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Effect of Booklet Education and Cadre Assistance on Iron Tablets Consumption among Anemic Pregnant Women in East Jakarta

Efek Pemberian Edukasi Buklet dan Pendampingan Kader terhadap Konsumsi Tablet Tambah Darah pada Ibu Hamil Anemia di Jakarta Timur

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ABSTRACT

Background: Anemia during pregnancy significantly increases maternal risk and poor pregnancy outcomes by 1.71-fold. Enhancing pregnant women's knowledge and adherence to health guidelines requires a comprehensive approach.
Objectives: This study analyzed the effects of booklet education and cadre assistance on adherence to iron tablet consumption among anemic pregnant women in East Jakarta.
Methods: This quasi-experimental study was conducted in 2019 on anemic pregnant women in Makasar Public Health Center, Jakarta. This study comprised three groups: iron-folic acid supplementation only (IF), iron-folic acid supplementation with booklet education (IFB), and iron-folic acid supplementation with booklet education and cadre assistance (IFBA), serving as control, intervention I, and intervention II, respectively. The interventions lasted for three months. Adherence to iron supplementation and knowledge, attitude, and behavior (KAB) regarding anemia were measured. The data were analyzed using ANOVA/Kruskall-Wallis test, Wilcoxon test, and Mc-Nemar test with a significance level of 0.05.
Results: There was no difference in the increase of knowledge and behavior regarding anemia among the three groups ($p < 0.05$) although the behavior score in the IFBA group was significantly higher than in the other two groups. In addition, there was no difference in the percentage of adherence to iron tablet consumption before and after the intervention in the IF, IFB, and IFBA groups ($p > 0.05$). However, the IFBA group showed an increase of about 41% in adherence.
Conclusions: There was no difference in the increase of knowledge and attitude regarding anemia among the three groups, except for behavior. However, the IFBA group showed a significant increase in knowledge, attitude, and behavior after the intervention.

INTRODUCTION

Anemia affects 24.8% of pregnant women worldwide, with a higher prevalence in developing countries[1]. According to the 2018 National Health Survey, 48.9% of pregnant women in Indonesia were anemic[2]. The number significantly increased from 37.1% in 2013 and 24.5% in 2007[3,4]. Anemia in pregnant women is associated with the risks of bleeding, labor complications, prematurity, low birth weight, and even mortality[5]. The risk of having an anemic child is 1.71-fold higher in women with pre-pregnancy anemia than in those without pre-pregnancy anemia[6].

The primary cause of anemia during pregnancy is iron deficiency, affecting between 20% and 80% of cases[7]. This condition arises from a combination of factors, including low socioeconomic status, inadequate iron supplementation, chronic energy deficiency, low dietary diversity, high parity, poor nutritional knowledge, and worm infection[8]. Furthermore, there is a lack of knowledge about proper dietary habits and food choices among women[9].

The Program for the Prevention and Control of Anemia in Pregnant Women has identified low number of antenatal care (ANC) visits, poor nutritional knowledge, and low adherence to iron-folic acid consumption (IFA) as persistent issues[10,11]. Despite efforts, the adherence rate to iron tablet consumption remains low, with only 34.69% compliance in Jakarta, far below the program's target of 80%. The lowest compliance rates are found in East Jakarta, particularly in Makasar Subdistrict, where many anemic pregnant women reside[12].

Barriers to adherence to IFA consumption include fear of side effects, inadequate counselling, and insufficient information on the importance of compliance[13]. Prenatal education and counselling have been shown to positively impact nutritional knowledge

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and diet quality[14], leading to improved hemoglobin levels, dietary intake, and nutritional knowledge about anemia and iron-rich foods[15]. Educational interventions, such as lectures, audiovisual materials, booklets, and discussions, have been effective in increasing knowledge and improving nutrition and health behaviors. In particular, the lecturing method has shown significant improvements in knowledge, attitudes, and practices among Maternal and Child Health Services cadres after module-based interventions[16].

Behavioral changes have also been observed through peer-group education and focus group discussions[17]. Research by Mithra et al. shows that cadre assistance and social support play an important role in enhancing in maternal adherence to iron tablet consumption[13]. Behavioral changes require support from the surrounding environment, such as family and educational institutions, highlighting the need for cadre assistance[18]. This study demonstrates that both booklet education and cadre assistance not only enhance understanding of anemia and the importance of iron supplements, but also substantially increase compliance. This showcases the benefits of integrating educational and supportive strategies. By combining booklet education with cadre assistance, this aims to develop a new nutritional education method that can be applied in future health education programs.

METHODS

This quasi-experimental study was conducted from May to October 2019 at the Makasar Public Health Center, East Jakarta, Indonesia. The study participants were selected using a stratified random sampling technique from four areas: Kebon Pala, Cipinang Melayu, Makasar, and Pinang Ranti. The sample size was calculated based on previous research by Sulastijah et al. (2015), with a confidence level of 95%, a beta of 5%, an expected difference of six points, and an expected 10% loss to follow-up[19]. The minimum sample size required for each group was eight pregnant women. This study received approval from the Ethics Committee of the Jakarta Health Polytechnic II with a certificate number LB.02.01/I/KE/277/2019. All participants were informed about the objectives of this study and provided written consent for voluntary participation.

A screening was conducted in Makasar Subdistrict, East Jakarta, involving 181 healthy pregnant women aged between 16-40 years. The inclusion criteria were pregnant women who were willing to participate in this study by signing an informed consent, with a gestational age of 12-24 weeks, a hemoglobin level of less than 11 g/dL (based on medical records), a single pregnancy, and good and cooperative awareness. Meanwhile, the exclusion criteria were pregnant women with chronic diseases (heart disease, diabetes, liver disease, or tuberculosis) and those with a history of bleeding (hemorrhoids, anemia, thalassemia, and leukemia).

Out of 181 subjects from the four areas, 38 anemic women were screened and randomly categorized into three groups with at least 12 subjects in each group. However, five subjects were dropped out due to reasons such as untraceable addresses, abortion during the intervention, or inability to attend the seminar because of illness or family matters. Therefore, only 33 subjects remained at the end of the intervention.

Measurement Tools

The baseline data were collected through interviews using semi-structured questionnaires. The collected data include age, mother's occupation and education, family income, trimester of pregnancy, gravidity, previous miscarriage, malnutrition, adherence to iron supplementation, knowledge, attitude, and behavior (KAB) regarding anemia, and nutrition during pregnancy. In addition, mid-upper arm circumference (MUAC) was measured using a non-elastic measuring tape to assess malnutrition.

Knowledge was assessed using true/false questions, including twelve questions related to healthy food intake during pregnancy, anemia, and IFA consumption. Knowledge was categorized as good (≥ 60%) and low (< 60%)[20]. The attitude questionnaire consisted of 10 Likert scale questions with the following response options: strongly disagree, disagree, agree, and strongly disagree. Attitude was categorized as negative (less than median) and positive (median or more)[21]. Behavior was also assessed using Likert scale questions with the following response options: always, often, rarely, and never[22]. The KAB questionnaire was validated with similar characteristics from a rural setting and had a Cronbach's α of 0.705.

Adherence to iron-folic supplementation was measured through self-reports, such as the number of tablets taken per week. All reports were collected monthly during ANC visits or maternal classes, and the subjects were considered adherent if they took at least five IFA tablets per week[23]. Otherwise, they were classified as non-adherent to iron-folic supplementation. Dietary intake was measured using 2x24-hour food recalls before the intervention, while nutrient intake was estimated using NutriSurvey version 2007 with database the Indonesian Food Composition Table (IFCT) database. The IFCT data were obtained from Indonesian Food Composition Table (IFCT), updated from panganku.org, and supplemented with additional information on certain nutrients such as vitamin C and iron. Dietary intake was compared to the Estimated Adequacy Requirement (EAR) from Indonesia's Recommended Dietary Allowance (RDA) for pregnant women[24].

Intervention

This study comprised three treatment groups: iron-folic acid supplementation only (IF), iron-folic acid supplementation with booklet education (IFB), and iron-folic acid supplementation with booklet education and cadre assistance (IFBA), serving as control, intervention I, and intervention II, respectively. All groups received iron and folic acid supplementation as per the government's policy regarding iron supplementation for pregnant women. The supplements were distributed through public health centers, with each tablet containing 60 mg of iron and 400 mcg of folic acid.

Initial data collection was conducted by trained enumerators and included socio-demographic data, nutritional status in early pregnancy (using MUAC as a

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malnutrition indicator), food intake, knowledge, attitude, behavior, hemoglobin levels, and adherence to iron supplementation. For both intervention groups, booklets were provided during baseline data collection. These booklets contained information on the definition of anemia, its etiology in pregnant women, and types of food that can enhance iron absorption. The booklets also included a monitoring section with blank boxes for placing stickers to track iron tablet consumption.

Cadre assistance was provided three times over a 12-week period for approximately 30 minutes each. This assistance was provided by trained local cadres using education materials through the booklet and focus group discussion methods to maintain adherence to iron supplementation. Furthermore, to ensure consistency, each cadre received the same materials and a question checklist for each session. Each cadre worked with two-three subjects, with a total of four cadres participating in this study. Before this study, the cadres received training on nutrition, anemia, iron supplementation, and counseling techniques specific to the IFBA group of pregnant women. Endline data collection was conducted after 12 weeks of intervention.

Data Analysis

The collected data were analyzed using a statistical software program. Frequencies and percentages were computed to describe characteristics and estimate the prevalence of categorical variables. The mean and standard deviation were computed to describe numerical variables. Chi-square test was used to analyze categorical data and assess the independence or association between variables. ANOVA or the Kruskal-Wallis test was used to analyze differences between independent groups, while paired t-test or the Wilcoxon test was used to analyze differences before and after the intervention. Dichotomous data before and after intervention were analyzed using the McNemar test.

RESULTS AND DISCUSSIONS

Table 1 shows the characteristics of the subjects in all three groups. Most subjects had received secondary education and worked as factory workers or traders, with family incomes ranging from low to middle (263.7-512.7 USD or 3,600,000-7,000,000 IDR). Statistically, there was no significant difference between the three groups, except for family income. Meanwhile, there was a significant relationship between family income and the intervention group, with the IFBA group tending to have a lower income than the other groups.

There was no significant difference in gestational age at the beginning of ANC as 30.3% of subjects started their ANC in the second and or third trimester. In general, acceptance of iron supplementation was neutral (54.5%), and only 30,3% dislike the characteristic of Fe tablets. Almost all the subjects were supported by their family, either husband or mother (78,8%). Two-thirds of the subjects had poor knowledge of anemia before the intervention, including knowledge about the frequency of ANC visits until delivery and nutrition-related anemia, although most were unaware of the definition of anemia. Based on the questionnaire regarding the subjects' knowledge and attitude, it was found that they had insufficient knowledge (81.8%) and negative attitude (75.8%).

Table 1. Distribution of socio-demographic characteristics of the anemia pregnant women in East Jakarta

Variables	Total	IF			IFB			IFBA			p value
	n (%)	mg/dL	n	%	mg/dL	n	%	mg/dL	n	%	
Hemoglobin level		10.03±0.34			9.96±0.62			10.24±0.68			-
Age											
At risk	5 (15.2)		1	12.5		2	15.4		2	16.7	-
Normal	28 (84.8)		7	87.5		11	84.6		10	83.3	
Education level											
Low	9 (27.3)		2	25.0		3	23.1		4	33.3	-
Moderate	21 (63.6)		5	62.5		9	69.2		7	58.3	
High	3 (9.1)		1	12.5		1	7.7		1	8.3	
Occupation											
Unemployed	8 (24.2)		2	25.0		2	15.4		4	66.7	-
Employed	25 (75.8)		6	75.0		11	84.6		8	33.3	
Family Income											
Low (< 263.7 USD)	18 (54.5)		2	25.0		7	53.8		9	75.0	<0.05[a*]
Moderate (263.7-512.7 USD)	12 (36.4)		3	37.5		6	46.2		3	25.0	
High (> 512.7 USD)	3 (9.1)		3	37.5		0	0.0		0	0.0	
Gravidity											
< 2	24 (72.7)		8	72.7		8	61.5		9	75.0	-
≥ 2	9 (27.3)		3	27.3		5	38.5		3	25.0	
Malnutrition											
Yes	8 (24.2)		2	25.0		4	30.8		2	16.7	-
No	25 (75.8)		6	75.0		9	69.2		10	83.3	

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Variables	Total	IF			IFB			IFBA			p value
	n (%)	mg/dL	n	%	mg/dL	n	%	mg/dL	n	%	
Gestational age at the beginning of ANC											
First trimester	23 (69.7)		6	75.0		8	61.5		9	75.0	-
Second and third trimester	10 (30.3)		2	25.0		5	38.5		3	25.0	
Knowledge											
Low	27 (81.8)		5	62.5		13	100.0		9	75.0	
Good	6 (18.2)		3	37.5		0	0.0		3	25.0	-
Attitude											
Negative	25 (75.8)		4	50.0		11	84.6		10	83.3	
Positive	8 (24.2)		4	50.0		2	15.4		2	16.7	-
Acceptance of iron supplementation											
Like	5 (15.2)		1	12.5		2	15.4		2	16.7	
Neutral	18 (54.5)		5	62.5		4	30.8		9	50.0	-
Dislike	10 (30.3)		2	25.0		7	53.8		1	8.3	
Family support for iron supplementation											
Yes	26 (78.8)		7	87.5		10	76.9		9	75.0	-
No	7 (21.2)		1	12.5		3	3.33		3	25.0	

ANC (Antenatal Care); Iron and folic acid supplementation (IF), iron, folic acid supplementation and booklet education (IFB), and iron, folic acid supplementation, booklet education, and cadre assistance (IFBA); [a]Ordinal Spearman Correlation; *p<0.05

Table 2 shows the dietary intake of pregnant women at the start of this study compared to the EAR, which is 77% of Indonesia's RDA. Most subjects did not meet the dietary recommendations. Although their protein and energy intakes were close to the EAR, they were still lower than the required amounts.

Table 2. Mean and percentage of adequacy intake anemic pregnant women in East Jakarta

Intake variables	Mean	%EAR
Energy (kkal)	1415.15±1044.50	83.64[a]
Protein (g)	47.02±22.31	91.12[a]
Iron (mg)	4.70±3.63	21.66[a]
Calcium (mg)	334.68±321.96	42.27[a]
Folic acid (mcg)	113.28±80.05	35.40[b]
Vitamin C (mg)	30.90±59.81	43.64[a]
Vitamin A	500.67±667.94	77.88 [a]
Iron bioavailability		
Heme iron intake (mg)	1.84±1.47	-
Non-heme iron intake (mg)	2.76±2.20	-
Heme iron absorption (mg)	0.42±0.34	-
Non-heme iron absorption (mg)	0.11±0.12	-
Total iron absorption (mg)	0.54±0.45	61.52[c]

[a]Estimated Average Requirement (EAR) were estimated from 77% Recommended Dietary Allowance (RDA) (Gibson, 2005)[25]; [b]FAO 2004[26]; [c] WHO 1989[27] (77% from 1.14 mg iron absorption)

In general, the iron intake of the subjects was low. A systematic review by Hartriyanti et al. (2012) indicated that the average iron intake of pregnant women in Indonesia is still below the EAR (90% of EAR)[28]. It is crucial for pregnant women to meet their nutrient requirements, including protein and iron. Despite consuming a variety of foods, the protein and iron intakes of the subjects were still below the EAR[29]. Insufficient intake can lead to a lack of energy and impaired metabolic function.

The subjects mostly consumed plant-based foods rather than animal-derived foods. Fitri (2015) noted that 70% of pregnant women in Bogor consumed less than three servings of animal-based food per day[30]. Furthermore, vegetable sources or legumes such as tempeh, tofu, or *oncom* have lower iron absorption compared to heme-containing foods. The amount of iron-based food consumed does not directly determine the amount absorbed as iron absorption is extremely sensitive to changes in body iron status. Both heme and

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non-heme iron absorption show an inverse relationship to iron stores, absorption will increase if iron stores decrease[31]. Several methods can be used to calculate iron bioavailability, including the Monsen et al. (1978) method, which is based on heme factors and vitamin C consumption[32]. This study suggested that the iron absorption of the subjects was low, fulfilling only about 61.52% of the EAR for iron absorption.

Table 3. Differences in knowledge, attitudes, behavior, and intake of groups of pregnant women after intervention in East Jakarta

Variables	IF	IFB	IFBA	*p value*
Knowledge				
Baseline	140.0 ± 23.9	136.2 ± 39.5	135.8 ± 30.6	
Endline	160.0 ± 7.6	156.2 ± 21.0	163.3 ± 13.0	
Δ	20.0 ± 23.3	20.0 ±39.4	27.5 ± 30.8	0.646[c]
p value	0.046[b*]	0.092[b]	0.008[a*]	
Attitude				
Baseline	35.38 ± 6.11	31.69 ± 6.58	33.58 ± 5.07	
Endline	37.25 ± 4.97	35.07 ± 6.38	39.33 ± 5.86	
Δ	1.87 ± 3.97[b]	3.38 ± 7.9 [b]	5.75 ± 7.5 [b*]	0.550[c]
p value	0.224[b]	0.142[a]	0.022[b]	
Behaviour				
Baseline	38.50 ± 9.94	36.00 ± 10.19	37.25 ± 5.03	
Endline	42.63 ± 12.68	42.77 ± 6.02	52.67 ± 9.55	
Δ	4.13 ± 13.2 [b]	6.77 ± 9.0 [b*]	15.42 ± 8.6 [b*]	0.020[c*]
p value	0.407[b]	0.020[b]	0.000[b]	

Iron and folic acid supplementation only (IF), iron-folic acid supplementation with booklet education (IFB), and iron-folic acid supplementation with booklet education and cadre assistance (IFBA); [a]Wilcoxon test; [b]Paired sample t-test; [c]Kruskall-Wallis test; *p < 0.05; Δ (difference)

Table 3 shows a significant increase in behavior regarding anemia among the three groups, with the highest increase observed in the IFBA group. However, there was no difference in the increase in knowledge and attitude regarding anemia across the three groups. The intervention in this study included booklet education and cadre assistance, with cadres providing health examination and education during pregnant women's classes. The number of active cadres in the area was relatively high compared to areas outside Jakarta, with cadres often conducting more than two activities per week. Supporting activities took place smoothly at each post, except when one or two pregnant women did not attend the class. In such cases, the cadre or researcher provided assistance at their homes.

The IFBA group showed the highest increase in behavior. However, no difference was found in the increase in knowledge and attitude regarding anemia across the three groups. Significant increases were also found in understanding IFA consumption for health, avoiding inhibitor foods after meals, maintaining minimal ANC frequency until delivery, and eating healthy meals. Education and counselling for pregnant women effectively imparted correct information and knowledge about anemia, enabling them to assess their own perceptions, beliefs, and behaviors to make necessary decisions[33] .

Research conducted in Aykel, Ethiopia, found that knowledge about anemia and IFAS did not significantly affect adherence levels. Despite being knowledgeable, some pregnant women did not adhere to IFAS recommendations consistently[34]. Another study in Kenya also indicated that educational interventions alone did not significantly improve adherence rates among pregnant women. Even with adequate knowledge about the benefits and importance of IFAS, many women still failed to comply with the supplementation guidelines[23]. Adherence to IFAS regimen was associated with knowledgeability on IFAS, primigravidity, and IFAS counselling, especially on the management of its side effects[23].

Changes in knowledge, attitude, and behavior require time to become significant, as evidenced by the notable increases found exclusively in the IFBA group. The Health Belief Model showed that behavioral change consists of several stages: perceived susceptibility (trust), perceived severity (recognition of the seriousness of a problem), perceived benefits (belief that change will reduce consequences), perceived barriers (recognition of obstacles to changes), and self-efficacy[35,36].

The Transtheoretical Method also outlines the stages of change: pre-contemplation, contemplation, preparation, action, and maintenance. In the pre-contemplation and contemplation stages, individuals recognize the need for change. In the preparation stage, they decide to change, and in the action stage, they begin to implement real changes. Finally, in the maintenance stage, individuals achieve the goal of making the new behavior a habit[37,38].

Based on these two theories, in this study, behavior change preceded changes in knowledge and attitude. This suggests that even without sufficient knowledge and attitude, behavior can change if individuals have passed the preparation and action stages or if they perceive the benefits and severity of the problem according to the Health Belief Model. Immediate action may also be driven by external pressure from health workers and family members, who encourage

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pregnant women to consume iron tablets regularly and maintain their health. However, if the behavior does not change, it can be influenced by low self-efficacy[39].

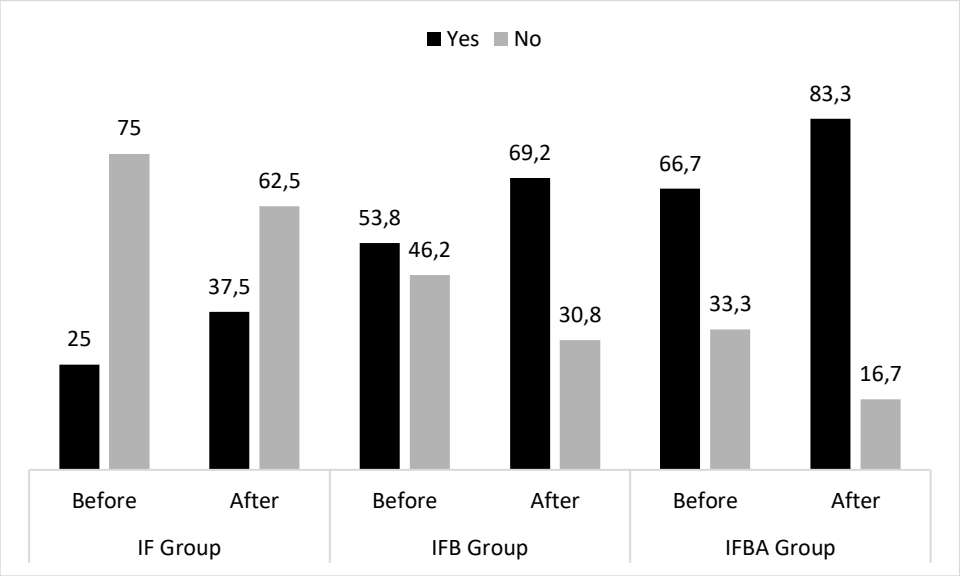

Figure 1. Prevalence of adherence to iron tablets before and after the intervention in the Iron and folic acid supplementation (IF), iron-folic acid supplementation with booklet education (IFB), and and iron-folic acid supplementation with booklet education and cadre assistance (IFBA) groups (McNemar test, no significance difference ($p > 0.05$)

Figure 1 shows no significant change in adherence to iron consumption among the three groups before and even after the intervention ($p > 0.05$). However, there was a slight tendency for an increase in adherence to iron supplementation in the IFB and IFBA groups. One contributing factor to low adherence is the poor acceptance of iron tablet characteristics[40]. Despite health services' efforts to improve maternal adherence through promotional activities, the non-adherence rate remains high[41]. Among the subjects, 30.3% expressed a dislike for iron supplementation, while 54.5% had a neutral attitude. Some subjects reported experiencing nausea, vomiting, dizziness, drowsiness, and urinating. Other factors include fear associated with the side effects of IFA tablets due to perceived or experienced effects, and forgetfulness[13,40].

Perceived barriers can be addressed by overcoming hesitation to consume iron tablets because of its side effects. A person who can control their behavior is more likely to develop the intention to engage in healthy behavior. This intention strengthens with the level of control exhibited[41]. Perceived benefits and barriers, as well as family support, are significantly correlated with pregnant women's adherence to iron supplementation. Further in-depth behavioral studies should be conducted since family support did not increase motivation among some subjects.

This study has several limitations. One of the obstacles in achieving adherence to IFA supplementation is the inconsistency in timing and quantity of tablet delivery across different subdistricts. Therefore, it is difficult to address their adherence, especially in the IF and IFB groups. In addition, this study faced low participation levels because of the high mobility in the urban population. For instance, pregnant women often moved to their hometowns to give birth in the third trimester, which made it difficult to follow up. Nevertheless, this study highlights different methods to monitor pregnant women's adherence to iron supplementation and potential nutritional counseling strategies through peer-group collaboration. These methods can be implemented in other populations, such as rural areas, which might yield different results.

CONCLUSIONS

There was no difference in the increase of knowledge and attitude regarding anemia among the three groups, except in behavior. However, there was a significant increase in knowledge, attitude, and behavior in the IFBA group after the intervention. Although there was no difference in adherence, cadre assistance for preventing anemia in pregnant women is required. This assistance addresses various inhibiting factors or barriers such as forgetfulness, side effects, and organoleptic properties of IFA tablets, which should be carefully managed for future improvement. Furthermore, creating a supportive environment is crucial to ensure program sustainability by increasing demand and support for anemia prevention. Family support cadres can help mitigate the problems experienced by pregnant women, such as forgetfulness, and contribute to better adherence.

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CONFLICT OF INTEREST AND FUNDING DISCLOSURE

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AUTHOR CONTRIBUTIONS

AF: conceptualization, data curation, formal analysis, funding acquisition; validation, visualization, roles/writing-original draft, writing-review & editing II: investigation, methodology, project administration, resources, writing-review and editing; SF: data curation, investigation, methodology, project administration, resources.

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