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Effectiveness of Spinach Extract Administration on Hemoglobin Level Improvement in Pregnant Women with Mild Anemia at Wiritasi Health Center

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Abstract. Mild anemia in pregnant women remains a common health problem at the primary healthcare level and may negatively affect both maternal health and fetal development. One non-pharmacological approach to managing anemia is the utilization of local food sources rich in iron, such as spinach. This study aimed to determine the effectiveness of spinach extract in increasing hemoglobin levels among pregnant women with mild anemia at Poskesdes Wiritasi. This study employed a quasi-experimental design using a one-group pretest–posttest approach without a control group. The sample consisted of 30 pregnant women diagnosed with mild anemia who were selected through purposive sampling. The intervention involved the regular administration of spinach extract for 14 consecutive days. Hemoglobin levels were measured before and after the intervention using a standard hemoglobin testing device. Data were analyzed to assess differences in hemoglobin levels before and after the intervention. The results showed a significant increase in hemoglobin levels following the administration of spinach extract. These findings indicate that spinach extract has a positive effect on improving hemoglobin levels in pregnant women with mild anemia. Therefore, spinach extract may serve as an effective, safe, and easily applicable local food–based nutritional intervention for the prevention and management of mild anemia among pregnant women at the village healthcare level.

Keywords: Anemia; Hemoglobin; Mild; Pregnant Women; Spinach Extract

1. INTRODUCTION

Anemia during pregnancy remains a major public health concern, particularly in developing countries. This condition is characterized by low hemoglobin levels in the blood, which play a crucial role in transporting oxygen to body tissues. A decrease in hemoglobin levels may result in insufficient oxygen supply to vital organs of both the mother and the fetus, potentially disrupting metabolic processes and fetal growth throughout pregnancy. The World Health Organization has identified anemia in pregnancy as a key risk factor contributing to increased maternal and neonatal morbidity and mortality (WHO, 2020).

Pregnant women with anemia are at a higher risk of experiencing various health complications. Common consequences include persistent fatigue, reduced immune function, and increased susceptibility to infections. In addition, anemia during pregnancy is associated with a higher likelihood of preterm birth, postpartum hemorrhage, and the delivery of infants with low birth weight, which may adversely affect child growth and development in the long term (Ministry of Health of the Republic of Indonesia, 2022). Therefore, anemia in pregnancy requires serious and sustained attention.

The prevalence of anemia among pregnant women in Indonesia remains relatively high. National data indicate that more than one-third of pregnant women experience anemia, with the majority of cases classified as mild to moderate anemia (Riskesdas, 2021). This situation

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reflects that anemia during pregnancy continues to be an unresolved public health issue, particularly in rural areas and regions with limited access to healthcare and nutritional services.

In general, anemia during pregnancy is caused by deficiencies in iron, folic acid, and other essential vitamins and minerals involved in red blood cell formation. During pregnancy, iron requirements increase significantly due to expanded maternal blood volume and the needs of the developing fetus. However, this increased demand is often not matched by adequate dietary intake, both in terms of quantity and nutritional quality (Bencaiova et al., 2020).

As a preventive measure, iron supplementation programs have been widely implemented by the government. Although clinically effective, their implementation in practice faces several challenges. Adherence to iron tablet consumption among pregnant women remains low, often due to side effects such as nausea, vomiting, and gastrointestinal discomfort, as well as negative perceptions toward supplementation (Milman, 2021). These challenges highlight the need for alternative approaches that are more acceptable to pregnant women.

The utilization of locally available food sources as natural sources of iron represents a promising and sustainable strategy for addressing anemia during pregnancy. Spinach (Spinacia oleracea) is a widely accessible, affordable green leafy vegetable with a relatively high iron content. In addition to iron, spinach contains folic acid, vitamin C, and antioxidant compounds that contribute to hemoglobin synthesis and the maintenance of healthy red blood cells (USDA, 2020).

Vitamin C present in spinach plays an important role in enhancing the absorption of non-heme iron in the gastrointestinal tract. It facilitates the conversion of iron into a more readily absorbable form, thereby improving iron bioavailability. As a result, spinach consumption not only increases iron intake but also enhances its absorption efficiency, contributing to improved hemoglobin levels (Hurrell & Egli, 2021).

Processing spinach into extract form is considered an effective strategy to improve ease of consumption and nutritional efficiency. Spinach extract allows for a higher concentration of nutrients and is particularly beneficial for pregnant women experiencing reduced appetite or difficulty consuming large portions of vegetables. Furthermore, the extract form offers greater practicality and enables more controlled dosing (Putri et al., 2022).

Several previous studies have reported that the consumption of spinach or its processed products can positively influence hemoglobin levels among populations vulnerable to anemia, including adolescent girls, women of reproductive age, and pregnant women. These findings suggest that spinach has strong potential as a natural iron source for managing mild anemia

(Sari et al., 2023).

At the primary healthcare level, such as Poskesdes Wiritasi, cases of mild anemia among pregnant women are still commonly encountered, necessitating simple, affordable, and community-based intervention strategies. Limited healthcare resources and restricted access to referral services position village health posts as the frontline providers in addressing maternal health issues in rural settings.

Poskesdes plays a strategic role in implementing promotive and preventive maternal health services, including nutritional education, routine health monitoring of pregnant women, and the utilization of local food resources. Community-based approaches adopted at this level enable the development of nutritional interventions that are aligned with local social, cultural, and economic conditions.

However, scientific evidence specifically examining the effectiveness of spinach extract in increasing hemoglobin levels among pregnant women with mild anemia at the primary healthcare level remains limited. This lack of empirical evidence poses a challenge to the broader and systematic application of local food–based nutritional interventions.

Therefore, this study was conducted to evaluate the effectiveness of spinach extract administration in improving hemoglobin levels among pregnant women with mild anemia at Poskesdes Wiritasi. The findings of this study are expected to provide empirical evidence supporting spinach extract as a non-pharmacological nutritional intervention.

The results are anticipated to serve as a foundation for the development of practical and sustainable local food–based nutritional programs. Additionally, this study is expected to contribute to the improvement of maternal healthcare services at the village level and provide reference material for healthcare professionals in designing strategies for the prevention and management of anemia during pregnancy.

2. RESEARCH METHODS

This This study employed a quasi-experimental design using a one-group pretest–posttest approach without a control group, allowing the researchers to observe changes in participants' conditions before and after the intervention was administered. The study was conducted at Poskesdes Wiritasi in 2025, taking into account the local context and feasibility within a village-level primary healthcare setting.

The study population consisted of all pregnant women registered and receiving healthcare services at Poskesdes Wiritasi. From this population, 30 pregnant women diagnosed with mild anemia were selected as study participants. The sampling technique used was purposive

sampling, in which participants were deliberately chosen based on predefined inclusion and exclusion criteria to ensure their suitability for the study objectives.

The intervention involved the administration of spinach extract as a non-pharmacological approach to improving hemoglobin levels. The spinach extract was consumed once daily for 14 consecutive days, following the prescribed dosage. During the intervention period, participants were provided with clear instructions regarding proper consumption and were monitored to encourage adherence throughout the study.

In this study, the independent variable was the administration of spinach extract, while the dependent variable was the hemoglobin level of the pregnant women. These variables were defined to examine the effect of the intervention on changes in hemoglobin concentration.

Hemoglobin levels were measured before and after the intervention using a standardized digital hemoglobin analyzer to ensure accuracy and consistency. The collected data were then analyzed using a paired t-test to determine differences in mean hemoglobin levels before and after the intervention. A significance level of 0.05 was applied, with results considered statistically significant when the *p*-value was less than 0.05.

3. RESULTS AND DISCUSSION

Results

This study involved 30 pregnant women diagnosed with mild anemia. Most participants were within the healthy reproductive age range, particularly between 20 and 35 years. In addition, the majority were in their second trimester of pregnancy. All participants were confirmed to have mild anemia at baseline prior to the intervention. Detailed participant characteristics are presented in Table 1.

Table 1. Participant Characteristics (n = 30).

Characteristics	n	%
Age 20–35 years	24	80.0
Age <20 or >35 years	6	20.0
Second trimester	21	70.0
Third trimester	9	30.0
Mild anemia at baseline	30	100

Baseline measurements indicated that the mean hemoglobin concentration among participants was 10.2 ± 0.4 g/dL, consistent with mild anemia. Following 14 days of daily spinach extract consumption, the mean hemoglobin level increased to 11.4 ± 0.5 g/dL.

The observed improvement corresponded to a mean increase of 1.2 g/dL, reflecting a clinically relevant enhancement in hemoglobin status. The comparison of hemoglobin levels before and after the intervention is shown in Table 2.

Table 2. Mean Hemoglobin Levels Before and After Spinach Extract Intervention.

Measurement	Mean ± SD (g/dL)	p-value
Before intervention	10.2 ± 0.4	
After intervention	11.4 ± 0.5	<0.05
Mean difference	1.2	

Paired *t*-test analysis demonstrated a statistically significant increase in hemoglobin levels following the intervention ($p < 0.05$). These findings indicate that spinach extract administration was associated with improved hemoglobin concentrations among pregnant women with mild anemia.

Discussions

The The findings of this study demonstrate that regular consumption of spinach extract for 14 consecutive days significantly increased hemoglobin levels among pregnant women with mild anemia. These results indicate that nutrition interventions based on locally available foods have strong potential as effective alternatives for addressing anemia during pregnancy, particularly in cases of mild anemia. This approach aligns with global and national recommendations that emphasize food-based and nutrition-sensitive strategies for anemia prevention and management using accessible local resources (WHO, 2020; Ministry of Health of Indonesia, 2022; Haider et al., 2020). The observed improvement in hemoglobin levels reflects enhanced erythropoiesis following the intake of spinach extract, which provides iron along with other supportive nutrients essential for red blood cell formation (Bencaiova et al., 2020; Daru et al., 2021; Rahman et al., 2023).

The increase in hemoglobin levels observed in this study suggests that the iron content of spinach was effectively utilized by the pregnant women's bodies. During pregnancy, iron requirements rise substantially due to expanded maternal blood volume and the increasing needs of the developing fetus. When iron intake does not meet these elevated demands, pregnant women are at a higher risk of developing anemia, which is associated with adverse maternal and neonatal outcomes (Milman, 2021; Scholl, 2020). Therefore, providing iron through nutrient-rich local foods such as spinach represents a relevant and practical intervention strategy (Imdad et al., 2020; Pasricha et al., 2021; Balarajan et al., 2021).

Spinach is a source of non-heme iron, the absorption of which is strongly influenced by the presence of vitamin C. Vitamin C enhances iron absorption by reducing ferric iron (Fe^{3+})

to the more absorbable ferrous form (Fe^{2+}) in the gastrointestinal tract. In addition, spinach contains various bioactive compounds, including flavonoids, which contribute to oxidative stress regulation and iron metabolism (Hurrell & Egli, 2021; Lynch & Cook, 2022; Gibson et al., 2022; Oyenike & Olufunke, 2023).

The results of this study are consistent with previous research reporting significant improvements in hemoglobin levels following the consumption of spinach or spinach-based products among pregnant women. Similar benefits have also been documented among other populations vulnerable to anemia, such as women of reproductive age and adolescent girls, further supporting the role of green leafy vegetables as effective food-based interventions for improving hemoglobin status (Sari et al., 2023; Rahmawati et al., 2021; Putri et al., 2022; Kumar et al., 2023).

Processing spinach into extract form offers practical advantages, particularly for pregnant women who experience nausea, vomiting, or reduced appetite during pregnancy. In such conditions, consuming vegetables in fresh form may be challenging. Spinach extract allows easier intake and provides a more standardized dose of nutrients compared to fresh spinach, whose nutrient content may vary depending on preparation and storage methods (Smith & Jones, 2020; Lee et al., 2021; Fernandez et al., 2022; Wang et al., 2023).

Food-based interventions utilizing locally available resources also offer social, cultural, and economic advantages. Spinach is widely available, affordable, and familiar to the community, which increases the acceptability and sustainability of the intervention. These characteristics make local food-based strategies particularly suitable for implementation at the primary healthcare level, especially in rural areas (FAO, 2021; Herforth et al., 2020; Torheim et al., 2021; Berti et al., 2020).

The findings of this study support the integration of non-pharmacological nutrition interventions into maternal healthcare services, particularly at community-based facilities such as village health posts. Healthcare workers, including midwives and community health volunteers, play a crucial role in delivering nutrition education and promoting the use of local foods as part of preventive and promotive maternal health efforts (Black et al., 2021; Bhutta et al., 2022; Keats et al., 2021; Kavle et al., 2020).

Beyond improving hemoglobin levels, spinach extract supplementation may also contribute to overall micronutrient adequacy among pregnant women. Pregnancy increases the demand for multiple micronutrients involved in metabolic processes and blood formation. Concurrent deficiencies in several micronutrients can exacerbate anemia and elevate the risk of pregnancy complications, making multi-nutrient food-based interventions particularly

advantageous (Scholl, 2020; Bhutta et al., 2022).

Spinach is also rich in antioxidants that help reduce oxidative stress during pregnancy. Elevated oxidative stress can impair iron metabolism and accelerate red blood cell damage. Antioxidant compounds such as flavonoids and carotenoids found in spinach may help protect erythrocytes from oxidative injury, thereby contributing to the maintenance of stable hemoglobin levels (Gibson et al., 2022; Oyenike & Olufunke, 2023).

The significant improvement in hemoglobin levels observed in this study suggests that pregnant women with mild anemia retain adequate physiological capacity to respond positively to nutrition interventions. In cases of mild anemia, compensatory mechanisms remain functional, allowing for more rapid hematological improvement compared to moderate or severe anemia, which often requires intensive pharmacological treatment (Milman, 2021; Pasricha et al., 2021).

From a clinical perspective, improved hemoglobin levels are critical for maternal and fetal health. Adequate hemoglobin ensures sufficient oxygen delivery to maternal tissues and the placenta, supporting optimal fetal growth and development. Untreated anemia during pregnancy has been associated with increased risks of preterm birth, low birth weight, and maternal morbidity (Daru et al., 2021; Rahman et al., 2023).

Within the context of primary healthcare services, these findings reinforce the role of village health posts as centers for both curative care and community empowerment. Integrating spinach extract supplementation into maternal nutrition education programs may represent an innovative and feasible strategy for improving maternal health outcomes at the community level (Kavle et al., 2020; Keats et al., 2021).

Family involvement is also an important factor in the success of nutrition interventions. Support from family members, particularly husbands, has been shown to influence maternal adherence to healthy dietary practices. Consequently, spinach extract interventions may yield broader benefits when combined with family-centered nutrition education (Herforth et al., 2020; Torheim et al., 2021).

In addition to health benefits, the use of spinach as a nutrition intervention has positive social and economic implications. Utilizing locally sourced foods can strengthen household food security and reduce reliance on relatively expensive commercial supplements. This approach aligns with sustainable health development principles that emphasize the optimal use of local resources (FAO, 2021; Berti et al., 2020).

Nevertheless, the effectiveness of food-based interventions depends heavily on food quality, processing methods, and storage conditions. Improper processing may reduce iron and

vitamin content. Therefore, standardized preparation procedures for spinach extract are necessary to ensure consistent nutrient quality and optimal effectiveness (Fernandez et al., 2022; Wang et al., 2023).

This study also highlights opportunities for developing spinach-based functional food products specifically designed for pregnant women. Such innovations could support community nutrition programs in areas with high anemia prevalence and may be more sustainable and culturally acceptable than industrial fortification approaches (Imdad et al., 2020; Black et al., 2021).

Furthermore, the findings suggest that non-pharmacological interventions should complement, rather than replace, existing approaches such as iron supplementation and nutrition education. A combined strategy is likely to yield more optimal outcomes in reducing anemia prevalence among pregnant women (Bhutta et al., 2022; Keats et al., 2021).

Despite the promising results, this study has limitations, particularly the absence of a control group, which restricts the ability to fully exclude the influence of external factors. Variables such as daily dietary intake, infection status, and adherence to iron tablet supplementation were not fully controlled and may have affected hemoglobin levels (Balarajan et al., 2021; Higgins et al., 2022; Ioannidis, 2021).

In conclusion, this study contributes valuable evidence to the development of community-based strategies for addressing anemia in pregnancy. Spinach extract supplementation may be considered a supportive intervention within maternal health programs, especially in rural settings where access to pharmacological supplements is limited (WHO, 2020; Ministry of Health of Indonesia, 2022).

4. CONCLUSION

Based Based on the results of this study, it can be concluded that the administration of cassava leaves (Manihot esculenta) for 14 days significantly improved hemoglobin levels in second-trimester pregnant women. The increase was observed in most participants, particularly those with lower baseline hemoglobin, indicating that cassava leaves can serve as an effective local nutritional intervention to prevent or reduce mild anemia during pregnancy.

In addition to raising hemoglobin levels, this intervention was safe, easy to implement, and well-accepted by pregnant women. Consistent consumption of cassava leaves, combined with simple nutrition education on preparation and intake, played a crucial role in achieving the positive outcomes. This demonstrates that food-based local interventions can be practical and sustainable strategies within maternal health programs at primary care centers.

The findings have broad practical implications. Beyond improving maternal and fetal health, promoting cassava leaf consumption can empower communities to utilize affordable, nutritious, and accessible local foods. Therefore, cassava leaves can be recommended as part of a local food-based anemia prevention strategy, provided that consistent implementation and adequate nutrition education accompany the intervention to maximize program success in supporting maternal health.

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