countries, including Indonesia (World Health Organization, 2025). The most recent *Riskesdas* data (2023) reported that the prevalence of anemia among pregnant women in Indonesia reached 37.1%, and even increased to 48.9% in 2024 (Kemenkes, 2023). These high figures indicate that existing anemia prevention and control programs have not been fully effective in reducing anemia rates, particularly among women of reproductive age 15–24 years, who in fact show the highest prevalence.

Although the government has intensified the program of providing iron-folic acid (IFA) tablets, with a minimum of 90 tablets during pregnancy, in reality pregnant women's adherence to consuming them remains low. Many women complain of side effects such as nausea, constipation, and an unpleasant metallic taste, which often leads them to stop taking the tablets. This phenomenon creates a gap between program targets and field realities (Kemenkes, 2019). For example, in Penyengat Olak Village, Muaro Jambi Regency, preliminary surveys revealed that most pregnant women do not take iron tablets regularly due to side effects and forgetfulness. This underscores that pharmacological approaches alone are insufficient to reduce anemia prevalence and should be complemented with non-pharmacological strategies that are more acceptable to the community (James, 2021).

The phenomenon gap is evident in the low achievement of anemia reduction targets, despite relatively high distribution coverage of IFA tablets (Abu-Hasira, 2007; Karami et al., 2022). This indicates that anemia is not merely a matter of drug availability but is also influenced by adherence, acceptability, and alternative dietary sources of iron. On the other hand, Indonesians' dietary patterns show low consumption of iron-rich animal-based foods, which are more readily absorbed, leading pregnant women to rely more on plant-based sources with lower bioavailability. This condition calls for innovations in local food sources that can provide alternative iron, are more acceptable, and have fewer side effects (Ardiani et al., 2023; Rahman et al., 2020).

The research gap also remains concerning the use of Moringa leaf products as an intervention to improve hemoglobin levels in pregnant women. Previous studies have demonstrated the effectiveness of Moringa leaves in improving hemoglobin among adolescent girls and women of reproductive age; however, research specifically examining the effect of Moringa leaf tea on pregnant women, particularly in rural communities such as Muaro Jambi, is still limited (Babeker & Bdalbagi, 2015; Roy & Sarate, 2020; Voemesse et al., 2019). Yet, Moringa leaves contain very high levels of iron (28.29 mg/100 g), nearly equivalent to one iron tablet (30 mg), making them a potential complementary therapy that is affordable, easy to process, and based on local food resources (Ajugwo et al., 2017; Otitoju et al., 2014).

The urgency of this study lies in the need for innovative and complementary approaches to address anemia in pregnant women. Given the high risks of anemia for both maternal and infant health including hemorrhage, miscarriage, low birth weight, prematurity, and maternal as well as perinatal death there is a need for interventions that are more acceptable to the community. Innovation in Moringa leaf preparations, such as tea or other products, offers a promising alternative considering its abundance, high nutritional value, and the fact that Moringa has long been recognized in local food traditions.

The objective of this study is to analyze the effect of Moringa leaf tea innovation on hemoglobin levels of pregnant women in Penyengat Olak Village, Muaro Jambi Regency. This research is expected to provide empirical evidence on whether regular consumption of Moringa leaf tea can increase hemoglobin levels among pregnant women at risk of anemia. In addition, this study aims to provide an alternative complementary therapy that can support the

success of government programs in reducing the prevalence of anemia in pregnancy.

MATERIALS & METHODS

This study is quantitative research using a pre-experimental design with a One Group Pretest–Posttest Design**.** This design was chosen because it allows observation of the effect of an intervention—in this case, the consumption of Moringa leaf tea—on hemoglobin levels in pregnant women by measuring outcomes before and after the intervention. The study was conducted in Penyengat Olak Village, Muaro Jambi Regency, Jambi Province, from May to September 2025.

The study population consisted of all third-trimester pregnant women residing in Penyengat Olak Village, totaling 64 individuals. The sampling technique used was total sampling, so the entire population was included as study participants. The inclusion criteria were third-trimester pregnant women who were willing to participate by signing informed consent and who had no history of chronic illness. The exclusion criteria were pregnant women who experienced pregnancy complications during the study period or those who were hospitalized or ill while the study was ongoing.

The independent variable in this study was the consumption of Moringa leaf tea, while the dependent variable was the hemoglobin level of pregnant women. Moringa leaf tea was defined as dried Moringa leaves, 2.5 grams per sachet, brewed in 250 ml of hot water and consumed twice daily for seven consecutive days. Hemoglobin level was defined as the concentration of hemoglobin in the blood, measured in g/dL using a digital Hb meter with the finger prick method.

The instruments used in this study included a digital Hb meter to measure hemoglobin levels, observation sheets to record respondent identity and examination results, and a short questionnaire to monitor compliance in consuming Moringa leaf tea. The research procedure began with preparation through socialization to respondents about the objectives, benefits, and procedures of the study. The pretest stage involved measuring Hb levels before the intervention. Respondents then received the intervention of consuming Moringa leaf tea according to the prescribed dosage for seven consecutive days. The posttest stage involved re-measuring Hb levels on the eighth day.

This study was approved by the Ethics Committee of the Health Polytechnic of the Ministry of Health Jambi. All respondents were informed about the study and signed informed consent before participation. Ethical principles, including informed consent, anonymity, and confidentiality, were strictly upheld throughout the research process.

Data collection was carried out directly by the researcher with assistance from local health workers. Primary data consisted of Hb measurements at the pretest and posttest stages, while secondary data were obtained from maternal health records at the local health center. Data processing was conducted in several stages: editing, coding, entry, and cleaning before analysis.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 23. Univariate analysis was used to describe respondent characteristics and hemoglobin levels before and after the intervention. Bivariate analysis was conducted to examine differences in hemoglobin levels before and after consuming Moringa leaf tea using the Wilcoxon Signed Rank Test, as the data were not normally distributed. Results were considered statistically significant at $p < 0.05$.

RESULT

Table 1. Distribution of Characteristics of Pregnant Women

Characteristics	Category	n	%
Age	< 20 years	10	15.6
	20–35 years	42	65.6
	> 35 years	12	18.8
Education	Elementary School	14	21.9
	Junior High School	20	31.3
	Senior High School	22	34.4
	Higher Education	8	12.5
Parity	Primigravida (1 pregnancy)	20	31.3
	Multigravida (2–3 pregnancies)	34	53.1
	Grand multipara (≥4 pregnancies)	10	15.6
Number of Living Children	0 child	22	34.4
	1–2 children	30	46.9
	≥3 children	12	18.8

Based on Table 1, the majority of respondents were aged 20–35 years (65.6%), while 15.6% were under 20 years and 18.8% were over 35 years old. In terms of education level, most respondents had completed senior high school (34.4%), followed by junior high school (31.3%), elementary school (21.9%), and only a small proportion had pursued higher education (12.5%). Regarding parity, more than half of the respondents were multigravida (53.1%), while 31.3% were primigravida and 15.6% were grand multipara. Meanwhile, in terms of the number of living children, most respondents had 1–2 children (46.9%), followed by those with no children (34.4%) and those with ≥3 children (18.8%).

Table 2. Distribution of Mean Hemoglobin Levels in Pregnant Women Before and After Consuming Moringa Leaf

Time of Measurement	n	Mean	Minimum	Maximum
Before intervention	64	10.33	10	13.5
After intervention	64	12.46	11.1	15.4

Based on Table 2, it can be seen that the mean hemoglobin level of pregnant women before the intervention was 10.33 g/dL, with the lowest value of 10 g/dL and the highest value of 13.5 g/dL. After receiving the intervention in the form of consuming Moringa leaf tea for seven consecutive days, the mean hemoglobin level increased to 12.46 g/dL, with the lowest value of 11.1 g/dL and the highest value of 15.4 g/dL. These results indicate an increase in hemoglobin levels among pregnant women after consuming Moringa leaf tea, suggesting that the intervention had a positive effect on hemoglobin status.

Table 3. Effect of Moringa Leaf Tea Consumption on Hemoglobin Levels of Pregnant Women

Variable	Median	Min–Max	p-value
Hemoglobin level before consuming Moringa leaf tea	10.75	10.0 – 13.5	0.000
Hemoglobin level after consuming Moringa leaf tea	11.75	11.1 – 15.4	

Based on Table 3, the median hemoglobin level of pregnant women before the intervention was 10.75 g/dL, which increased to 11.75 g/dL after the intervention. The Wilcoxon Signed Rank Test yielded a *p-value* of 0.000 (< 0.05), indicating a statistically significant difference in hemoglobin levels before and after the consumption of Moringa leaf tea. These findings suggest that Moringa leaf tea has a significant effect on increasing hemoglobin levels in pregnant women.

DISCUSSION

The results of this study showed that the majority of respondents were in the age group of 20–35 years (65.6%), which is considered the optimal reproductive age with a relatively lower risk of pregnancy complications compared to women under 20 or over 35 years of age. However, there were still respondents younger than 20 years (15.6%) and older than 35 years (18.8%) who fall into the high-risk category. Maternal age is closely related to nutritional needs, especially iron; younger women still require iron for growth, while older women face higher risks of comorbid conditions that may worsen anemia. This finding is consistent with (Viveki et al., 2012), who reported that pregnant women of high-risk age are more likely to develop anemia compared to those of reproductive age.

In terms of education, most respondents had completed senior high school (34.4%) and junior high school (31.3%), while only 12.5% had attained higher education. Educational level plays an important role in shaping maternal knowledge of nutrition during pregnancy and compliance with iron supplementation. Women with higher education levels generally have better access to health information and greater awareness of anemia prevention, which can positively influence their hemoglobin status (Lokare et al., 2012; Prakash et al., 2015).

With regard to parity, more than half of the respondents were multigravida (53.1%), while 31.3% were primigravida. Multigravida women are more vulnerable to anemia due to the increased iron requirements during previous pregnancies, which may not have been fully replenished. This finding is supported by earlier studies that highlighted the relationship between higher parity and reduced iron stores, leading to greater prevalence of anemia among pregnant women (Bh et al., 2017; Savaliya et al., 2021).

In terms of the number of children, most respondents had 1–2 children (46.9%), while 34.4% had no children. Having more children is associated with higher energy and nutritional demands for child care, which may reduce the mother's focus on meeting her own nutritional needs during pregnancy. This situation can increase the risk of anemia in mothers with high parity and larger numbers of children (Bezabih et al., 2018; Koletzko et al., 2019).

The results regarding hemoglobin levels indicated that the mean Hb level before the intervention was 10.33 g/dL, which falls into the mild anemia category. After the intervention with Moringa leaf tea for seven consecutive days, the mean Hb level increased to 12.46 g/dL. This improvement suggests that Moringa leaf tea can serve as an effective alternative source of iron. The high iron content of Moringa leaves (28.29 mg/100 g), combined with natural vitamin C that enhances iron absorption, makes it a promising complementary therapy for anemia in pregnant women (Saha et al., 2022; Singh, 2021).

The Wilcoxon Signed Rank Test yielded a *p-value* of 0.000 (<0.05), indicating a statistically significant difference in Hb levels before and after Moringa leaf tea consumption. This finding is in line with Apriyanti (2024), who reported a significant increase in hemoglobin levels among third-trimester pregnant women after Moringa leaf tea intervention. Similarly, (Voemesse et al., 2019) confirmed the effectiveness of Moringa in various forms (tea, powder, capsules) in raising hemoglobin levels, although the effect may vary depending on dosage and duration of intake.

Overall, the findings of this study confirm that Moringa leaf tea consumption significantly increases hemoglobin levels in pregnant women. This is particularly important because it provides a non-pharmacological alternative that is more acceptable to the community, especially considering the low compliance of pregnant women in consuming iron tablets due to side effects. Utilizing Moringa leaves as a natural source of iron also aligns with the principle of promoting local food sources that are affordable, widely available, and highly nutritious.

CONCLUSION

This study showed that the majority of pregnant women in Penyengat Olak Village, Muaro Jambi Regency, were in the healthy reproductive age group (20–35 years), had secondary education (senior and junior high school), were multigravida, and mostly had 1–2 children. These characteristics indicate that pregnant women remain at risk of anemia if their iron requirements are not adequately met. The mean hemoglobin level before the intervention was 10.33 g/dL, which falls into the mild anemia category. After the intervention with Moringa leaf tea for seven consecutive days, the mean hemoglobin level significantly increased to 12.46 g/dL. The Wilcoxon Signed Rank Test yielded a *p-value* of 0.000 (< 0.05), indicating a significant difference in hemoglobin levels before and after the intervention.

Declaration by Authors

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