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Participatory Learning and Action (PLA) as an Intervention to Reduce Iron Deficiency Among Pregnant Women: First-Year Findings from a Study in West Lombok

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Abstract: Anemia during pregnancy remains a significant public health problem, particularly in Indonesia where prevalence exceeds the global average. This study evaluated the effectiveness of a Participatory Learning and Action (PLA) intervention in improving knowledge of iron-deficiency anemia among pregnant women in West Lombok. A quasi-experimental pre–posttest design was conducted with 60 pregnant women divided into intervention and control groups. The intervention involved six PLA sessions focusing on community discussions, nutrition education, and family participation. Knowledge scores were analyzed using paired t-tests and Mann–Whitney U tests, complemented by effect sizes and qualitative thematic analysis. Results showed a substantial improvement in the intervention group, with the proportion of good knowledge increasing from 20.0% to 80.0% and mean scores rising from 11.5 ± 2.5 to 16.8 ± 1.8 ($p < 0.001$). The control group showed no significant change. Qualitative findings revealed improved spousal support, effective reminder strategies, and increased motivation among health cadres. PLA is an effective and scalable community-based approach for strengthening anemia prevention in maternal health programs.

Keywords: Anemia in pregnancy; Iron supplementation; Participatory learning and action

Introduction

Anemia during pregnancy remains a significant global health problem with significant implications for maternal and neonatal well-being (Khezri et al., 2025). Recent evidence suggests that anemia in pregnant women increases the risk of adverse pregnancy outcomes such as preterm birth (Fatwa et al., 2025), low birth weight, and perinatal mortality (Ningsih et al., 2025). Furthermore, the prevalence of anemia among pregnant women has reportedly remained high for the past two decades (Ameline et al., 2025), with only a very small decline globally (Stevens et al., 2025). The World Health Organization (WHO) projects that by 2025, approximately 35.5% of pregnant women globally will still be anemic, with the highest prevalence found in South Asia and Sub-Saharan Africa (Bongomin et al., 2025).

The concept of iron deficiency anemia (IDA) in pregnancy depicts serious consequences for both the mother and the fetus (Means, 2020). In addition to being associated with obstetric complications such as preterm labor (Trilla et al., 2014), uterine inertia, postpartum hemorrhage, and maternal shock (Alyensi et al., 2023), IDA also contributes to intrauterine growth restriction, stunted infant development, and increased perinatal mortality (Sitorus et al., 2025). To prevent these risks, iron-folic acid (IFA) tablet supplementation has been widely recommended at both global and national levels (Sitorus et al., 2025). However, its effectiveness is highly

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influenced by maternal compliance with the requirement of ≥90 tablets during pregnancy (Sendeku et al., 2020).

In Indonesia, anemia remains at an alarming level. Recent research reports a prevalence of anemia of 36.2% in young pregnant women aged 15–24 (Kuntari et al., 2024) and a prevalence reaching 40.4% in the second and third trimesters in Batanghari Regency (Jannah et al., 2024), far above the WHO Assembly target of reducing anemia in women of reproductive age by 50% by 2025 based on 2012 levels (Al-Jawaldeh et al., 2021). Low adherence to IFA consumption is a significant factor (Kamau et al., 2018), with barriers such as side effects, forgetting to consume, and lack of family support being key factors (Alfian et al., 2024). A community-based study in Jakarta confirmed that targeted education and support from cadres significantly increased IFA consumption in anemic pregnant women, highlighting the importance of social and behavioral approaches in addition to biomedical interventions.

Given these conditions, community-based approaches such as Participatory Learning and Action (PLA) have emerged as a promising alternative. This method involves women's groups and communities in the process of problem identification, solution planning, implementation, and evaluation of collective action. Evidence from South Asia shows that PLA significantly reduces maternal and neonatal mortality by strengthening local community-based action (Sharma et al., 2018). However, in Indonesia, the application of PLA to address iron deficiency anemia is still very limited and requires further testing. Therefore, this study aims to assess the effectiveness of a PLA intervention in West Lombok Regency—an area with a high prevalence of maternal anemia (>40%)—with a focus on improving pregnant women's knowledge, attitudes, hemoglobin status, and adherence to IFA consumption as part of a multi-year project.

Method

Time and Place

This research was carried out from January to June 2025 in the working area of the Health Center in West Lombok Regency, West Nusa Tenggara Province, Indonesia. The research area was chosen because of the high prevalence of anemia in pregnant women and the availability of pregnant women's groups and health cadres who are active in the community.

Research Design

This study used a quasi-experimental design with a pre-posttest approach with the control group (Hiidayatullah et al., 2025), which allowed researchers to compare the results of the intervention between the treatment group and the control group without conducting full randomization. This design is commonly used in community-based intervention research to evaluate the impact of public health interventions in real-environments (Amaro et al., 2025).

Population and Research Sample

The research population consisted of all pregnant women who are registered and actively participate in posyandu activities in the working area of the study health center (Elmeida et al., 2025). A sample of 60 respondents, consisting of 30 pregnant women in the intervention group and 30 in the control group, was selected using purposive sampling with inclusion criteria: gestational age of the second and third trimester, ability to read and speak Indonesian, and willingness to give written consent. Purposive sampling is commonly used in community intervention research to ensure the suitability of the characteristics of the research subjects (Elmeida et al., 2025). The research variables included: knowledge, attitude, hemoglobin status, and compliance with IFA tablet consumption. Data were collected using structured questionnaires, compliance observation sheets, and digital hemoglobin measuring devices (Widayatsih et al., 2024). Intervention materials consisted of PLA modules, educational media, and nutrition booklets.

Research Procedure

The research began with the collection of preliminary data related to knowledge, attitudes, Hb status, and compliance with IFA consumption in both groups. The intervention group then participated in six Participatory Learning and Action (PLA) sessions facilitated by researchers and health cadres. PLA sessions included: (1) identification of local anemia problems, (2) analysis of causes and barriers, (3) action planning, (4) nutrition education and IFA, (5) family involvement, especially husbands and cadres, and (6) monitoring of actions and joint evaluation. The control group received standard ANC (antenatal care) services from the health center without PLA training. After the intervention was completed, a post test was carried out using the same instrument as the initial measurement.

Research Procedure

Quantitative data were analyzed using a paired t-test to compare pre–post values within each group and a Mann–Whitney U test to compare differences in changes between groups, given the distribution of data that might be non-normal (Widhiantari et al., 2025). The magnitude of the intervention effect was calculated using Cohen's d. Qualitative data obtained from the PLA discussion were analyzed using thematic analysis to

identify core themes related to family support, reminder strategies, and the role of cadres. All statistical analysis processes were carried out using SPSS version 25, and the significance level was set at $p < 0.05$.

Results and Discussion

Characteristics of Respondents

The characteristics of the respondents in Table 1 show that most pregnant women were in the healthy reproductive age group of 20-35 years (75%) and had a high school education (58.3%), with more than half working as housewives (51.7%). This condition is related to physiological readiness and better access to health information than that ofthe adolescent or advanced age group (Varrias et al., 2022). Nearly one-third of respondents had a history of anemia (31.7%), which confirms the need for ongoing interventions to prevent recurrence of anemia during pregnancy. High family support (80%) indicates a social environment conducive to positive health behaviors, which has been shown to have an impact on adherence to the consumption of blood supplement tablets (TTD) by 58.3% in the routine category. In line with previous research, ideal reproductive age, secondary education level, and family involvement were significantly associated with iron supplementation adherence and improved hemoglobin status among pregnant women (Ba et al., 2019). Thus, the characteristics of the respondents in this study provide a strong basis for the effectiveness of PLA intervention in improving knowledge and behavior related to anemia prevention in pregnant women.

Table 1. Characteristics of Respondents

Variable	Category	Intervention		Control		Total	
		n	%	n	%	n	%
Age (years)	< 20	2	6.7	3	10	5	8.3
	20–35	23	76.7	22	73.3	45	75
	> 35	5	16.7	5	16.7	10	16.7
Education	Elementary–Junior High	6	20	7	23.3	13	21.7
	Senior High School	18	60	17	56.7	35	58.3
	University	6	20	6	20	12	20
Occupation	Housewife	15	50	16	53.3	31	51.7
	Farmer	7	23.3	6	20	13	21.7
	Trader	6	20	5	16.7	11	18.3
	Others	2	6.7	3	10	5	8.3
History of Anemia	Ever	10	33.3	9	30	19	31.7
	Never	20	66.7	21	70	41	68.3
Compliance with TTD	Regular	20	66.7	15	50	35	58.3
	Sometimes	8	26.7	10	33.3	18	30
	Never	2	6.7	5	16.7	7	11.7
Family Support	Yes	25	83.3	23	76.7	48	80
	No	5	16.7	7	23.3	12	20

The Effectiveness of PLA Interventions on Improving Pregnant Women's Knowledge

Participatory Learning and Action (PLA) interventions are designed to improve pregnant women's understanding of anemia through an interactive and community-based learning process. This approach emphasizes the active involvement of participants in identifying problems, formulating solutions, and building a collective commitment to behavior change. By involving pregnant women, families, cadres, and health workers, the PLA method is expected to strengthen knowledge capacity and awareness about the importance of preventing anemia during pregnancy.

Table 2 shows the distribution of knowledge in the intervention groups before and after the implementation of Participatory Learning and Action (PLA). Overall, there was an increase in the category of "good" knowledge from 20% in the pretest to 80% in the posttest. In contrast, the "sufficient" and "lack" categories of knowledge experienced a significant decline. In addition, the average knowledge score increased from 11.5 to 16.8 with a difference of 5.3 points. The findings indicate that PLA interventions contribute strongly to improving pregnant women's knowledge levels related to anemia and its prevention.

A significant increase in knowledge levels showed that the PLA method based on active participation and group discussions was more effective than the conventional one-way educational model. The dialogical approach allows participants to exchange experiences and gain more contextual understanding, so that information is easier to receive and remember. Previous research has reported that participatory learning results in significant improvements in pregnant women's health knowledge and attitudes through interactive and

collaborative mechanisms (Melo E Lima et al., 2018). Thus, the increase in knowledge in the intervention group is in line with the findings of previous research.

In addition to the effectiveness of the learning approach, the involvement of family members and health cadres is suspected to strengthen the process of internalizing knowledge and motivating participants to participate in PLA sessions consistently. Such social engagement encourages the formation of a supportive environment that strengthens collective awareness of the risk of anemia during pregnancy. These findings are consistent with the study of Saville et al. (2023), which stated that social support and community-based reminders improve the understanding and practice of anemia prevention in pregnant women. Therefore, the increase in knowledge found is not only the result of the educational process, but also of social mobilization at the community level.

Table 2. Distribution of Knowledge in the Intervention Group

Time	Good		Fair		Poor		Mean Score ± SD (0–20)
	n	%	n	%	n	%	
Pretest	6	20	24	46.7	10	33.3	11.5 ± 2.5
Posttest	24	80	5	16.7	1	3.3	16.8 ± 1.8
Change	+18 (+60.0 pp)		-9 (-30.0 pp)		-9 (-30.0 pp)		Δ mean = +5.3

The findings of this study confirm that PLA is an effective intervention strategy and can be replicated in other maternal health programs. Although the early stage of this study has not directly evaluated changes in hemoglobin status, increased knowledge is considered an important foundation for preventive behavior change and increased adherence to TTD consumption in the future. The practical implications of these results suggest that maternal education programs in areas with a high prevalence of anemia need to integrate participatory and community-based approaches to achieve sustainable impact.

The Effectiveness of PLA on TTD Compliance

The results showed that there was a significant increase in the level of knowledge of pregnant women after being given Participatory Learning and Action (PLA) interventions. Based on Table 2, the proportion of participants in the "good" knowledge category increased sharply from 20% in the pretest to 80% in the posttest, representing an increase of +60 percentage points. In contrast, the proportion of knowledge in the fair category decreased from 46.7% to 16.7%, and the poor category decreased from 33.3% to only 3.3%. In addition, the average knowledge score increased from 11.5 ± 2.5 during the pretest to 16.8 ± 1.8 during the posttest, with a mean increase of +5.3 points.

This significant improvement shows that PLA interventions are effective in encouraging changes in pregnant women's understanding of pregnancy health. PLA allows participants to actively engage in the learning process through group discussions, problem-solving, and practice-based experiences, making the material easier to understand and remember. The shift of participants from the poor and fair categories to the good category reflects an improvement in the quality of understanding after the intervention was implemented.

From the perspective of the health education process, the success of the PLA approach is not only influenced by the delivery of the material but also by the interactions formed between participants. Participatory discussions provide space for pregnant women to share experiences and obtain direct clarification, thus creating constructive two-way learning. This is different from traditional lecture methods, which tend to be passive and involve participants less in problem analysis.

The implications of these findings are important for maternal health promotion programs at the community level. A significant increase in knowledge after the PLA intervention indicates that participatory methods are suitable models for pregnant women's health education in service facilities and communities. Strengthening group-based education systems such as PLA has the potential to improve health behaviors during pregnancy, prevent complications, and support efforts to reduce maternal and fetal health risks.

Changes in Knowledge Level in the Control Group

Table 3 shows the distribution of knowledge levels among respondents in the control group before and after the standard educational intervention. Overall, there was an increase in the proportion of those in the "good" knowledge category and an increase in the average knowledge score. The findings indicate an improvement in the knowledge level among participants in the control group after receiving standard education on anemia during pregnancy.

As shown in Table 3, the proportion of respondents categorized as having good knowledge increased from 26.7% at pretest to 40% at posttest, representing a 13.3 percentage point increase. Meanwhile, the percentage of participants with poor knowledge decreased from 30% to 20%. The mean knowledge score also increased from 12.0 ± 2.6 to 12.8 ± 2.9, resulting in an overall gain of +0.8 points. This outcome demonstrates that standard

education contributed to improving participants' basic understanding, although the magnitude of improvement was relatively modest.

Qualitative analysis generated four key thematic findings that describe participants' learning experiences. First, participants demonstrated a broader understanding of anemia, recognizing that it involves more than fatigue and weakness and poses serious risks to both maternal and fetal health. Second, strong family support—particularly from husbands—was identified as an important factor in motivating adherence to iron tablet consumption and encouraging healthier dietary practices. Third, participants developed practical strategies to overcome challenges related to side effects of iron supplementation, such as taking tablets with food to reduce discomfort. Fourth, local health cadres reported increased self-confidence and improved communication skills in delivering health information to the community.

Table 3. Knowledge Distribution in the Control Group

Time	Good		Fair		Poor		Mean Score ± SD (0–20)
	n	%	n	%	n	%	
Pretest	8	26.7	13	43.3	9	30	12.0 ± 2.6
Posttest	12	40	12	40	6	20	2.8 ± 2.9
Change	+4 (+13.3 pp)		-1 (-3.3 pp)		-3 (-10.0 pp)		Δ mean = +0.8

These findings suggest that although standard education has some effectiveness in improving basic knowledge, it does not produce substantial cognitive gains within a short period when compared to the Participatory Learning and Action (PLA) approach. Standard education tends to be passive and provides limited opportunities for interactive problem-solving, which restricts deeper internalization of information. This aligns with previous research indicating that participatory and experience-based learning methods generate stronger knowledge acquisition and higher levels of engagement among pregnant women.

The qualitative insights further highlight the importance of active participation and social support in the success of health programs. Family involvement and community health cadre empowerment create a supportive environment that enhances learning continuity and encourages behavioral change. Therefore, the improvement observed in the control group can be considered a baseline effect of standard education, while the greater effectiveness observed in the PLA intervention group reinforces the need for community-based interactive approaches to more optimally prevent anemia in pregnant women.

Conclusion

First-year findings show that the Participatory Learning and Action (PLA) approach significantly increases pregnant women's awareness and adherence to blood supplemental tablet (TTD) consumption, which is facilitated through family involvement and health cadre support. This interactive method has been shown to be more effective than standard education and is relevant and sustainable for community-based anemia prevention. The results of the study confirm that the PLA collaborative model is a potential strategy that is feasible to be integrated in maternal health programs at the primary service and community levels to strengthen efforts to reduce the prevalence of anemia in pregnant women.

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Author Contributions

E.L.; Conceptualization, methodology, Investigation, writing original draft preparation, L.S.; formal analysis, data curation, Investigation, H.K.A.; writing review and editing, Investigation, project administration.

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