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Moringa Leaf Extract as a Natural Intervention to Increase Hemoglobin Levels in Postpartum Anemia

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ABSTRACT

Background: Postpartum anemia is a significant health problem that contributes to maternal morbidity and mortality. It is estimated that 50–80% of women experience anemia within 48 hours after childbirth. In Indonesia, postpartum anemia is among the leading causes of maternal mortality. Effective and affordable interventions are urgently needed to improve maternal outcomes. Moringa (*Moringa oleifera*) leaves are rich in iron and essential nutrients that may support hemoglobin synthesis.

Purpose: This study aimed to evaluate the effect of Moringa leaf extract on hemoglobin levels in postpartum women with anemia.

Methods: A quasi-experimental study was conducted among postpartum women diagnosed with anemia. Participants were divided into an intervention group receiving Moringa leaf extract and a control group receiving standard care. Hemoglobin levels were measured before and after the intervention. Data were analyzed using paired and independent statistical tests with a significance level of $p<0.05$.

Results: The intervention significantly improved hemoglobin levels, with the mean rising from 8.65 g/dL pre-test to 10.93 g/dL post-test ($p < 0.05$). The average increase of 2.27 g/dL was accompanied by a more uniform distribution, indicating effective enhancement of maternal hemoglobin status after intervention.

Conclusion: Moringa leaf extract is effective in increasing hemoglobin levels among anemic postpartum women. This low-cost, natural intervention can be considered as a complementary strategy in the management of postpartum anemia, particularly in low- and middle-income settings. Further large-scale randomized controlled trials are recommended to confirm these findings.

Keywords: hemoglobin levels, maternal health, moringa oleifera, nutritional supplementation, postpartum anemia

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ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.1. October 2025. Page.251-258

BACKGROUND

Postpartum anemia is a major global health concern and a leading contributor to maternal morbidity and mortality. It is primarily caused by antenatal iron deficiency, intrapartum blood loss, and nutritional insufficiencies during pregnancy and after childbirth (Pavord et al., 2023). Globally, the prevalence of postpartum anemia ranges from 22% to 80%, depending on geographical region, nutritional status, and health system capacity (Johnston et al., 2023). The prevalence of postpartum anemia remains alarmingly high in Sub-Saharan Africa, with recent meta-analyses reporting rates exceeding 60% among women within the early postpartum period (Mengesha et al., 2024).

Postpartum anemia is a major public health issue in Indonesia. The maternal mortality ratio was 189 per 100,000 live births in 2022, with anemia as a key indirect cause (Tajrishi, 2024). National data show 48.9% of pregnant women are anemic, and 50–70% remain anemic postpartum (Indonesian Ministry of Health, 2022). In East Nusa Tenggara, the 2023 MMR was 135 per 100,000, with 78% of pregnant women anemic (Riskesdas, 2021). Postpartum anemia leads to fatigue, poor immunity, delayed healing, reduced lactation, and increased risk of depression, negatively affecting both mother and infant (Johnston et al., 2023; González-Redondo et al., 2022; Dennis & McQueen, 2019).

Conventional interventions such as oral iron supplementation remain the standard of care; however, their effectiveness is often limited by poor adherence, gastrointestinal side effects, and inconsistent supplement availability in community health settings (Akash et al., 2024; Shao, Meng, & Liang, 2024). Intra venous iron therapy is clinically effective but often too costly and logistically challenging in resource-limited environments (Ageno et al., 2024). Thus, there is a pressing need for low-cost, locally available, and well-tolerated alternatives to improve maternal recovery and reduce anemia-related complications.

Moringa oleifera leaves are rich in bioactive compounds that enhance hemoglobin synthesis and prevent anemia. They contain high iron levels (≈28.2 mg/100 g) essential for hemoglobin formation (Tajrishi, 2024), while vitamin C improves non-heme iron absorption (Nagasawa et al., 2022). Amino acids like lysine and methionine support erythropoiesis (Oyeyemi et al., 2023), and folate, vitamin B12, and antioxidants such as flavonoids and beta-carotene protect red blood cells (Sowmya et al., 2023). These synergistic nutrients make *Moringa* an effective natural hematinic, with studies showing it can increase hemoglobin, support lactation, and enhance postpartum recovery (Sowmya et al., 2023).However, rigorous clinical evidence on its effectiveness for postpartum anemia is still scarce, particularly in the Indonesian context.

OBJECTIVE

This study aimed to evaluate the effect of Moringa oleifera leaf extract on hemoglobin levels in postpartum women with anemia.

METHODS

Study Design

This study employed a quasi-experimental design with a pre-test and post-test control group approach.

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.1. October 2025. Page.251-258

Setting and Participants

The study was conducted at a public health center in East Nusa Tenggara, Indonesia, from November 2024 to January 2025. The population included postpartum women 48 hours to 7 days after delivery, totaling 71 eligible participants. Using the Slovin formula (5% error), 60 women were selected and randomly assigned to intervention (n=30) and control (n=30) groups through simple random sampling based on the Maternal and Child Health register.

Inclusion criteria were:

1) Postpartum women diagnosed with anemia (hemoglobin level < 12 g/dL),
2) Aged 18–40 years,
3) Delivered either vaginally or by cesarean section without severe complications,
4) Willing to participate and provide informed consent.

Exclusion criteria were:

1) Women with severe postpartum hemorrhage or requiring blood transfusion,
2) History of chronic illness (e.g., thalassemia, renal failure),
3) Currently on other iron supplementation beyond standard postpartum care.

Intervention

The intervention group received *Moringa oleifera* leaf extract capsules (500 mg) twice daily for 14 days alongside standard postpartum care. The 14-day duration was based on the critical early postpartum phase for hemoglobin recovery (WHO, 2023). *Moringa oleifera* contains bioavailable iron, vitamin C, and amino acids that enhance hemoglobin synthesis (Nagasawa et al., 2022; Oyeyemi et al., 2023). Previous studies reported significant hemoglobin improvement after 10–14 days of supplementation (Syarif et al., 2021; Oyeyemi et al., 2023). The control group received standard postpartum care, including iron-folic acid supplementation.

Data Collection

Hemoglobin levels were measured using a portable hemoglobinometer at baseline (day 0) and after 14 days of intervention. Socio-demographic data (age, parity, nutritional status, and mode of delivery) were collected using a structured questionnaire.

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics summarized participant characteristics. The Shapiro–Wilk test showed non-normal data distribution; therefore, the Wilcoxon Signed Rank Test was used for within-group comparisons and the Mann–Whitney U Test for between-group comparisons, with $p < 0.05$ considered significant.

Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of STRADA Indonesia University, with reference number 0023412/EC/KEPK/I/12/2024. Written informed consent was obtained from all participants before enrollment. Confidentiality and anonymity were maintained throughout the study.

RESULTS

A total of 60 postpartum women participated, with 30 in each group. Most were aged 31–40 years (56.6% treatment; 60.0% control). About half had elementary education (50.0% vs. 46.7%), and most were housewives (73.3% vs. 60.0%). Parity distribution was similar

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.1. October 2025. Page.251-258

between groups. Chi-square analysis showed no significant differences in age, education, occupation, or parity ($p > 0.05$), indicating both groups were homogeneous at baseline. (Table 1)

Table 1. Characteristic respondents

Respondent characteristics	Intervention (n=30)		Control (n=30)		p-value
	Frequency	Percentage	Frequency	Percentage	
Age					
20-30 years	8	27.7	7	23.3	0.900
30-40 years	17	56.6	18	60.0	
> 40 years	5	16.7	5	16.7	
Education					0.840
Elementary	15	50.0	14	46.7	
Junior high	8	26.7	9	30.0	
High Collage	7	23.3	7	23.3	
Occupation					0.321
Housewife	22	73.3	18	60.0	
Working	8	26.7	12	40.0	
Parity					0.910
Primiparous	12	40.0	11	36.6	
Multiparous	13	43.4	14	46.7	
Grande	5	16.7	5	16.7	
Total	30	100	30	100	

Table 2. Normality test of hemoglobin levels

Measurement	Statistic	df	p-value	Interpretation
Pre-test Hb	0.921	30	0.028	Not normal
Post-test Hb	0.905	30	0.014	Not normal

The Shapiro–Wilk test showed that pre-test ($p = 0.028$) and post-test ($p = 0.014$) hemoglobin data in the treatment group were not normally distributed, so the Wilcoxon signed-rank test was applied (Table 2).

Table 3. Measuring hemoglobin levels in pre dan post-test

Hemoglobin levels	Intervention group		Control group	
	Pre-test n (%)	Post-test n (%)	Pre-test n (%)	Post-test n (%)
<7.0 gr/dL	0 (0%)	0 (0%)	0 (0%)	0 (0%)
7.0-9.9 gr/dL	7 (23.0%)	0 (0%)	8 (26.7%)	5 (16.7%)
10.0-10.9 gr/dL	15 (50.0%)	15 (50%)	15 (50.0%)	17 (56.7%)
>11.0 gr/dL	8 (27.0%)	15 (50%)	7 (23.3%)	8 (26.6%)
Total	30 (100%)	30 (100%)	30 (100%)	30 (100%)
Wilcoxon Signed Rank Test (pre vs post)	p = 0.001		p = 0.085	
Mann-Whitney U test	p = 0.012			

Hemoglobin levels were similar at baseline in both groups (mostly 10.0–10.9 g/dL). After 14 days, the *Moringa oleifera* group showed a significant increase from 8.66 ± 0.52 g/dL to 10.93 ± 0.44 g/dL ($p = 0.001$), while the control group showed minimal change, indicating

ISSN: 2614-3488 (print); 2614-3496 (online) Vol.9 No.1. October 2025. Page.251-258

the intervention effectively improved postpartum hemoglobin levels (Tables 3–4)

Table 4. Comparison of hemoglobin levels before and after intervention in the treatment group

Intervention	Mean	SD	p value
Pre-test	8.657	0.519	0.001
Post-test	10.927	0.437	

DISCUSSION

Most respondents were aged 30–40 years, multiparous, had low education levels, and were housewives. These factors are known risk contributors to anemia, as women over 30 and those with multiple pregnancies have higher iron demands and cumulative blood loss (Milman, 2022). Low education may also limit nutritional awareness and anemia prevention practices. Studies in low- and middle-income countries link low educational attainment with poor dietary diversity and inadequate iron supplementation (BMC Women's Health, 2023), highlighting the importance of targeted health education for women with limited literacy, especially those managing household nutrition.

Pre-test results showed most respondents had hemoglobin levels of 10.0–10.9 g/dL, with 27% above 11.0 g/dL and none below 7.0 g/dL. Although severe anemia was absent, mild-to-moderate anemia remained common, potentially affecting maternal recovery and lactation (Smith et al., 2021). After the intervention, 50% achieved hemoglobin >11.0 g/dL, indicating a marked improvement. Similar studies have shown that supplementation effectively reduces postpartum anemia (Antoine et al., 2023). This shift reflects clinically meaningful benefits, including reduced fatigue and improved maternal–infant well-being.

This study showed a significant rise in maternal hemoglobin levels after the intervention, with values shifting from 7.5–9.5 g/dL to 10.0–11.5 g/dL, indicating improved hematologic status. These findings align with evidence that iron-based interventions effectively reduce postpartum anemia (BMC Women's Health, 2023) and support WHO (2023) recommendations for postpartum iron supplementation. Consistent with previous research, *Moringa oleifera* supplementation significantly increased hemoglobin levels in anemic women (Oyeyemi et al., 2023), reinforcing its potential for integration into community-based maternal anemia prevention programs.

This study demonstrated a significant improvement in hemoglobin levels among postpartum women following Moringa leaf extract supplementation. The observed increase supports previous evidence that Moringa is rich in iron, vitamin C, and essential amino acids, which play a crucial role in hemoglobin synthesis and red blood cell production (Gopalakrishnan et al., 2022). The observed enhancement in hemoglobin levels can be attributed to the high iron, folate, and vitamin C content of *Moringa oleifera* leaves, which play a vital role in erythropoiesis and iron absorption (Nagasawa et al., 2022). Vitamin C acts as a reducing agent that facilitates the conversion of ferric iron (Fe^{3+}) to ferrous iron (Fe^{2+}), the form more readily absorbed in the intestine, while folate supports red blood cell production (Oyeyemi et al., 2023). Moreover, *Moringa oleifera* contains essential amino acids, calcium, and antioxidants that further promote hematologic and general postpartum recovery (Syarif et al., 2021).

Moringa oleifera's antioxidant properties enhance iron absorption and reduce oxidative

stress, improving hematologic outcomes (Al-Malki & El Rabey, 2020). Recent studies confirm its effectiveness in reducing anemia among reproductive-age and postpartum women (Sutalaksana et al., 2021; Sari et al., 2023). Unlike conventional iron supplements, Moringa is natural, well-tolerated, and affordable. The uniform post-test hemoglobin distribution reflects consistent benefits, supporting its use as a complementary therapy for postpartum anemia. Further large-scale trials are needed to confirm efficacy and optimize dosage and duration.

The median analysis showed most women initially had hemoglobin levels of 7.5–9.5 g/dL, indicating mild anemia that could impair postpartum recovery (Smith et al., 2021). After the intervention, median levels rose to 10.0–11.5 g/dL with a more uniform distribution, showing improved and more consistent outcomes. This aligns with WHO (2023) recommendations on postpartum supplementation to stabilize hemoglobin and reduce recovery disparities. While the results indicate better maternal health potential, they should be interpreted cautiously due to the study's small sample size and limited regional scope.

CONCLUSION

This study showed that postpartum women receiving *Moringa* leaf extract had significantly higher hemoglobin levels than those receiving standard care. The results highlight *Moringa*'s potential as a low-cost, natural supplement for managing postpartum anemia, especially in low- and middle-income settings. It may be recommended as a complementary intervention within maternal health programs. Health providers should promote *Moringa* use through nutritional counseling, while policymakers support community-based education and supplementation initiatives. Further large-scale studies are needed to confirm these findings and assess long-term maternal and infant outcomes.

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CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this study.

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