Adherence status to iron with folic acid supplementation and associated factors among pregnant women receiving antenatal care at public health facilities in Northwest Ethiopia

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Abstract

Introduction: Iron and folic acid deficiency is among the most frequent nutrient inadequacies in the world, affecting expected two billion people, and causing nearly a million deaths. The adherence rate to iron with folic acid supplements remains very low in Ethiopia. Therefore, this study aimed to assess adherence status to iron with folic acid supplementation and associated factors among pregnant women receiving antenatal care at public health facilities in Northwest Ethiopia.

Methods: A facility-based cross-sectional study was conducted among pregnant women at public health facilities in the Debay Tilat Gen district from 27 February 2018 to 27 March 2018. Systematic random sampling was used to select pregnant women. Data were entered into Epidata version 3.1 and analysis was performed using SPSS version 20. Binary logistic regression was used to predict the association of the dependent variable with independent variables. Variables that showed association at a p-value of less than 0.25 in the bivariable analysis were a candidate for multivariable analysis. Finally, variables at a p-value less than 0.05 with corresponding 95% confidence interval declared statistically significant factors of iron with folic acid supplementations.

Results: A total of 400 participants were included in the study. The mean (± standard deviation) age of study participants was 26.64 (±4.37 standard deviation) years. This study revealed that about 52.8% of pregnant women attending antenatal care clinics were adherent to iron with folic acid supplementation. Counseling on iron with folic acid supplementations (adjusted odd ratio = 2.53, 95% confidence interval = 1.37–4.66; p-value < 0.003), having current anemia (adjusted odd ratio = 4.21, 95% confidence interval = 1.77–9.94; p-value < 0.001), and good knowledge of iron with folic acid supplementations (adjusted odd ratio = 2.1, 95% confidence interval = 1.29–3.44; p-value < 0.003) showed statistically significant associations with adherence to iron with folic acid supplementation.

Conclusion: This study revealed that more than half of pregnant women were adherent to iron with folic acid supplementation. Knowledge of iron with folic acid supplementations, current anemia, and being counseled were factors associated with pregnant women’s adherence to iron with folic acid supplementation. Therefore, counseling and awareness creation should be strengthened by health institutions.

Keywords

Pregnant, adherence, iron with folic acid supplementation, Debay Tilat Gen

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Introduction

Medication adherence is the degree to which patients take medications as prescribed by healthcare workers. Adherence to a drug or supplementation demonstrates the percentage of the prescribed doses of the medication taken by the patient over a predetermined period.1

Iron supplementation has a higher influence on population wellbeing by reducing maternal and perinatal mortality, and it has not reached the normal range of public health coverage.2,3 In Ethiopia, different nutrition intervention activities have been implemented in the form of community-based nutrition to prevent the occurrence of iron–folate deficiencies during pregnancy by enhancing the nutritional status of women.4 World Health Organization (WHO) recommends all pregnant women to be supplemented with iron–folic acid tablets daily for at least 3 months starting from the first antenatal care visit.5 This supplementation of iron–folic acids for pregnant women is of significant importance to reduce and prevent maternal iron deficiency anemia, different infections after delivery, low birth weight, preterm birth, and maternal death during and after delivery.5,6

Anemia is a condition in which red blood cells are insufficient to satisfy the body’s physiologic needs.7 WHO also indicates that a hemoglobin level less than 11 g/dL in pregnant women indicates anemia.5,8 In developing countries, it is a public health problem and it affects both developed and developing countries globally, leading to severe consequences for human health. Globally, iron deficiency anemia affects 1.62 billion people, which accounts for 24.8% of the population and causing a million deaths each year. Worldwide, 41.8% of pregnant women were also affected.7,9

Anemia among pregnant women is 24.1% in the Americas, 48.2% in South East Asia, 25.1% in Europe, 44.2% in Eastern Mediterranean, 30.7% in the West Pacific, and 57.1% in Africa.2 In Ethiopia, the prevalence of anemia among reproductive age group women (15–49 years) was increased from 17% in 2011 to 24% in 2016.10

Based on Ethiopia’s Demographic Health Survey (EDHS) 2016, in Ethiopia, greater than half of the pregnant women in the last 5 years missed iron–folate tablet supplementation during their recent pregnancy. Nationally in Ethiopia, almost 5% of pregnant women took iron–folic for 90 days, even though the Ministry of health recommends 180 days of supplementation. In the Amhara region, almost 46.4% did not take iron–folic acid supplementation (IFAS) and from supplemented, 38.5% took for less than 60 days while only 5.2% of women took for at least 90 days.11

In a systematic review and meta-analysis study done in Ethiopia on a total of 5808 pregnant women, the overall pooled prevalence of adherence to IFAS among pregnant women was 41.38%. Having secondary and above the educational status of the women, having an early registration of antenatal care follow-up (≤16 weeks), having anemia complication during the current pregnancy, having good knowledge of IFAS, having four times or more antenatal care follow-up, getting health education about benefit of iron and folic acid, and having good knowledge about anemia were associated risk factors for adherence to IFAS.16

In a study done in southern Ethiopia, 163 (51.4%) of participants were adherent to IFAS. The factors significantly associated with adherence to IFAS were maternal educational status, early registration for antenatal care (ANC), history of anemia during the current pregnancy, and knowledge about IFAS. Forgetfulness and fear of side effects were among the leading reasons for pregnant women to be non-adherent to IFAS.17

In a study done at Debre Tabor General Hospital, Ethiopia on a total of 241 pregnant women, 107 (44%) were adherent to IFAS. Only 39% received counseling on IFAS, and 52% had some knowledge of IFAS. Gravity, gestational age at first ANC visit, pregnant women who were provided with advice on IFAS current anemia, and had knowledge about IFAS were statistically associated with adherence to IFAS among pregnant women.18

In a study done on 22 sub-African countries on adherence to iron supplementation and its determinants, the overall prevalence of adherence to ≥90 days of iron supplementation during pregnancy was 28.7%, ranging from 1.4% in Burundi to 73.0% in Senegal. Receiving ≥4 antenatal care visits compared with no antenatal visits, secondary or higher education compared with no education, wealthy compared with poor, and older women aged 35–49 years compared with younger women aged 15–24 years were the factors affecting adherence to iron supplementation.19

Efforts were made in advocating IFAS as one of the approaches for anemia and neural tube defect control and prevention during pregnancy.20,21 However, adherence to IFAS remains very low and is a public health problem for the country.11,22 It is also believed that improved ANC service utilization especially IFAS for whatever reason does not guarantee the full prevention and control of pregnant women and newborns from anemia-related mortality and morbidity unless adherence to the supplements is optimum.4,6 Even though adherence to iron with folic acid supplementation programs has a major role in the management and control of anemia during pregnancy, no documented research has been done in the study area about IFAS. Therefore, this study would address this gap by assessing the adherence status and associated factors of IFAS among pregnant women attending ANC in public health facilities of Debay Tilat Gen district, East Gojam Zone, North West Ethiopia.

Methods

Study design and site

An institution-based quantitative cross-sectional study was conducted. This study was conducted in Debay Tilat Gen district, Northwest Ethiopia. Debay Tilat Gen district is found in East Gojjam Zone, Amhara region, 298 and 62 km
away from Addis Ababa and Debre Markos, respectively. The total population of the Debay Tilat Gen district was 148,381. Among this population, the expected number of pregnant was 5000. There are six public health centers (HCs) and 22 health posts in the Debay Tilat Gen district. This study was conducted from 27 February 2018 to 27 March 2018.

Study population
Pregnant women who have ANC visit in selected health facilities (Kuy, Debre Eyesus, Nabera, Jeremis, Yekebabat, and Yeabat HCs) at least for the second time and who took iron with folic acid (IFA) supplement for at least 1 month before the date of the study period were included. Pregnant women who were critically ill were not included in the study.

Sample size determination
The single population proportion formula was used to calculate the sample size for this study

\[ n = \frac{Z_{\alpha/2}^2 \cdot p \cdot q}{w^2} \]

where \( n \) is the minimum sample size required for the study; \( Z \) is the standard normal distribution (\( Z = 1.96 \)) with a confidence interval (CI) of 95%; \( p \) is the estimated prevalence from previous studies of adherence rate in Misha district, southern Ethiopia, (\( p = 39.2\% \)); \( q \) is 1 - \( p \); and \( w \) is a tolerable margin of error (\( d = 0.05 \)).

Therefore, based on using the above single population proportion formula, the sample size was calculated as

\[ n = \frac{(1.96)^2 \cdot 0.392 \cdot 0.608}{(0.05)^2} \]
\[ n = 366 \]

The final sample size was determined to be 403 after adding a non-response rate of 10%. Accordingly, the final sample size was calculated to be 403.

Sampling technique
First, the HCs were selected by lottery methods from total HCs. Then, the sample was proportionally allocated for each health institution based on estimated pregnant women who had ANC follow-up. Finally, the study participants were selected by systematic random sampling methods

\[ n_j = \frac{n}{N} \cdot N_j \]

where \( N_j \) is the sample size of the \( j \)th health facilities, \( N_j \) is the total population size of \( j \)th health facilities, \( n \) is the number of respondents from each health facility, and \( N \) is the total number of 2-month pregnant women in all selected public health facilities 834.

To select study participants from each HC, first, we determined the number of pregnant women attending ANC clinic for each HC according to their proportion of ANC plan, and finally, the study participant or pregnant women were selected using simple random sampling to determine the first mother by lottery method from each HC, then systematically every \( k = 2 \) mother was interviewed during their visit (Figure 1).

Study variables
The dependent variable of this study was adherence to IFAS. The independent variables include socio-demographic characteristics of respondents like age, residence, maternal education level, husband education level, family support, income, and family support. Obstetric and health-related variables included were parity, gravidity, the number of ANC visits, time of ANC registration, history of previous anemia, and history of current anemia. The health service-related variables included were adequate explanation about the tablets by providers, shortage of iron with the folic acid supplement, and distance from the health facility, waiting time in the facility. Also, women’s knowledge-related variables like knowledge on anemia, knowledge on IFAS, and supplement-related factor (side effects, forgetfulness, and fears of big weight baby) were included.

Operational definitions and definition of terms
Adherence to IFAS: it is defined as those respondents who had taken the combined iron with folic acid tablets at least 4 days per week in the previous 1 month before study periods.  

Supplementation: the process of providing micronutrients in the form of tablets, capsules, liquid, or powder to increase the dietary intake of these micronutrients by the people to improve their nutritional status.

Good knowledge about anemia: those pregnant women who answered mean value and above on questions prepared to assess comprehensive knowledge of anemia in study participants.

Poor knowledge about anemia: those pregnant women who answered below the mean value on questions prepared to assess comprehensive knowledge of anemia in study participants.

Good knowledge about IFAS: those pregnant women who answered mean value and above on questions set to assess comprehensive knowledge of IFAS of the respondents.

Poor knowledge about IFAS: those pregnant women who answered below mean value on questions set to assess comprehensive knowledge of IFAS of the respondents.
Anemia: those pregnant women whose hemoglobin level in the blood is less than 11 g/dL. 

**Data collection tool**

Data were collected using the Amharic version structured questionnaire. The questionnaire was developed after reviewing different peer-reviewed published pieces of literature on related topics.26,27 The adapted and further developed English language questionnaire was translated into the Amharic language (the language spoken in the study area). The questionnaire addressed the women’s socio-demographic factors; obstetric and health-related factors, health service-related factors; women’s knowledge-related factors; and iron with folic acid supplement-related factors. The data collection tool’s feasibility, readability, consistency of style and formatting, the likelihood the pregnant women would be able to answer the questions, and content area and the clarity of the language used was evaluated by five experts. The internal consistency reliability of the tool was also established. The overall Cronbach’s alpha of the modified tool was 0.83.

**Data collection procedure**

Six data collectors (clinical nurses from other HCs) and two supervisors were assigned. Data were collected using face-to-face interview techniques using pretested structured Amharic version questionnaires. The interviewers informed the pregnant women about all details of the

![Diagram](image_url)
Data quality assurance

To maintain data quality, data collectors were selected based on the experience of data collection and they were adequately trained about the data collection tool and the purpose of the study for 1 day before the actual data collection period. The questionnaire was developed by the principal investigator based on questions used in previous peer-reviewed published studies. Some questionnaire was adopted from similar studies that were previously conducted. A pretest was done on 5% of the sample to see the accuracy of responses, language clarity, and appropriate-ness of the tools. The amended tool was used for actual data collection. The collected data were reviewed and checked for mistakes, legibility of handwriting, completeness and consistency and any mistakes or ambiguity were cleared by the principal investigator and supervisor on daily basis during data collection. Proper coding and categorization of data were maintained for the quality of the data to be analyzed. Frequencies and cross-tabulation were done for missing and outliers.

Data processing and analysis

The data were entered into Epidata version 3.1. Analysis including data cleaning and recoding was analyzed using SPSS version 20. Descriptive statistics like frequency were used to describe the variables. The bivariate logistic regression model was fitted. Both the bivariate and multivariate logistic regression analyses were performed to assess the association between dependent and independent variables. Independent variables that showed \( p < 0.25 \) at 95% CI in the bivariate logistic regression analysis were included in multivariate logistic regression analysis. \( p \)-value < 0.05, with 95% CI and adjusted odds ratio, was considered to declare the variables significantly associated factors of the dependent variable. The finding was presented using tables and narration.

Ethical approval and informed consent

The study was approved by the research and ethics review committee of the College of Health Sciences, Debre Markos University. The ethics approval number given was AMb/961/16/11. Informed oral consent was obtained from pregnant women before being involved in the study as per the requirements of the research and ethics review committee of the College of Health Sciences, Debre Markos University. Written informed consent was waived by the research and ethics review committee of the College of Health Sciences, Debre Markos University. According to the Declaration Helsinki 64th WMA General Assembly, Fortaleza, Brazil, in October 2013, verbal informed consent is acceptable. Informed verbal consent was prepared and approved by the research and ethics review committee of the College of Health Sciences, Debre Markos University; therefore, informed verbal consent was obtained from pregnant women before being involved in the study. For pregnant women under 18 years of age, their husbands or parents gave the consent. Participants were informed that they could leave the study at any stage of the interview. Confidentiality of data was assured for participants by removing personal identifiers.

Results

Socio-demographic characteristics of the respondents

In this study, 403 study participants were involved, making a response rate of 99.3%. The mean age of study participants was 26.64 (±4.37 standard deviation (SD)) years. One hundred seventy-seven (44.3%) of the participants were found within the age group of 25–29 years.

All of the study participants were Amhara by ethnicity, 98.3% (\( n = 393 \)) were Orthodox by religion, and 98.0% (\( n = 392 \)) were married. One-fourth of pregnant women were at the secondary education level and 145 (36.2%) were farmers. Concerning pregnant women’s husband’s educational status and occupation, 103 (26.4%) have college and above and 187 (47.7%) were farmers by occupation. Almost two-thirds (64%) of the respondents were from urban residences (Table 1).

Knowledge of the respondents toward IFAS

Items scores related to knowledge level toward anemia were summed up and the mean score was calculated. Accordingly, the mean score was 10.79 (SD = 5.34). Finally, those respondents who scored mean and above were labeled as having good knowledge of anemia and those who scored below the mean were labeled as having poor knowledge of anemia. Of the respondents, 226 (56.5%) had good knowledge of anemia. For knowledge toward iron–folate supplemetations, items were summed up and the mean score was calculated. The mean score was 5.58 (SD = 1.86). Respondents who scored mean and above were labeled as having good knowledge of iron–folate supplementation. Of the respondents, 227 (56.8%) had good knowledge of iron–folate supplementation (Figure 2).
Table 1. Socio-demographic characteristics of pregnant women receiving ANC in public health facilities at Debay Tilat Gen district, Northwest Ethiopia, 2018.

| Variables (n=400) | Frequency | % |
|------------------|-----------|---|
| Age (years)      |           |   |
| 15–19            | 14        | 3.5|
| 20–24            | 115       | 28.7|
| 25–29            | 177       | 44.3|
| 30–34            | 68        | 17.0|
| 35+              | 26        | 6.5|
| Marital status   |           |   |
| Married          | 392       | 98.0|
| Other*           | 8         | 2.0|
| Religion         |           |   |
| Orthodox         | 393       | 98.3|
| Muslim           | 7         | 1.7|
| Pregnant women educational level | | |
| Cannot read and write | 75 | 18.8|
| Can read and write | 84 | 21.0|
| Primary education | 82 | 20.5|
| Secondary education | 99 | 24.7|
| College and above | 60 | 15.0|
| Husband educational level (n=392) | | |
| Cannot read and write | 33 | 8.4|
| Can read and write | 68 | 17.3|
| Primary education | 88 | 22.4|
| Secondary education | 100 | 25.5|
| College and above | 103 | 26.4|
| Husbands’ occupation (n=392) | | |
| Farmer           | 187       | 47.7|
| Government employee | 90 | 22.9|
| Self-employee    | 81        | 20.7|
| Daily laborer    | 29        | 7.4|
| Other**          | 5         | 1.3|
| Residence        |           |   |
| Urban            | 256       | 64.0|
| Rural            | 144       | 36.0|
| Pregnant women occupation | | |
| Farmer           | 145       | 36.2|
| Housewife        | 132       | 33.0|
| Government employee | 52 | 13.0|
| Self-employee    | 43        | 10.8|
| Other**          | 28        | 7.0|
| Family monthly income | | |
| <2756 birr       | 231       | 57.8|
| ⩾2756 birr       | 169       | 42.2|

ANC: antenatal care.
Other*: divorced, widowed, and single.
Other**: student and private employee.

Obstetrics and health-related characteristics

More than half (56.5%) of pregnant women were registered early for ANC (before or at 4 months of pregnancy). More than three-fifth (66%) of pregnant women were multigravid and 175 (43.8%) and 136 (34%) were primiparous and nulliparous, respectively. This study showed that only 8.5% of women had a history of anemia in the current pregnancy. The majority (86.3%) of respondents had less than four ANC visits (Table 2).

Health facility-related characteristics

Of the total respondents, 386 (96.5%) of them waited for less than or equal to 60 min in the health institutions to receive proper healthcare service. Three hundred thirty-six (84%) of respondents were provided counseling on IFA tablets. According to the study participants, 328 (82%) did not face a shortage of IFA supplements (Table 3).

IFAS adherence status of respondents

The overall self-reported adherence status of pregnant women receiving antenatal clinics was 52.8% (95% CI=48.0–57.5). Among all respondents who were adherent to iron with folic acid supplements, the most cited reasons for adherence were clinician instruction and explanation about the tablets which accounts for 164 (77.7%) followed by fear of illness 74 (35.1%) and they thought that the tablets would increase their blood volume 73 (34.6%). Regarding reasons for non-adherence, 117 (61.9%) pregnant women said the reason for non-adherence to IFA tablets was side effects followed by not knowing the importance of taking all the tablets and forgetfulness which accounts for 62 (32.8%) and 40 (21.2%), respectively. Gastric upset, nausea and vomiting, and heartburn were reported by 74 (63.2%), 63 (53.8%), and 59 (50.4%) respondents, respectively (Table 4).

Factors associated with adherence to IFA supplementation

In bivariable analysis, mother’s education, residence, current anemia, ANC visit, monthly income, first registration week, obtained counseling, anemia knowledge, and knowledge of IFAS were candidates for the multivariable model. In the multivariable model, being counseled about IFAS, knowledge of IFAS, and current anemia were associated with adherence status of IFASs.

Pregnant women who had obtained counseling about IFAS during current pregnancy were 2.53 times more likely to adhere to IFAS than those who did not obtain counseling (adjusted odd ratio (AOR)=2.53, 95% CI=1.37–4.66; p-value <0.003). Anemic pregnant women were 4.21 times more likely to be adherent to IFAS as compared to pregnant women who had not anemia (AOR=4.21, 95% CI=1.77–9.94; p-value <0.001). Pregnant women who had good knowledge of IFAS were two times more likely to adhere to IFAS as compared to those who had poor knowledge (AOR=2.1, 95% CI=1.29–3.44; p-value <0.003) (Table 5).
This study was conducted to assess the IFA supplementation adherence among pregnant women and its associated factors in Northwest Ethiopia. The findings of this study showed that more than half of pregnant women were adherent to IFAS during pregnancy. Women obtaining counseling about IFAS, those pregnant women who had current anemia, and pregnant women who had good knowledge of IFAS were independent factors affecting women’s adherence to IFAS. Side effects, not knowing the importance of taking all iron with folic acid supplements, and forgetfulness were the major mentioned reason for non-adherence to IFAS.

The overall pregnant women’s adherence to IFAS was 52.8%. This finding was in line with the results of studies conducted in Senegal (51%).

Discussion

Table 2. Obstetrics and health-related characteristics of pregnant women receiving in ANC public health facilities at Debay Tilat Gen district, Northwest Ethiopia.

| Variables                          | Frequency | % |
|------------------------------------|-----------|---|
| Gravidity                          |           |   |
| Primigravida                       | 136       | 34|
| Multigravida                       | 264       | 66|
| Parity                             |           |   |
| Nulliparous                        | 136       | 34.0|
| Primiparous                        | 175       | 43.8|
| Multiparous                        | 89        | 22.2|
| ANC visit                          |           |   |
| 2–3 visits                         | 345       | 86.3|
| ⩾4 visits                          | 55        | 13.7|
| The first registration for ANC     |           |   |
| <16 weeks                          | 226       | 56.5|
| ⩾16 weeks                          | 174       | 43.5|
| Medical illness other than anemia  |           |   |
| Yes                                | 45        | 11.3|
| No                                 | 355       | 88.7|
| History of anemia during a previous pregnancy (n=264) | | |
| Yes                                | 28        | 11|
| No                                 | 236       | 89|
| Current anemia status              |           |   |
| Anemic                             | 34        | 8.5|
| Non-anemic                         | 366       | 91.5|

ANC: antenatal care; IFA: iron with folic acid; IFAS: iron with folic acid supplementation.

Table 3. Health facility-related characteristics of pregnant women receiving ANC public health facilities at Debay Tilat Gen district, Northwest Ethiopia, 2018.

| Variables                          | Frequency | % |
|------------------------------------|-----------|---|
| Facility distance                  |           |   |
| ⩽60 min                            | 355       | 88.8|
| >60 min                            | 45        | 11.2|
| Waiting time                       |           |   |
| ⩽60 min                            | 386       | 96.5|
| >60 min                            | 14        | 3.5|
| Obtained counseling on IFA         |           |   |
| Yes                                | 336       | 84.0|
| No                                 | 64        | 16.0|
| Shortage of supplement             |           |   |
| Yes                                | 72        | 18.0|
| No                                 | 328       | 82.0|
| Provided with IFAS freely          |           |   |
| Yes                                | 350       | 87.5|
| No                                 | 50        | 12.5|

ANC: antenatal care; IFA: iron with folic acid; IFAS: iron with folic acid supplementation.

Figure 2. Knowledge status on anemia and IFAS of pregnant women receiving ANC at Debay Tilat Gen district, Northwest Ethiopia, 2018.
higher than the study conducted in Tigray, Ethiopia (37.2%), Western Amhara, Ethiopia (20.4%), and Kenya (24.5%), Southern Ethiopia (39.2%), and Afar, Ethiopia (22.9%). This difference may be due to a higher number of pregnant women with good knowledge regarding IFAS, being the majority of the respondents were from the urban, difference in socio-demographic characteristics of the respondents and the time gap between studies. Nevertheless, this study was lower than the study conducted from India (64.7%), eight rural districts of Ethiopia (74.9%), and Bench Maji Zone, Ethiopia (70.6%). This might be due to geographic location, study design, and differences in awareness of pregnant women about IFAS.

There were several reasons for non-adherence to IFAS. In this study, a relatively higher proportion of women reported side effects of drugs and forgetfulness as the main reason for non-adherence. This finding is supported by the study conducted by eight rural districts of Ethiopia, Bench Maji Zone, Ethiopia, and Southern Ethiopia. This might be due to women who had anemia during their current pregnancy were counseled in detail about the consequence of anemia for the fetus and themselves, the benefit of taking iron with folic acid tablets to prevent and treat anemia which makes them more adherent to IFAS. In addition, pregnant women may take all the prescribed supplements due to fear of illness and complications from severe anemia during pregnancy.

Having good knowledge of IFAS was more likely to be adherent than counterparts. This finding is supported by the studies conducted in Southern Ethiopia and Western Amhara, Ethiopia. This may be because knowledge helps pregnant women to understand the benefit of taking the supplement which results in a good perception about the prevention and treatment of anemia by taking iron with folic acid tablets as prescribed by healthcare providers.

**Table 4. Reasons for adherence and non-adherence of IFAS among pregnant women who were receiving ANC in public health facilities at Debay Tilat Gen district, Northwest Ethiopia, 2018.**

| Reasons for IFA supplement adherence | Frequency | % |
|-------------------------------------|-----------|---|
| Directly consumer advertising       | 37        | 17.5 |
| Free of charge                      | 18        | 8.5  |
| Reminding technique use             | 36        | 17.1 |
| Family support                      | 49        | 23.2 |
| Fear of illness                     | 74        | 35.1 |
| Clinician instruction and explanation | 164       | 77.7 |
| IFAS increases blood volume         | 73        | 34.6 |
| Reason for IFA supplement non-adherence |           |     |
| Not knowing the importance of taking all the tablets | 62 | 32.8 |
| Forgetfulness                       | 40        | 21.2 |
| Table-related issues (taste, size, color, and coating) | 19 | 10.0 |
| Side effects                        | 117       | 61.9 |
| IFA tablets supplements given insufficient | 18 | 9.5 |
| Taking other supplements and treatments | 12   | 6.4 |
| Too many tablets would harm the mother/baby and fear of big baby | 12 | 6.4 |

ANC: antenatal care; IFA: iron with folic acid; IFAS: iron with folic acid supplementation.

**Limitations of the study**

This study has certain limitations. Information on adherence status was from a self-report of taking tablets. Therefore, this study could not reject the possibility of reporting those pregnant women who did not actually take the tablets and it might suffer from recall bias and social desirability bias. Further studies should be done using observation and pill count methods.

**Conclusion**

This study revealed that more than half of pregnant women were adherent to IFAS. Knowledge of IFASs, current anemia, and being counseled were factors associated with pregnant women’s adherence to IFAS. Therefore, counseling and awareness creation should be strengthened by health institutions.
Table 5. Factors associated with adherence to IFAS among pregnant women receiving ANC in public health facilities at Debay Tilat Gen district, Northwest Ethiopia, 2018.

| Variables                  | Adherence to IFAS | Non-adherence to IFAS | COR (95%CI) | AOR (95%CI) | p-value |
|----------------------------|-------------------|-----------------------|-------------|-------------|---------|
|                            | N (%)             | N (%)                 |             |             |         |
| Mother educational status  |                   |                       |             |             |         |
| No formal education        | 82 (51.6)         | 77 (48.4)             | 1.00        | 1.00        |         |
| Primary (Grade 1–8th)      | 43 (52.4)         | 39 (47.6)             | 0.96 (0.56–1.64) | 1.14 (0.63–2.05) | 0.657   |
| Secondary and above        | 64 (40.3)         | 95 (59.7)             | 1.58 (1.01–2.46) | 1.59 (0.95–2.64) | 0.075   |
| Residence                  |                   |                       |             |             |         |
| Rural                      | 78 (54.2)         | 66 (45.8)             | 1.00        | 1.00        |         |
| Urban                      | 111 (43.4)        | 145 (56.6)            | 1.54 (1.02–2.32) | 1.39 (0.857–2.25) | 0.182   |
| Current anemia status      |                   |                       |             |             |         |
| Non-anemic                 | 181 (49.5)        | 185 (50.5)            | 1.00        | 1.00        |         |
| Anemic                     | 8 (23.5)          | 26 (76.5)             | 3.18 (1.40–7.21) | 4.21 (1.77–9.94) | 0.001*  |
| Monthly income             |                   |                       |             |             |         |
| <2756 birr                 | 115 (49.8)        | 116 (50.2)            | 1.00        | 1.00        |         |
| ≥2756 birr                 | 74 (43.8)         | 95 (56.2)             | 1.27 (0.854–1.896) | 1.11 (0.716–1.73) | 0.634   |
| Counseling on IFA          |                   |                       |             |             |         |
| Yes                        | 144 (42.9)        | 192 (57.1)            | 3.15 (1.77–5.63) | 2.53 (1.37–4.66) | 0.003*  |
| No                         | 45 (70.3)         | 19 (29.7)             | 1.00        | 1.00        |         |
| ANC visits                 |                   |                       |             |             |         |
| 2–3 visits                 | 170 (49.3)        | 175 (50.7)            | 1.84 (1.01–3.33) | 0.59 (0.31–1.13) | 0.114   |
| ≥4 visits                  | 19 (34.5)         | 36 (65.5)             | 1.00        | 1.00        |         |
| Time of registration       |                   |                       |             |             |         |
| ≥16 weeks                  | 92 (52.9)         | 82 (47.1)             | 1.00        | 1.00        |         |
| <16 weeks                  | 97 (42.9)         | 129 (57.1)            | 1.49 (1.01–2.22) | 1.41 (0.91–2.19) | 0.122   |
| Knowledge of anemia        |                   |                       |             |             |         |
| Poor knowledge             | 95 (54.6)         | 79 (45.4)             | 1.00        | 1.00        |         |
| Good knowledge             | 94 (41.6)         | 132 (58.4)            | 1.68 (1.13–2.51) | 1.09 (0.67–1.78) | 0.702   |
| Knowledge of IFAS          |                   |                       |             |             |         |
| Poor knowledge             | 102 (59.0)        | 71 (41.0)             | 1.00        | 1.00        |         |
| Good knowledge             | 87 (38.3)         | 140 (61.7)            | 2.31 (1.54–3.46) | 2.1 (1.29–3.44) | 0.003*  |

ANC: antenatal care; AOR: adjusted odd ratio; CI: confidence interval; IFA: iron with folic acid; IFAS: iron with folic acid supplementation; OR: odds ratio.

*Significant at: p < 0.05, 1.00 = reference.

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Author contributions

Birhanu D. contributed to the conceptualization. Birhanu D., Bekalu D., H.T., and G.M.K. contributed to the formal analysis. Birhanu D. and G.M.K. contributed to the development or design of methodology. Birhanu D. contributed to the entering data into computer software. G.M.K. and H.T. contributed to the supervision. H.T. and G.M.K. contributed to the validation. Birhanu D. contributed to the writing original draft. Birhanu D., H.T., Bekalu D., and G.M.K. contributed to the writing review and editing. All authors read and approved the final manuscript.

Availability of data and material

The data sets analyzed during this study are available from the corresponding author upon reasonable request.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The study was approved by the research and ethics review committee of the College of Health Sciences, Debre Markos University. The ethics approval number given was የጤሳኮ/961/16/11.

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Informed consent

Informed oral consent was obtained from pregnant women before being involved in the study as per the requirements of the research and ethics review committee of the College of Health Sciences,
Debre Markos University. Written informed consent was waived by research and ethics review committee of the College of Health Sciences, Debre Markos University. According to the Declaration of Helsinki 64th WMA General Assembly, Fortaleza, Brazil, in October 2013, verbal informed consent is acceptable. Informed verbal consent was prepared and approved by the research and ethics review committee of College of Health Sciences, Debre Markos University; therefore, informed verbal consent was obtained from pregnant women before being involved in the study. For pregnant women under 18 years of age, their husband or parents gave the consent. Participants were informed that they could leave the study at any stage of the interview. Confidentiality of data was assured for participants by removing personal identifiers.

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