Effectiveness of Leaflet-Based Health Education on Pregnant Women's Knowledge of Anemia Prevention: A Quasi-Experimental Study at Paniaran Community Health Center, North Tapanuli, Indonesia

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Abstract

Anemia in pregnancy remains a major public health problem in Indonesia and is associated with serious maternal and neonatal complications, including hemorrhage, low birth weight, prematurity, and stunting. Adequate maternal knowledge is essential for prevention, and simple educational media such as leaflets may help improve awareness. This study aims to analyze the effect of leaflet-based health education on pregnant women's knowledge of anemia prevention. A quasi-experimental one-group pretest–posttest design was conducted from July to December 2025 at Paniaran Community Health Center, North Tapanuli Regency. Twenty-five pregnant women attending antenatal classes were recruited. Knowledge was assessed using a structured questionnaire before and 14 days after the intervention. Data were analyzed using the Wilcoxon signed-rank test with a significance level of 0.05. Prior to the intervention, 72% (n=18) of respondents demonstrated good knowledge; this proportion increased to 92% (n=23) after the intervention. The Wilcoxon test indicated a statistically significant improvementin knowledge ($p = 0.011 < 0.05$). Leaflet-based health education significantly improved pregnant women's knowledge of anemia prevention. This approach can serve as a simple, low-cost educational tool to strengthen anemia prevention within antenatal care services.

Keywords: Anemia In Pregnancy, Maternal Health Education, Health Promotion, Iron Deficiency Anemia Prevention, Leaflet.

INTRODUCTION

Pregnancy is a critical period that requires close attention to maternal nutritional status and health, particularly given the risk of anemia, which often goes unrecognized by pregnant women due to a limited knowledge of its causes and consequences (Oluwabiyi et al., 2024). Anemia during pregnancy not only contributes to maternal fatigue and inreases the risk of perinatal mortality but also directly impairs the child's future growth and optimal development (FAO et al., 2023). Evidence shows that iron supplementation and education on nutritional fortification can significantly reduce the risk of maternal anemia and iron deficiency prior to delivery (Kinyoki et al., 2021; Safiri et al., 2021).

However, barriers to equitable access to health information often create knowledge gaps at the grassroots level, where anemia prevalence continues to show significant trends across various regions (Kanu et al., 2022). Given the long-term impact of anemia on maternal productivity and mortality, the effectiveness of educational strategies such as leaflet-based

visual media needs to be systematically evaluated to improve nutritional awareness among vulnerable populations (FAO et al., 2024).

Anemia in pregnancy is defined as a hemoglobin (Hb) level below 11 g/dL in the first and third trimesters or below 10.5 g/dL in the second trimester, the lower threshold reflecting physiological hemodilution (Ubom et al., 2025). Globally, anemia affects a substantial proportion of pregnant women; the World Health Organization estimates that 36–40% of pregnant women worldwide are anemic, with prevalence in Asia amongthe highest. In Indonesia, anemia in pregnancy remains highly prevalent and constitutes a persistentpublic health problem. According to the 2018 Basic Health Research (Riskesdas), 48.9% of pregnant women in Indonesia were anemic (Kemenkes RI, 2018). Most cases are attributable to iron deficiency, which may be exacerbated by acute blood loss.

Anemia carries substantial consequences. For mothers, low hemoglobin increases the risk of miscarriage, antepartum and postpartum hemorrhage due to uterine atony, shock, and peripartum infection; for fetuses, it increases the risk of low birth weight, prematurity, and subsequent stunting (Kamila, 2021). These complications contribute significantly to maternal and infant mortality. To reduce anemia, the government provides at least 90 iron tablets free of charge to every pregnant woman through community health centers. However, adherence remains low. Preliminary data collected by the North Tapanuli Health Office and Paniaran Community Health Center showed that in December 2023, 23% (6 of 26) of pregnant women who underwent hemoglobin testing were anemic, the highest prevalence among the 22 community health centers in North Tapanuli, and that only 13 of 26 pregnant women reported taking their iron tablets regularly.

Low adherence and persistently high anemia prevalence indicate that information and education efforts at this site need to be strengthened. Health education using leaflets is a simple, low-cost medium that has been shown to improve maternal knowledge (Ghafouri et al., 2026). However, evidence specific to the Paniaran working area remains limited, and few local studies have evaluated leaflet-based counseling as an anemia-prevention strategy in routine antenatal classes. This gap forms the basis of the present study. Therefore, this study aims to analyze the effect of leaflet-based health education on pregnant women's knowledge of anemia prevention in the working area of Paniaran Community Health Center, Siborong-borong District, North Tapanuli Regency, in 2025.

METHODS

This study employed a quantitative, quasi-experimental design with a one-group pretest–posttest approach. A single group of pregnant women was assessed before the intervention (pretest), received health education using leaflets, and was reassessed afterwards (posttest), allowing changes in knowledge to be attributed to the intervention.

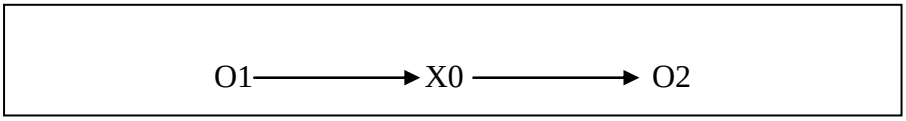

Figure 1. Research Design Model

O1 = knowledge measurement before the intervention (pretest); X = health education using leaflets on anemia prevention; O2 = knowledge measurement after the intervention (posttest).

The pretest was administered 30 minutes before the leaflet-based education, and the posttest was conducted 14 days later. The 14-day interval was based on the sleeper-effect principle, which suggests that the content of a message remains well retained 10–14 days after delivery (Brigham, in Azwar, 2005).

The study was carried out from July to December 2025 in the working area of Paniaran Community Health Center, Siborong-borong District, North Tapanuli Regency. This site was selected because it had the highest prevalence of anemia in pregnancy among all community health centers in the regency.

The timeline for this research can be described as follows:

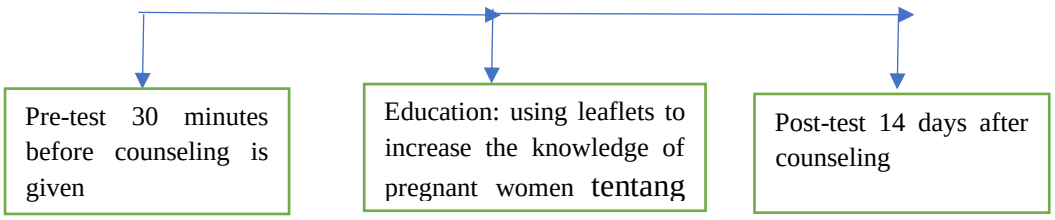

Figure 2 Research Timeline

The study population consisted of pregnant women attending antenatal classes in the Paniaran working area. A total of 25 participants were recruited through total sampling in accordance with the inclusion criteria.

Knowledge of anemia prevention was measured using a structured questionnaire developed by the researchers, covering the definition, causes, signs and symptoms, consequences, and prevention of anemia in pregnancy. Knowledge scores were categorized as good, fair, or poor.

Data collection used primary and secondary sources. Primary data, including respondent characteristics (age, education, occupation, gravida) and knowledge scores from the pretest and posttest, were obtained directly through the questionnaire. Secondary data on the number of pregnant women per district were obtained from the North Tapanuli District Health Office (2024). After data collection, responses were edited, coded, and entered for analysis.

The independent variable was leaflet-based health education, and the dependent variable was pregnant women's knowledge of anemia prevention. Data were analyzed using the Paired Samples T-Test, with a statistical significance set at $p < 0.05$.

RESULT

Table 1 Distribution of Age, Education, Occupation, and Pregnancy among Pregnant Women at the Paniaran Community Health Center

Characteristics	Treatment Group	
	Amount	%
Age		
<20 years old	1	4
20-35 years old	18	72
>35 years old	6	24
Total	**25**	**100**
Education		
Primary	1	4
Secondary	20	80
Higher	4	16
Total	**25**	**100**
Job		
Working	16	64
Not Working	9	36
Total	**25**	**100**
Pregnancy		
Primigravida	7	28
Multigravida	16	64
Grandegravida	2	8
Total	**25**	**100**

Table 1 shows that most respondents were aged 20–35 years (72%), had secondary education (80%), were employed (64%), and were multigravida (64%).

Table 2 Distribution of knowledge levels among pregnant women

Levels of Knowledge	Before Treatment Anemia Counseling		After Anemia Counseling Treatment	
	n	%	n	%
Good	18	72	23	92
Fair	7	28	2	8

Poor	-	-	-	-
Total	**25**	**100**	**25**	**100**

Before the intervention, 72% of respondents had good knowledge; after the leaflet-based education, this increased to 92%, while the proportion with fair knowledge decreased from 28% to 8%.

Table 3 Effectiveness of Counseling Using Leaflets in Increasing Knowledge Among Pregnant Women in the Paniaran Community Health Center Working Area

Intervention	Mean	*p value*	N
Anemia Education	0.240	0,011	25

The Paired sample T-Test test showed a significant difference in pregnant women's knowledge of anemia prevention before and after the intervention ($p = 0.011 < 0.05$).

DISCUSSION

Knowledge of Pregnant Women Before and After the Intervention

The percentage of respondents with good knowledge increased from 72% before to 92% after the leaflet-based education. This improvement in nutritional literacy is crucial, as inadequate micronutrient intake during pregnancy is closely associated with the risk of preterm birth and low birth weight (Lakhlani & Mehta, 2025). Furthermore, structured educational interventions can improve mothers' understanding of the importance of micronutrient supplementation, which biologically supports metabolic efficiency to reduce the risk of small-for-gestational-age infants (Hunter et al., 2023).

These findings are consistent with Anggraini et al. (2026), who reported a significant increase in the proportion of pregnant women in the "good knowledge" category, from 19.2% to 69.2%, following an educational intervention using leaflets and posters. Similarly, Sinaga and Virgian (2024) confirmed that health education using leaflets effectively improves maternal understanding anemia, reinforcing the urgency of utilizing visual media to address inequities in access to essential nutritional information during the first 1,000 days of life. Targeted education of this kind is expected to reduce the incidence of anemia and prevent stunting, as adequate nutritional intake during pregnancy provides the foundation for optimal physical growth and neurocognitive development of the fetus (Panzeri et al., 2024; Zakariya et al., 2022).

Enhancing maternal competence through structured education also plays a critical role in motivating adherence to iron supplementation, which is often neglected due to limited understanding of side effects and the urgency intake (Taufiqoh et al., 2021; Umalihayat & Qonita, 2023). The systematic integration of printed educational materials has been shown to strengthen self-confidence and improve retention of health information among pregnant

women, consistent with evidence that appropriate workshops and supporting materials significantly enhance patient engagement in self-directed health management.

Effectiveness of Leaflet-Based Education in Improving Knowledge

The paired-sample t-test confirmed a statistically significant difference in knowledge before and after the intervention ($p = 0.011$), indicating that leaflet-based education effectively improved pregnant women's knowledge of anemia prevention. New information provides a cognitive foundation for shaping attitudes and behaviors; thus, improved knowledge represents an important first step toward better adherence to anemia-prevention practices such as iron supplementation.

The effectiveness of this method underscores that simple yet targeted health communication strategies can disrupt the cycle of micronutrient deficiency from the preconception through the postnatal period (Mertens et al., 2023). Implementing a structured visual education model has proven crucial in bridging information gaps, consistent with evidence that improved maternal health literacy not only supports adherence to supplementation but also plays a vital role in preventing adverse pregnancy outcomes such as preterm birth and low birth weight (Hunter et al., 2023; Lakhlani & Mehta, 2025). This positions maternal knowledge as a primary determinant in fostering supportive attitudes toward fetal development. Furthermore, adequate health literacy empowers pregnant women to make more informed dietary choices and to develop a deeper understanding of health risks during gestation (Lee et al., 2023).

This digital transformation has the potential to significantly reduce information gaps; however, its effectiveness depends heavily on inclusive, culturally sensitive design, and ease of access for populations with low health literacy (Hauwaert et al., 2024; Lee et al., 2023). Although the integration of technology offers flexibility for self-monitoring health, barriers related to digital infrastructure and technological literacy remain critical challenges that must be addressed to ensure these interventions empower all pregnant women equally without exacerbating existing health disparities (Mohamed et al., 2025; Till et al., 2023). Therefore, aligning conventional visual-based educational media with interactive health technology support should be prioritized to ensure sustainable knowledge retention and more adaptive health behaviors in the future.

Limitations

This study has several limitations. First, the sample size was small (25 respondents), which restricts the generalizability of the findings. Second, the one-group pretest–posttest design lacked a control group, meaning external factors during the 14-day interval cannot be

fully excluded. Third, knowledge was self-reported through a questionnaire and did not capture actual behavioral changes or hemoglobin outcomes. Future research with a larger sample, inclusion of a control group, and longer follow-up, ideally comparing different educational media, is recommended.

CONCLUSION

Leaflet-based health education significantly improved pregnant women's knowledge of anemia prevention in the working area of Paniaran Community Health Center ($p = 0.011 < 0.05$). This finding demonstrates that leaflets are an effective, simple, and low-cost educational medium that can be integrated into routine antenatal classes to strengthen anemia-prevention efforts. Community health centers are encouraged to adopt leaflet-based counseling as part of maternal health promotion, while recognizing that improved knowledge must be supported by strategies to translate it into preventive behaviors, such as adherence to iron supplementation.

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