Effect of Behaviour Change Communication and Reminder Strategies on Coverage and Adherence to Iron-Folic Acid Supplementation among Pregnant Women in Kano: A Hybrid Effectiveness Design Study

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ABSTRACT

Background and Objectives: Iron folic acid supplements (IFAS) are currently provided for free to pregnant women during Antenatal Care (ANC), but compliance/adherence remains low over the years.

Objective: The study aimed to test the effectiveness of behaviour change communication and reminder strategies to improve adherence to IFAS and determine factors associated with IFAS utilization during pregnancy in Kano state.

Methods: Hybrid effectiveness implementation type 2 design was used simultaneously involving two independent surveys. The first was a cluster randomized control trial conducted among pregnant women (n = 143). Intervention I group received IFAS education, distribution and reminder to the pregnant women. Intervention II group received reminders via their husbands. The information group received only IFAS education. The second survey involved women with children less than 6 months old (n = 350).

Result: Only Intervention group II was found to be more effective (81.7% adherence) when compared with the control group unlike Intervention I (72.7% adherence) and information group (55.0% adherence). The prevalence of anaemia and normocytic normochromic anaemia decreased in all groups but remained unchanged in the Information group. Macrocytic and mixed anaemia decreased while microcytic hypochromic anaemia increased in all groups but remained unchanged in the control group. Factors associated with adherence were; practice of IFAS intake, number of ANC visits, access to ANC and perception of health services. Adherence (66.0%) and coverage (96.6%) levels were recorded.

Conclusion: Prevention of anaemia through strengthening the system by health promotion and education programs among health care providers, husbands, pregnant women, and reminding mechanisms, appear effective in improving adherence to IFAS.

KEYWORDS:

- IFAS,
- Behaviour Change Communication,
- Reminder,
- Adherence and Coverage

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INTRODUCTION

Anaemia is one of the most common public health issues worldwide, and it has remained the leading cause of frailty and one of the most pressing global health concerns (1). It is a low circulating haemoglobin (Hb) condition in which the concentration falls below a threshold of two standard deviations below the median of a healthy population of the same age, sex, and pregnancy stage, resulting in a pregnant woman's oxygen carrying capacity being reduced (2). Because of the diminished oxygen carrying capacity, both the mother and the developing baby receive less oxygen. It is a major source of concern in poor nations because, in addition to many other negative effects on the mother and foetus, it contributes considerably to high maternal mortality (3). While the WHO defines anaemia in pregnancy as a Hb level of less than 11 g/dL (or a haematocrit of less than 33%); in developing countries such as Nigeria, a number of less than 10 g/dL is typically used. It has been demonstrated that the foetus suffers no major injury until the Hb concentration falls below 10 g/dL. In the first and third trimesters, Hb concentrations of less than 11 g/dL are used, while in the second trimester, Hb concentrations of less than 10.5 g/dL are used (2). Women with anaemia have a higher risk of death, morbidity, postpartum haemorrhage, and poor birth outcomes, such as preterm deliveries and low birth weight (4).

The direct administration of vitamins and minerals in the form of liquid, pill, tablet, or dispersible formulations is referred to as supplementation. This is arguably the most widespread intervention done clinically and in public health, since it has proven to enhance micronutrient status and minimize their related clinical problems. Supplements can be taken on a daily or irregular basis (5). Iron is required for blood synthesis, and is present in the body largely as a component of the oxygen-carrying protein Hb. As a component of myoglobin, iron aids oxygen consumption and storage in muscle. Anaemia is caused by a shortage of iron, which affects physical working capacity, mental function, and behaviour (6). One of the top-ranked therapies for improving maternal survival is universal iron-folic acid supplementation (IFAS) for anaemia prevention in pregnant women. It may also be linked to higher new-born and child survival (7).

Despite the fact that the World Health Organization (WHO) recommends supplementing all pregnant women with a standard dose of 30-60 mg Iron and 400 g Folic Acid for 6 months on a daily basis to prevent maternal anaemia and neonatal neural tube defects, adherence to IFA supplementation during pregnancy is only 33% in Nigeria and has not improved significantly (8). The IFA supplements are currently provided for free to pregnant women in Kano State during antenatal care (ANC), but available data on compliance/adherence remains scarce over the years. With an interest in revitalizing existing IFA programmes, there is need for a better understanding of the context specific barriers and enablers to improving IFAS coverage and adherence in Kano state, Nigeria where information is lacking. Thus, the purpose of the current study is to evaluate the effectiveness of behaviour change communication and reminder strategies on improving IFAS coverage and adherence during pregnancy in health facilities in Kano state. The study will also appraise prevalence of anaemia during pregnancy based on duration of IFAS intake and the effect on maternal haematological indices and also identify factors associated with utilization of IFAS during pregnancy.

MATERIALS AND METHODS

Study Design

A health facility-based study using mixed-method approach was conducted using an effectiveness-implementation type 2 hybrid design. In this study design, the type 2 design was used simultaneously to test the intervention and its implementation strategy. The study embraced two distinct facility-based surveys carried out simultaneously. The first survey was conducted among pregnant women to test the effectiveness of behaviour change communication and reminder strategies on adherence to IFAS, which was a cluster randomized control trial and haematological indices were assessed before and after intervention. This involved 4 (four) cluster randomized groups.

Table 1: Cluster Randomized Groupings

Groups	Group label	Group description
1	Intervention I	Received IFAS education/counselling, IFAS distribution and text message remainder to the pregnant women
2	Intervention II	Received IFAS education/counselling, IFAS distribution and text message remainder via the husbands
3	Information	Received IFAS education/counselling. There was no IFAS distribution and no text message reminder.
4	Control	Did not receive IFAS education/counselling, IFAS distribution and text message remainder from the researcher but followed the normal protocol of the health facility.

The second survey was conducted among women with children less than 6 months, to assess the adherence, coverage and factors associated with the utilization of IFAS during pregnancy.

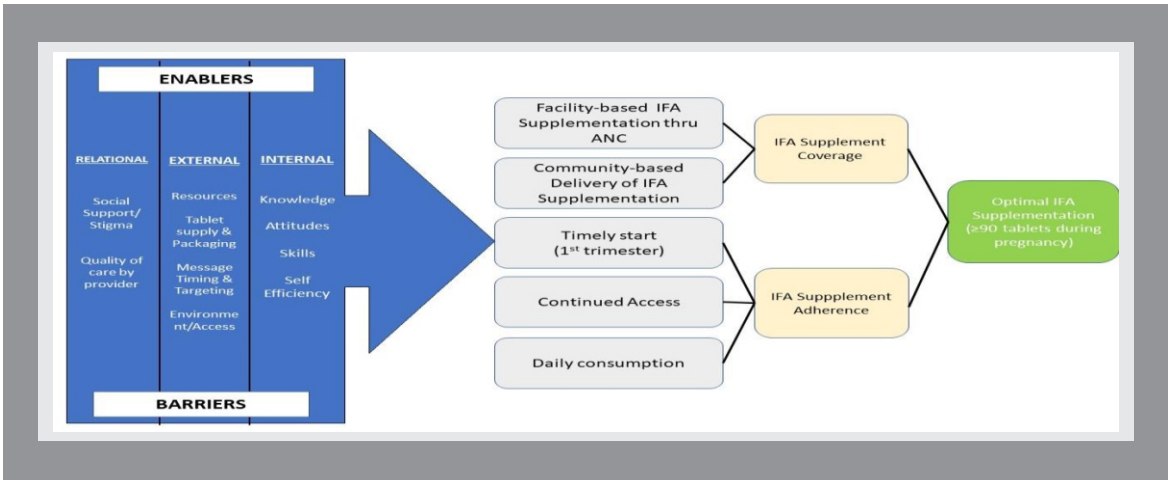

Figure 1: IFA programme implementation using the WHO/Centers for Disease Control (CDC) logic model for micronutrient interventions in public health.

The framework design (Figure 1) target increasing coverage (defined as receiving any amount of IFA during pregnancy) and adherence (defined as regularly consuming IFA throughout pregnancy as recommended by provider for 3 months) were considered as two essential outcomes that would contribute to optimal IFA supplementation. Target behaviours considered as barriers and enablers to increased adherence included (a) timely access to IFA supplements (starting in first trimester); (b) continued access to IFA supplements throughout pregnancy, requiring regular refills of IFA supplements through repeat ANC visits and (c) daily consumption of IFA supplements.

Data Collection Tools

A structured questionnaire was used to collect socio-demographic information and factors associated with utilization of IFAS from study participants.

Study Population

The study population included pregnant women attending ANC and women with children less than 6 months attending postnatal care at the same health

facility. The study participants were recruited from Kawaji Primary Health Care, Nassarawa LGA, Kano state.

Sampling and Sample Size

Cluster randomized sampling technique was used for the pregnant women. Fisher's formula, (1998) was used to determine the sample size: $n = z^2p(1-p)/d^2$

Where; n=the desired sample size z=95% confidence interval or 1.96 d=degree of precision usually set at 0.05 P= 0.5%. The prevalence of 12.3% was used (9). A sample size of 168 was used. However, 143 study participants completed the study to the end due to attrition.

Convenience sampling technique was used for women with children less than 6 months. A sample size of 350 was used.

Ethical Approval

Ethical approval was obtained from the Ethical Committee of the Kano state Ministry of Health and approval number NHREC/17/03//2018 was assigned. Participants were duly informed about the research to give informed consent. The provisions of the Helsinki declaration were respected at every step of the study. Information about the study was provided to each participant verbally and written consent was obtained from participants. Verbal consent was obtained from participants who consent to the study but decline written consent. To protect the identity of participants, verbal consent was not audio recorded. Notes were taken in details where the participant consents to participate in the study but does not consent to voice recording.

Participants Selection

Pregnant women in their first trimester and women with children less than 6 months willing to participate without any concomitant health issue satisfied the inclusion criteria.

Data Collection Method

For pregnant women, behaviour change communication was employed as a strategy and pregnant women received a public lecture and health education was provided on anaemia (causes, signs and symptoms, consequences, prevention method) and IFA supplementation (time to start taking, recommended number to be taken, benefit, negative effect to mother and child if not taken, side effects). And also IFA tablets supply for 2 weeks were distributed to pregnant women consecutively for 3 months. Before and after the intervention, blood samples were collected to measure haematological indices and phone numbers (pregnant women/husband) were also collected. At each antenatal visit (after every 2 weeks), the number of tablets consumed were recorded (pill counts). In-between antenatal visits, phone calls/SMS were sent as a remainder to take the IFA tablet.

A structured questionnaire was administered to women with children less than 6 months. The structured questionnaire captured; socio demographic information, maternal factors, health facility factors, household factors, medication factors, access to health care, perception of the quality of services, knowledge of anaemia, knowledge of IFAS, and adherence to IFAS. All tools were developed in English and translated into Hausa (the local language) for simplicity and understanding and then back-translated to English to facilitate consistency.

Analytical Methods

Haematological indices were measured from blood samples using electrical impedance method (an automated analyzer) from an accredited laboratory. (Nihon Kohden Celltac MEK7222, Tokyo).

Data Analysis

Data were analyzed using IBM SPSS Statistics 20. Socio-demographic characteristics were represented as frequencies and percentages. Change in Hb concentration was analyzed using Tukey's Kramer Post Hoc test and significance was considered at 0.05 level. A binary logistic regression model was fitted after multi collinearity diagnosis to establish factors to IFAS adherence. Adjusted odds ratio (AOR) with 95% CI; *P* value < 0.05 were considered statistically significant.

Operational Definition

Adherence to IFAS: Adherence to IFAS was self-reported and assessed by considering the total numbers of IFAS tablets consumed during their last

pregnancy. Pregnant women were recommended to consume one tablet of iron and folic acid tablets containing 30-60 mg of iron and 400 g of folic acid daily for at least 90 days. Questions were added together to assess adherence to IFAS. These include information about the number of ANC visits, the number of sachets given in each visit, and the total number of tablets given for the whole period of pregnancy. All women who took tablets for at least 90 days were considered to adhere to the IFAS program and vice versa.

Knowledge of Anaemia: The knowledge of anaemia was assessed by adding up the four multiple-choice items which included causes, symptoms, consequences, and prevention methods of anaemia. The correct answers were labelled, and the wrong answer was not labelled. Answers were categorized into two groups; those who scored medium and above were considered to have high knowledge and low knowledge when scored below medium.

Knowledge of IFAS: To understand the knowledge of IFAS among respondents, six multiple-choice questions were added together which included physical appearance (colour), time to start using IFAS, the recommended number of tablets, benefits of IFAS, and negative effects to mothers and children when the adequate tablets were not consumed. The correct answers were labelled, and the wrong answer was not labelled. Answers were classified into two groups and labelled high knowledge if scored medium and above and low knowledge of IFAS if scored below medium.

Attitude to IFAS intake: To determine the attitude to IFAS intake, five multiple-choice questions were included; likelihood to be anaemic, seriousness of anaemia, difficulty in taking IFAS, confidence in taking IFAS and personal perception to the taste and odour of IFAS. The correct answers were labelled, and the wrong answer was not labelled. Answers were classified into two groups and labelled positive attitude if scored three and above and poor attitude if scored below medium.

Practice of IFAS intake: Mothers were said to have a good practice if they took 65% or more of IFAS, equivalent to taking at least 4 days a week using recall and reporting. Those that took below that were said to have poor practice.

Perception of the Quality of Services: To measure perception, three multiple-choice questions were added up. These were the number of tablets provided, general physical check-up and service satisfaction and being given IFAS for free. The answers were ordered into two groups and labelled positive perception when scoring medium and above and negative perception when scoring below medium.

Coverage of IFAS: To estimate coverage, the number of women that were given/prescribed IFAS and counselling during pregnancy out of the entire respondents were assessed.

RESULTS

The level of adherence to IFAS revealed, that Group 2 showed the highest percentage of adherence (81.7), followed by Group 1 and Group 3 with 72.7 and 55.0 percentages respectively and least adherence of 36.8% was found in Group 4 which is the control group. The change in Hb concentrations of adherents was compared with control group in which only Group 2 (Intervention 2) showed significance. Therefore, the intervention of Group 2 who received IFAS education/counselling, IFAS distribution and text message remainder via the husbands was found to be the most effective. Despite having an adherence of 72.2% and 55.0%, statistically Groups 1 and 3 were not significant compared to the control group (Table 2).

The prevalence of anaemia and normocytic normochromic anaemia decreased in all groups but remained unchanged in Information group. Macrocytic anaemia also showed a decrease in all groups but remained unchanged in the control group. Mixed anaemia also showed a decrease in all groups but increased in the control group. However, the prevalence of microcytic hypochromic anaemia increased in all the groups with the exception of the control group which did not change (Table 3).

Data from 350 nursing mothers were collected.

Table 2: Level of Adherence within interval of study and relationship with change in Hb concentration

	Adherence Level				
	Adhered (<90)	Not Adhered (<90)	% Adherence	Mean difference Hb conc. (95% CI)	significance
GROUP 1 Intervention I (n=44)	32	12	72.7	0.329(-0.346-0.995)	0.569
GROUP 2 Intervention II (n=60)	49	11	81.7	1.049(0.428-1.669)	0.000*
GROUP 3 Information (n=20)	11	9	55.0	0.115(-0.755-0.985)	0.986
GROUP 4 Control (n=19)	7	12	36.8	Reference	

* The mean difference is significant at 0.05 level; Hb conc- Hb concentration

Most were between the age ranges of 15-24years (46.0%), had completed secondary school education (57.1%), self-employed (58.6%), earned less than 18,000 monthly (68.9%), married (100.0%), multiparous (46.9%) and had less than 4 children (68.6%) (Table 4).

Result from Table 5 shows that most of the respondents had low knowledge of anaemia (56.6%), high knowledge of IFAS (77.4%), positive attitude towards IFAS intake (81.1%), a good practice of IFAS intake (63.4%), estimated distance of less than 30 minutes to health facility (61.7%), started ANC at second trimester (73.2%), more than 3 ANC visits (84.3%), accessed IFAS through ANC (99.1%), did not receive IFAS for free (74.3%), did not experience side effects (84.9%), a positive perception of health service (91.7%), reminded by husband to take IFAS (82.9%) and counselled by health workers (97.4%). Adherence and coverage level of 66.0% and 96.6%, respectively were recorded.

Knowledge of anaemia: The findings from qualitative study concerning the signs and symptoms of anaemia included weakness, paleness, swelling, dizziness and headache. The causes of anaemia were thought to be inadequate intake of iron rich diet, inadequate intake of IFAS, malaria, typhoid, living in an unhealthy environment and a disease from God which has no cause. The health risks for lack of iron in the diet included: low blood, morbidity and mortality. Food sources rich in iron were thought to be beans, spinach, fluted pumpkin (ugwu), milk, palmoil, liver, fish, meat, maltina, egg, fruits and vegetables.

Knowledge of IFAS: The physical appearance of IFAS was described as red and yellow. The best time to start taking IFAS was thought to be "even before one is pregnant", "once one is confirmed pregnant and throughout the period of pregnancy", "once ANC is started and recommended by the health workers". The nursing mothers did not know the recommended number of tablets during the period of pregnancy. The benefits of IFAS were believed to improve appetite, improve blood, health and wellbeing of the pregnant woman and her child and also a child will be born without dirt. The negative effects to

Table 3: Prevalence of Anaemia Classifications Based on Red Blood Cell Indices in Pregnant Women

	GROUPS							
	G1 (n=43)		G2 (n=60)		G3 (n=20)		G4 (n=19)	
Anaemia morphology	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Anaemia (Hb <11g/dl)	3(7.0)	1(2.3)	5(8.3)	1(1.7)	3(15.0)	3(15.0)	5(26.3)	3(15.8)
Normocytic normochromic (normal MCV,MCH and MCHC)	26(60.5)	7(16.3)	32(53.3)	22(36.7)	9(45.0)	9(45.0)	10(52.6)	8(42.1)
Microcytic hypochromic (low MCV,MCH,MCHC)	3(7.0)	9(20.9)	5(8.3)	16(26.7)	5(25.0)	6(30.0)	4(21.1)	4(21.1)
Macrocytic (high MCV)	1(2.3)	0(0.0)	5(8.3)	1(1.7)	1(5.0)	0(0.0)	2(10.5)	2(10.5)
Mixed- Normocytic hypochromic (normal MCV, low MCH, low MCHC)	13(30.2)	4(9.3)	18(30.0)	7(11.7)	4(20.0)	0(0.0)	3(15.8)	4(21.1)

Table 4: Socio-demographic Characteristics of Women with Children Less Than 6 Months

Variables	Categories	Frequency (n)	Percentage (%)
Mothers' age (years)	15-24	161	46.0
	25-34	157	44.9
	35-49	32	9.1
Mothers' education	No formal education	42	12.0
	Primary	53	15.1
	Secondary	200	57.1
	Tertiary	55	15.7
Mothers' occupation	Not employed	116	33.2
	Self employed	205	58.6
	Civil servant	25	7.1
	Student	4	1.1
Monthly income	<18,000	241	68.9
	18,000-36,000	84	24.0
	36,000-72,000	19	5.4
	>72,000	6	1.7
Marital status	Single	0	0.0
	Married	350	100.0
	Widow	0	0.0
Parity	Primiparous	91	26.0
	Diparous	95	27.1
	Multiparous	164	46.9
Number of children	1-3	240	68.6
	4 and above	110	31.4

mothers due to inadequate intake were described as delivery problems, shortage of blood, pre-term delivery, morbidity and mortality. The negative effects to the child included: low birth weight, morbidity, mortality and a child born with mental problem.

Attitude towards IFAS intake: Some of the nursing mothers believed that they were healthy and not likely to be anaemia as they get tested regularly. A few feel that anaemia is not a serious health issue amidst the presence of other diseases like hypertension, diabetes, cancer and HIV. Some did not feel confident in taking IFAS as they reported: "I just hate taking medicine", "I prefer and feel more confident to take healthy foods like fruits and vegetables than taking IFAS" and "I'm healthy and I see no reason for a healthy person to take medicine". Despite the fact that some did not like the taste and odour of IFAS, some reported to have still adhered to intake due to its benefit.

Practice of IFAS intake: About one third (36.6%) had a poor practice as reported "I always forget to take IFAS", "I don't forget but I simply get bored of taking IFAS" and "I really want to take IFAS but it makes me to vomit throughout the day".

Time at first ANC: Most of the women started ANC at their second trimester of pregnancy (73.2%). This was described as "ANC is supposed to start when the

Table 5: Characteristic Factors Associated with IFAS among respondents

Variables	Categories	Frequency (n)	Percentage (%)
Knowledge of anaemia	High knowledge	152	43.4
	Low Knowledge	198	56.6
Knowledge of IFAS	High knowledge	271	77.4
	Low knowledge	79	22.6
Attitude to IFAS intake	Positive attitude	284	81.1
	Negative attitude	66	18.9
Practice of IFAS intake	Good practice	222	63.4
	Poor practice	128	36.6
Distance to health facility	0-30 minutes	216	61.7
	30-60 minutes	115	32.9
	>60 minutes	19	5.4
Time at first ANC	0-3 months	54	15.4
	4-6 months	256	73.2
	7-9 months	40	11.4
Number of ANC visit	Less than 4	55	15.7
	4 and above	295	84.3
Access to IFAS	ANC	347	99.1
	Not ANC	3	0.9
IFAS given for free	Yes	90	25.7
	No	260	74.3
Side effect	Yes	53	15.1
	No	297	84.9
Perception of health service	Positive	321	91.7
	Negative	29	8.3
Reminded by husband	Reminded	290	82.9
	Not reminded	60	17.1
Counselled by health workers	Counselled	341	97.4
	Not counselled	9	2.6
Adherence level	Adherence	231	66.0
	No adherence	119	34.0
Coverage level	Coverage	338	96.6
	No coverage	12	3.4

baby starts to move which is around 5th to 6th month of pregnancy", "The health workers prefer ANC to start in the second trimester may be to relieve their work load", "I feel shy to start ANC early", "I have experience because this was not the first time I gave birth, so I buy all the tablets from a pharmacy and take at home" and "I get tired of the long queue at ANC so I save myself from the stress by starting ANC later".

Table 6: Factors Associated with Adherence to IFAS among Respondents

Variables	Adherence level		COR (CI at 95%)	AOR (CI at 95%)
	A n(%)	NA n(%)		
Knowledge of anaemia				
High knowledge	112(73.7)	40(26.3)	0.538(0.340-0.852)*	0.359(0.065-1.975)
Low knowledge	119(60.1)	79(39.9)	1.00[r]	1.00[r]
Knowledge of IFAS				
High knowledge	198(73.1)	73(26.9)	3.781(2.244-6.369)*	0.613(0.095-3.955)
Low knowledge	33(41.8)	46(58.2)	1.00[r]	1.00[r]
Attitude to IFAS intake				
Positive attitude	224(78.9)	60(21.1)	0.032(0.014-0.073)*	0.638(0.105-3.891)
Negative attitude	7(10.6)	59(89.4)	1.00[r]	1.00[r]
Practice of IFAS intake				
Good practice	219(98.6)	3(1.4)	0.001(0.000-0.005)*	0.000(0.000-0.005)*
Poor practice	12(9.4)	116(90.6)	1.00[r]	1.00[r]
Distance to health facility				
0-30 minutes	151(69.9)	65(30.1)	0.738(0.278-1.959)	0.324(0.006-17.022)
30-60 minutes	68(59.1)	47(40.9)	1.185(0.434-3.232)	1.058(0.018-63.317)
>60 minutes	12(63.2)	7(36.8)	1.00[r]	1.00[r]
Time at first ANC				
0-3 months	44(81.4)	10(18.6)	0.018(0.005-0.072)*	0.138(0.004-4.595)
4-6 months	184(71.9)	72(28.1)	0.032(0.009-0.106)*	0.337(0.025-4.499)
7-9 months	3(7.5)	37(92.5)	1.00[r]	1.00[r]
Number of ANC visit				
Less than 4	7(12.7)	48(87.3)	1.00[r]	1.00[r]
4 and above	224(75.9)	71(24.1)	0.046(0.020-0.107)	0.080(0.007-0.850)*
Access to IFAS				
ANC	229(66.0)	118(34.0)	1.031(0.092-11.482)	6752.482(21.443-2126346.795)*
Not ANC	2(66.7)	1(33.3)	1.00[r]	1.00[r]
IFAS given for free				
Yes	66(73.3)	24(26.7)	0.632(0.371-1.074)	0.745(0.127-4.372)
No	165(63.5)	95(36.5)	1.00[r]	1.00[r]
Side effect				
Yes	19(35.2)	35(64.8)	4.463(2.412-8.257)*	2.259(0.325-15.700)
No	212(71.4)	85(28.6)	1.00[r]	1.00[r]
Perception of health service				
Positive	220(68.5)	101(31.5)	0.281(0.128-0.616)*	0.021(0.001-0.443)*
Negative	11(37.9)	18(62.1)	1.00[r]	1.00[r]
Reminded by husband				
Reminded	206(71.0)	84(29.0)	0.291(0.164-0.516)*	0.350(0.051-2.390)
Not reminded	25(41.7)	35(58.3)	1.00[r]	1.00[r]
Counselled by health workers				
Counselled	228(66.9)	113(33.1)	0.248(0.061-1.009)	205.859(0.918-46143.242)
Not counselled	3(33.3)	6(66.7)	1.00[r]	1.00[r]

Side effect: The side effects described were vomiting, nausea and constipation.

Reminder by husband: Many women (82.9%) have been reminded by their husbands to take IFAS. Some however stated otherwise "He doesn't know the benefit how do you expect him to remind me" and "He doesn't care".

The factors associated with adherence to IFAS were: practice of IFAS intake, number of ANC visit, access to ANC and perception of health services (Table 6)

AOR = adjusted odds ratio; CI = confidence interval; COR = crude odds ratio; = statistically significant; 1.00[r] = reference; A = Adhered; NA = Not Adhered.

DISCUSSION

Improving behaviour change communication alone cannot address larger issues around improving adherence to IFAS thus, engaging family members in maternal health is a low-cost, simple strategy that can be included in ANC. Daily oral IFAS has been recommended to reduce the risk of low birth weight in pregnancy as part of the ANC care (10). This study suggests that a combination of behaviour change communication (counselling or education), reminders, and husband engagement could be a powerful influencer in improving adherence. Male involvement in maternal health is linked to a variety of favourable health outcomes, including reduced postpartum depression, increased use of health-care services, and higher rates of competent delivery attendance (11). Pregnant women who attend health education sessions with their husbands benefit from more comprehensive postnatal visits and better birth preparation (12). A husband can help his wife throughout delivery and discuss antenatal care and family planning with her by accompanying her to antenatal appointments to the health facility, expanding his knowledge of antenatal and child care, providing financial support, and being present during the delivery (13). It may take a long time for cultural norms to shift toward male involvement in maternal health. This is due to gender disparities in pregnancy decision-making and responsibility (14). Male involvement in maternal care, on the other hand, may have an impact on the first two delays in maternity and child care, namely the decision to seek care and the time it takes to get care (15). Male involvement in mother and child health is linked to a number of recognized parameters, including the father's age, education, income, and occupation (16). Traditional gender roles can be questioned in order to encourage more men to seek prenatal care (17). However, despite having 72.2% and 55.0% adherence, Intervention I and Information groups did not show significant Hb changes when compared to the control group. Even when supplements are available, women frequently face insufficient counselling (18) and more proximal challenges to adherence, such as family criticism (19) and forgetting to take it (20). Alternative tactics are required to guarantee that women and their families are aware of the necessity of supplements and that they remember to take it (21).

Hb concentrations are normally stable until around the 16th week of pregnancy, following which they begin to fall steadily until they reach their lowest point in the second trimester as the plasma volume expands. When enough iron is available, it is expected that the Hb concentration will remain steady or slightly grow during the third trimester (22). The results of this study defied expectations, showing an increase in Hb concentration from the first to the second trimester, demonstrating that following IFAS has a significant impact on preventing Hb concentration drops in the second trimester. Other haematological markers changed in a similar way to Hb concentration, which is consistent with prior observations. Anaemia is categorized into four types based on red cell size: microcytic, normocytic, macrocytic, and mixed anaemia. Although the incidence of diverse anaemia types decreased in the current study, the prevalence of microcytic anaemia increased. Iron deficiency or malabsorption, thalassemia, and other genetic abnormalities in Hb synthesis are the chief aetiologies' in microcytic anaemia with a mean corpuscular volume (MCV) smaller than normal. Macrocytic anaemia occurs when the mean MCV is higher than normal, and is caused primarily by Vitamin B12 and folate insufficiency, as well as liver diseases. Anaemia of persistent infection and inflammation, various causes, and hemolysis or

blood loss are the most common causes of normocytic anaemia. Anaemia is characterized as hypoproliferative (low RBC production) or maturation abnormalities (high RBC loss or destruction) depending on the underlying mechanism (23). Multiple anaemia aetiologies' can coexist in economically disadvantaged women due to a poor quality of life and poor nutrition (24). High prevalence of micronutrient deficiencies that play a role in Hb production, such as vitamin A, vitamin B12, folic acid, and riboflavin (vitamin B2), has been documented (25). It's possible that a deficiency of one micronutrient affects the genesis and therapy of another micronutrient deficiency when multiple micronutrient deficiencies coexist in the same person (26).

Practice of IFAS intake, number of ANC visits, access to ANC, and perception of health services were all linked to IFAS adherence. According to Lyabo et al. (27), adherence is linked to knowledge of anaemia, understanding of IFAS, distance to health facility, IFAS given each visit, time at first visit, and number of children. This contradicts the findings of the current study. Mothers' education, monthly income, and the number of ANC visits were all linked to adherence in another study (28). Knowledge of anaemia, IFAS, and distance to a health centre were also found to be related to adherence (29). Nursing mothers had a satisfactory adherence rate of 63.4%. This could be attributed to the fact that the current investigation was conducted in a city. The experience of side effects, forgetfulness, bad taste and odour, and opinion that healthy food is more important than IFAS intake were among the reasons given by women with low practice (36.6%). The percentage of those who visited the ANC more than three times was 84.3. ANC is an important pathway for iron supplementation and adherence reinforcement. As a result, the link discovered between the frequency of ANC and the quantity of iron utilization is to be expected. Several researches have confirmed this (30, 31, 32). Women who had access to IFAS at ANC were more likely to stick to their regimen than those who did not. 91.7% of people said health care was good. The vast majority of respondents thought the health facility's services were of good quality. Many women reported spending a lot of time at the ANC queue, which was attributed to the large number of women who showed up at each visit.

The findings of this study suggests that the prevention of anaemia through strengthening the system to create health promotion and counselling, husband involvement and reminding mechanisms is paramount to improve adherence to IFAS. Renewed investment in prenatal supplementation programmes with strong behaviour change interventions at policy, provider, community and individual levels is urgently needed to achieve the global targets for anaemia reduction.

This study has 2 limitations. The study sampled respondents from only one Primary Health Care facility of the State thus; the findings cannot be generalized beyond the study district. Pregnant women in the first trimester may likely be over represented due to various reasons (the study only used presumptive symptoms of pregnancy to recruit the study subjects and there is common culture of not revealing pregnancy status in public until it becomes obvious).

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Conflict of Interest

There is no conflict of interest.

Author Contributions

Conceptualization and Methodology: SA & SMA, Data curation & analysis: SA, Investigation & original writing: SM & SMA, Writing, review & editing: SA, SMA, FTA, VA, FS & WAA, Supervision: SMA & FTA

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