Adherence to prenatal iron–folic acid supplementation and associated factors among pregnant women attending antenatal care services in Dilla town, South Ethiopia

Tizalegn Tesfaye Mamo, Eden Ashenafi, Addisu Alemayehu Gube and Tesfanew Bekele

Abstract

Background: During pregnancy, due to the physiological and hormonal change, the requirement of iron–folic acid is enhanced. Therefore, the occurrence of iron/folic acid deficiency is relatively high and it is responsible for 95% of anemia during pregnancy.

Objectives: The aim of this study was to assess adherence to prenatal iron–folic acid supplementation (IFAS) and associated factors among pregnant women attending antenatal care services at public health facilities of Dilla town.

Methods: Facility-based cross-sectional study design was employed selecting 403 pregnant women attending antenatal care services in three public health institutions of Dilla town. The women were included in the study by simple random sampling. Data were collected by interview and document review. Then it was entered into EPI Data version 3.1 and exported to SPSS version 20 for analysis. Bivariate and multivariate binary logistic regression techniques were used to identify independent predictors. A p-value <0.05 was taken as indication of statistical significance.

Results: From the total of planned 403 pregnant women, 396 participated in the study, with a response rate of 98.2%. Of these, 172 (43.4%) pregnant women were adhered to IFAS. The study also revealed that history of previous anemia (adjusted odds ratio (AOR) = 1.87; 95% confidence interval (CI): (1.01–3.47); p = 0.04), frequency of antenatal care center (ANC) visits (AOR = 2.51; 95% CI: (1.17–5.37); p = 0.01), knowledge of IFA supplement (AOR = 2.28; 95% CI: (1.36–3.82); p = 0.002), and knowledge of anemia (AOR = 2.30; 95% CI: (1.40–3.77); p = 0.001) were independent predictors of adherence to IFAS.

Conclusion: The finding of this study showed that less than half of the pregnant women were adhered to IFAS. History of previous anemia, frequency of ANC visits, knowledge of IFA supplement, and knowledge of anemia were the factors associated with adherence to IFA supplement.

Keywords

Adherence, pregnant women, iron–folic acid, Dilla

Introduction

In a woman’s life, pregnancy is a critical stage that affects the future generation. During pregnancy, due to the physiological and hormonal change, the requirement of iron–folic acid is enhanced. Therefore, the occurrence of iron/
Folic acid deficiency is relatively high.\(^1\) Pregnancy-related folic acid deficiency at conception and in early stage is associated with increased risk of congenital anomalies (e.g. neural tube defects) and other adverse pregnancy outcomes such as preeclampsia, malformations such as oro-facial clefts, fetal death, fetal growth restriction, and preterm delivery.\(^2\)

Men generally have iron homeostasis even in settings where dietary iron is low, but in women, both before pregnancy because of blood loss resulting from menses and during pregnancy, the body’s capacity to regulate iron absorption is often insufficient.\(^3\) Anemia is more prevalent in women in developing countries and usually associated with inadequate iron stores due to nutritional deficiency and intestinal helminthic infections, inadequate intake of folate, and due to malarial infection leading to chronic hemolytic states.\(^4\) Similarly, according to Ethiopian demographic and health survey of 2016, in Ethiopia, anemia prevalence among women of age 15–49 was estimated to be 24% and particularly 29% of the pregnant and lactating women were anemic. Iron deficiency anemia is the most widespread nutritional problem among pregnant women and it has also severe consequences for both their productive and reproductive roles.\(^5\)

Iron is an essential micro nutrient, which is required for hemoglobin synthesis. The most feasible mass intervention for iron supplementation to pregnant women is giving the elemental iron parallel with folic acid in the form of tablets. But for such interventions, the effectiveness and success depend on the adherence to the iron–folic acid (IFA) tablets.\(^6\)

Folic acid requirements are increased in pregnancy because of the rapidly dividing cells in the fetus and elevated urinary losses. Since neural tube closes by day 28 of pregnancy, it is recommended that, folic acid supplementation should be initiated as early as possible to decrease the risk of neural tube defects.\(^7\)

During normal pregnancies women need an estimated 6mg of iron per day and about 10mg of iron per day during the last six weeks as compared to a non-pregnant woman, which is 1.3mg of iron per day.\(^8\) Therefore, According to the WHO guideline and Ethiopian national guideline for control and prevention of micronutrient deficiencies, all pregnant women should receive and consume a standard dose of 30–60mg iron + 400µg folic acid as part of antenatal and neonatal care program to improve the pregnancy outcome and prevent the adverse effects of elemental deficiency. This program is applied for all pregnant women irrespective of their hemoglobin levels. Women are said to be adhered to iron/folic acid supplement if they took 65% or more of the supplement equivalent to taking supplement at least 4 days a week.\(^9,10,11\)

Iron–folic acid supplementation (IFAS) is the main strategy for anemia control and prevention in Ethiopia. While many developing countries including Ethiopia are now implementing IFA supplementation through antenatal care programs, only few countries have reported significant improvement in IFA supplementation and anemia control and prevention.\(^12,13,14\) In Ethiopia, iron/folate supplementation is the main strategy for anemia control and prevention. However, adherence rate remains very low. According to the finding from Ethiopian demographic and health survey (EDHS) 2016, more than half of the women (58%) did not take any iron tablets during their pregnancy in the preceding 5 years of the survey and only 5% took the supplement for more than 90 days. Despite there being improvement in adherence when compared to the finding of EDHS 2011 which was less than 1%, still the adherence is poor.\(^7\)

The major problem with this elemental iron and folic acid deficiency is related to adherence status as women fail to take the dose of tablet prescribed by health providers due to varying factors.\(^15\) Even though adherence is a major problem in IFA supplementation programs, it is even worse in case of Southern Nations Nationalities and Peoples Region (SNNPR) as there is limited information on the use of prenatal iron/folic acid supplement in this study area. Limited researches have been done and to the investigators’ best knowledge no study is done in the study area with this title. Since the Dilla town is the biggest town and business center between Southern Ethiopia and Northern Kenya, significant numbers of pregnant women in the town are merchants and they move between Ethiopia and Kenya and they may not have time for visiting health facilities during pregnancy and they give more attention for their business than their pregnancies. Therefore, this study was done to determine the adherence status and identify factors associated with adherence to IFAS among pregnant women attending ANC in health facilities of Dilla town administration.

**Materials and methods**

**Study area and period**

The study area was Dilla town, which is located in Southern Ethiopia at a distance of 359km from the capital city, Addis Ababa, on the way from Addis Ababa to Moyale. The town has administratively structured to three subtowns; Haro wolabu, Sesa, and Bedecha. Each of the subtown had three kebeles totaled to nine kebeles for Dilla town and bordered by northern part with Sidama and west and east with Guji zone. The estimated total population of the town is 99,067 of which 52,034 (52.5%) were males and 47,033 (47.5%) were females. The total pregnant women who attended the ANC service were 3079. Regarding health service, Dilla town has 1 referral hospital, 2 government health centers, 10 private clinics, and 1 governmental and 12 private pharmacies.

The study was conducted from 26 March to 13 May 2018 in public health institutions of Dilla town.
Mamo et al.

Study design
A facility-based cross-sectional study design was conducted among pregnant women during their ANC visit at public health facilities.

Target and study population
The target populations were all pregnant women who were attending ANC clinic of public health facilities in Dilla town, whereas the study populations were pregnant women who were visiting the ANC clinic of public health facilities in Dilla town for at least the second time.

Inclusion criteria
- ANC clients who took IFAS at least for a month and visited the ANC clinic during the study period.

Exclusion criteria
- This study excluded those pregnant women who were seriously ill, and mothers who were unable to respond because of physical or psychological disabilities.

Sample size determination
For the first specific objective of this study, sample size was calculated based on single population proportion formula using the following assumptions: $P = 39.2\%$ (the proportion of pregnant women adherent to iron–folic acid supplement), with 95% confidence level and 5% level of precision. Accordingly, $n = 366$.

For the second specific objective, various factors significantly associated with the dependent variable are considered and calculated using Epi Info 7 (Table 1).

Finally, the required sample size for this study was decided by taking the maximum from the first objective ($n = 366$). And by adding 10% for non-response rate, the final sample size became 403.

Sampling techniques
All public health facilities providing ANC service in Dilla town were included in this study (Dilla University Referral Hospital, Haroresa Health Center, and Oddaya’a Health Center). By using the previous months of ANC flow of pregnant women as a baseline, there were a total of 758 pregnant women in those public health facilities, who fulfill the eligibility criteria during the study period. Using this information, the total number of clients that were interviewed for each health facility was calculated based on proportionate allocation to size. And then by assuming that pregnant mothers will come to the health facility randomly, eligible mothers were taken consecutively till the sample size reaches in each facility.

Data collection tools and procedures
Data were collected using structured questionnaires adapted and modified after reviewing different literatures as appropriate to address the study objectives. To ensure reliability, the questionnaire was pre-tested on 5% of the sample size (20 pregnant women) in Wonago Health Center, which is located in one of the neighboring Districts of Gedeo Zone, and then the necessary modification was made to it. To ensure the internal validity of the questionnaire, senior scholars in the school of public health have looked into it and made comments and corrections on it. The main contents of the questionnaire were socio-economic and demographic, obstetric and medical history, health service–related issues, mother’s knowledge status on anemia and IFA supplement, and benefits of IFA tablets. The adopted and modified questionnaire was initially prepared in English and then it was translated to Gede’uffa and Amharic. To check for consistency, the questionnaire was further translated from the Gede’uffa and Amharic to English. Then it was collected through face to face exit interview. The charts of the clients were also reviewed as a secondary data.

Operational definition
Adhered to IFAS: pregnant women who were said to be adhered to IFA supplement were women that took the supplement at least 4 days per week in the preceding 1 month of the survey.

IFA supplement: a tablet containing iron and folic acid compound that was prescribed to pregnant women.

Table 1. Sample size determination for the second objective of the study.

| Factors considered                        | CI (%) | Power (%) | Ratio | % of exposed | % of unexposed | OR  | Total sample | Ref |
|------------------------------------------|--------|-----------|-------|--------------|----------------|-----|--------------|-----|
| Age of mothers                           | 95     | 80        | 1:1   | 30.0         | 12.9           | 2.9 | 202          | 16  |
| Counseling on iron folate supplement     | 95     | 80        | 1:1   | 55.9         | 24.1           | 4.0 | 84           | 16  |
| Knowledge of IFA supplement              | 95     | 80        | 1:1   | 34.1         | 12.9           | 3.5 | 142          | 18  |
| Frequency of ANC visits                  | 95     | 80        | 1:1   | 92.3         | 77.5           | 3.5 | 208          | 19  |

CI: confidence interval; OR: odds ratio; IFA: iron–folic acid; ANC: antenatal care center.
Good knowledge about anemia: those pregnant mothers who are capable of answering \( \geq \) mean score of computed knowledge–related questions on anemia.

Poor knowledge about anemia: those pregnant mothers who are capable of answering \(<\) mean score of computed knowledge–related questions on anemia.

Good knowledge about IFAS: those pregnant mothers who are capable of answering \( \geq \) mean score of computed knowledge–related questions on IFAS.

Poor knowledge about IFAS: those pregnant mothers who are capable of answering \(<\) mean score of computed knowledge–related questions on IFAS.

Data processing and analysis

Following accomplishment of data collection activities, the data were coded and entered using EPI DATA version 3.1 statistical software and exported to SPSS version 20 statistical software for analysis. Binary logistic regression was used to determine a dependent variable on the basis of continuous and/or categorical independent variables and variables with \( p \leq 0.25 \) in bivariate analysis were candidates for multivariate analysis and variables with \( p < 0.05 \) in final model were statistically significant. The degree of association between dependent and independent variables was assessed using adjusted odds ratio (AOR) at 95% confidence interval (CI).

Ethical consideration

Ethical clearance was obtained from Institutional Review Board of College of Health and Medical Sciences, Dilla University (Reference No: 008/2018). A formal letter was given to each of the public health institutions in Dilla town. In addition, verbal informed consent was obtained from study participants to confirm willingness for participation after explaining the objective of the study. Since, there are no procedures carried out on study participants, we only take verbal consent after explaining the research protocol to them. And the respondents were notified that they have the right to refuse or terminate at any point of the interview. To keep the confidentiality of the study participants, the anonymity was kept by using only codes; and to keep the privacy, each of the pregnant women were interviewed separately in a quiet room prepared for this purpose.

Results

Socio-demographic and economic characteristics of pregnant women

From a total of 403 pregnant women, 396 were participated in the study, with a response rate of 98.2%. The mean age was 27.5 (SD = \( \pm 5.1 \)) years and most participants, 233 (58.8%), were between 25 and 34 years of age. Of the study participants, 320 (82.1%) were married. About 285 (72.0%) of the study participants reside in urban areas and 185 (46.7%) of the participants were Protestants by religion followed by Orthodox followers. About 153 (38.6%) of the study participants were primary educated and 169 (42.2%) of the respondents’ husband has attended secondary and above.

About 182 (46.0%) of the participants were government employees. Regarding their monthly income as told by the participants, about 193 (48.7%) of the participants had monthly income of \( \geq 1000 \) birr (Table 2).

| Variables                          | Frequency | Percentage |
|-----------------------------------|-----------|------------|
| Age (years)                       |           |            |
| 15–24                             | 120       | 30.3       |
| 25–34                             | 233       | 58.8       |
| \( \geq 35 \)                      | 43        | 10.9       |
| Marital status                    |           |            |
| Single                            | 48        | 12.5       |
| Married                           | 325       | 82.1       |
| Others*                           | 23        | 5.8        |
| Residence                         |           |            |
| Urban                             | 285       | 72.0       |
| Rural                             | 111       | 28.0       |
| Religion                          |           |            |
| Protestant                        | 185       | 46.7       |
| Orthodox                          | 166       | 41.9       |
| Muslim                            | 30        | 7.6        |
| Others                            | 15        | 3.8        |
| Educational status of woman       |           |            |
| Cannot read and write             | 116       | 29.3       |
| Primary education (1–8)           | 153       | 38.6       |
| Secondary and above               | 127       | 32.1       |
| Educational status of husband     |           |            |
| Cannot read and write             | 110       | 27.8       |
| Primary education (1–8)           | 119       | 30.1       |
| Secondary and above               | 167       | 42.2       |
| Occupation                        |           |            |
| Housewife                         | 97        | 24.5       |
| Daily laborer                     | 31        | 7.8        |
| Merchant                          | 86        | 21.7       |
| Government employee               | 182       | 46.0       |
| Monthly income                    |           |            |
| \(<500\) ETB                      | 87        | 22.0       |
| \(500–1000\) ETB                  | 149       | 37.6       |
| \(>1000\) ETB                     | 160       | 40.4       |

ETB: Ethiopian birr.

*Others include divorced and widowed.
Obstetric and health service–related characteristics of pregnant women

The mean ± SD gestational age of the study participants was 24.0 ± 5.6 weeks. Half of the participants, 194 (49.0%), were in their second trimester. About 264 (66.5%) of the study participants were primigravida. Majority, 337 (85.1%), of the participants visited the ANC clinic in their second trimester. About 320 (80.8%) of the study participants had less than four ANC visits. Majority, 335 (84.5%), of the study participants had no history of previous anemia and about 238 (60.1%) of the study participants were not anemic during data collection time. More than half of the participants 209 (52.8%) live near the health centers and reach the health centers within 30 min and more than three-fourth 318 (80.3%) of the participants have the service within 1 h. About 302 (76.3%) of the study participants obtained adequate IFA tablets during their ANC visits. Majority of the participants, 325 (82.1%), got medical advice about IFAS (Table 3).

Knowledge of the pregnant mother

Comprehensive knowledge of anemia. Knowledge of anemia was evaluated using seven relevant knowledge items on sign and symptoms, cause, prevention, complication, and others where a score of 1 was given for correct responses and 0 for incorrect answers/do not know responses. The mean was 3. Those pregnant women who score above the mean were considered as having a good knowledge on anemia. But, those pregnant women who scored less than the mean score were labeled as having a poor knowledge on anemia. Accordingly, about 251 (63.4%) of the participants had a poor knowledge of anemia and 145 (36.6%) had a good knowledge of anemia.

Comprehensive knowledge of IFAS

Knowledge of iron folic acid supplement was also evaluated by seven relevant knowledge items on the importance of IFAS, when to take it, consequences if not taken, and importance of taking it regularly; where a score of 1 was given for correct responses and 0 for incorrect answers/do not know responses. The mean score was 4. Those pregnant women who scored above the mean score were considered as having a good knowledge on IFAS and those who scored less than the mean score were labeled as having a poor knowledge on IFAS. Accordingly, about 221 (55.8%) of the participants had a good knowledge of IFAS and 171 (44.2%) of the participants had a poor knowledge of IFAS.

Self-reported rate of adherence to IFAS

All participants (100%) used IFA tablet in the previous month and 172 (43.4%) of pregnant women were adhered to IFAS (took ≥ 4 tablets per week in the previous 1 month preceding the survey) and 224 (56.6%) were not adhered to IFAS (took < 4 tablets per week in the previous 1 month preceding the survey). The main reason for adherence to IFAS were getting medical advice (168, 97.6%) followed by fear of illness (123, 71.5%) and getting family support (46, 26.7%). From those pregnant women who got medical advice, (268, 82.4%), (215, 66.1%), and (117, 36.0%) were advised about the importance of the supplement, how and for how long it is taken, and the possible side effects of the supplement, respectively.

In this study, for 200 (89.2%) of the pregnant women who missed the dose of tablet, the reason was forgetfulness. The other reason of missing the dose of the tablet was due to side effects for 168 (75.0%) pregnant women, and

| Variables                                | Frequency | Percentage |
|------------------------------------------|-----------|------------|
| Gravidity                                |           |            |
| Primigravida                             | 264       | 66.7       |
| Multigravida                             | 132       | 33.3       |
| Parity                                   |           |            |
| Nulliparous                              | 126       | 31.8       |
| Primiparous                              | 141       | 35.6       |
| Multiparous                              | 129       | 32.6       |
| Gestational age                          |           |            |
| First trimester                          | 8         | 2.0        |
| Second trimester                         | 337       | 85.1       |
| Third trimester                          | 51        | 12.9       |
| Previous history of anemia               |           |            |
| No                                       | 335       | 84.5       |
| Yes                                      | 61        | 15.5       |
| Current anemia                           |           |            |
| No                                       | 238       | 60.1       |
| Yes                                      | 158       | 39.9       |
| Time of registration                     |           |            |
| ≥16 weeks (late)                         | 224       | 56.6       |
| <16 weeks (early)                        | 172       | 43.4       |
| Number of ANC visit                      |           |            |
| <4 visits                                | 320       | 80.8       |
| ≥4 visits                                | 76        | 19.2       |
| Waiting time in health facility          |           |            |
| 0–60 min                                 | 318       | 80.3       |
| >60 min                                  | 78        | 19.7       |
| Time spent from health facility (by foot)|           |            |
| ≤30 min                                  | 209       | 52.8       |
| >30 min                                  | 187       | 47.2       |
| Obtain adequate IFAS                     |           |            |
| No                                       | 94        | 23.7       |
| Yes                                      | 302       | 76.3       |
| Got medical advice about IFAS            |           |            |
| No                                       | 71        | 17.9       |
| Yes                                      | 325       | 82.1       |

ANC: antenatal care center; IFAS: iron–folic acid supplementation.

Table 3. Obstetric and health service–related characteristics of pregnant mothers in public health facilities of Dilla town, South Ethiopia (N=396).
the perception that the tablet would harm the mother and her fetus for 103 (46.0%) pregnant women.

Factors associated with adherence to IFAS

Both bivariate and multivariate analyses were used to investigate the association of predictors with IFA supplement. Variables that showed an association with IFA supplement at p-values less than 0.25 levels were entered into multivariate logistic Regression.

Out of all variables, age of the mother, educational status of mothers, occupation of the mothers, monthly family income, number of pregnancy, gestational age, time of registration at ANC, frequency of ANC, distance from health facility, waiting time in the health facility, availability, counseling about IFAS, knowledge of mothers about anemia, knowledge of mother about IFAS, previous history of anemia, current status of anemia were candidate variables for multivariate logistic regression analysis.

Finally, after adjusting for potential confounders using multivariate binary logistic regression model, previous history of anemia, frequency of ANC visits, knowledge of IFA supplement, and knowledge of anemia were found to be statistically significant predictors for adherence to IFA supplement.

Adherence to IFA supplement has increased with previous history of anemia in the women. Pregnant women who had previous history of anemia were 1.8 times (AOR = 1.87, 95% CI (1.01, 3.47), p=0.04) more likely to be adhered to IFA supplement than those pregnant women who had no history of anemia.

Moreover, frequency of ANC visit has also been an important predictor of adherence to IFA supplement. Pregnant women who visited ANC four times and above were 2.5 times (AOR = 2.51, 95% CI (1.17, 5.37), p=0.01) more likely to be adhered to IFAS compared to those pregnant women who visited ANC less than four times.

Pregnant women who had a good knowledge of iron folate supplement were 2.2 times (AOR=2.28, 95% CI (1.38, 3.82), p=0.002) more likely to be adhered to IFAS than those pregnant women who had poor knowledge of IFAS. Similarly, pregnant women who had a good knowledge of anemia were 2.3 times (AOR=2.30, 95% CI (1.40, 3.77), p=0.001) more likely to be adhered to IFAS compared to those who had poor knowledge of anemia (Table 4).

Discussion

This study revealed that 43.4% of pregnant women were adherent to IFA supplement (took ≥ 4 tablets per week in the previous 1 month preceding the survey). This implies that substantial proportion of pregnant women do not take the prescribed dose of tablets. Proportion of women who were adherent to IFA supplement in this study was comparable with a study conducted in Egypt (41.1%) and Philippines (40.1%).18 In addition, the result is consistent with a study conducted in Bahir Dar, Northwest Ethiopia (41.5%).19

The adherence level in this study is lower compared to the studies conducted in Sudan, South India, and Nepal, which was 64.7%, 55.7%, and 92.1%, respectively.8,14,20 The variation may be due to the difference in lifestyle and the given low attention for adherence issue due to lack of awareness. Similarly, the adherence level was also much lower than the study conducted in Hossana town, which was 69.6%.21 The possible reason would be the differences in awareness of pregnant women about IFAS and educational status. But this result is higher when compared to the findings of the studies conducted in North Western Zone of Tigray (37.2% in urban and 28.9% in rural), Assaita district (22.9%), and Mecha district (20.4%).12,22,23 The probable reason might be the difference in geographic locations and time gap between the studies.

This study revealed that pregnant women who had previous history of anemia are 1.8 times more likely to be adherent to IFAS than those pregnant women who had no history of anemia. This finding was supported by the studies done in North Western Zone of Tigray, Nepal, and Western Iran.12,14,24 The possible reason would be pregnant women who had history of anemia had better experience in the prevention and treatment of iron-deficiency anemia.

In this study, pregnant women who had visited ANC service for four and more times are 2.5 times more likely to be adherent to IFAS than those pregnant women who visited ANC service less than four times. This finding is consistent with the findings of the studies in Misha district, Philippines, Urban Islam, and Eritrean refugee camps (Northern Ethiopia).16,18,25,26 The possible reason of this would be the health providers will advise the pregnant woman during their ANC visits where there are frequent ANC visits which will increase awareness on IFAS.

This study showed that pregnant women who had a good knowledge of anemia are 2.3 times more likely to be adherent to IFAS than those women who had a poor knowledge of anemia. This finding is consistent with the findings of the studies carried out in Misha district, Amhara region, and Nigeria.15,16,23

The other factor significantly associated with adherence of IFAS was knowledge of IFAS. Mothers who had a good knowledge of IFAS are two times more likely to be adhered to IFAS than those mothers who had a poor knowledge of IFAS. This finding is consistent with the findings of the studies done in South India, Amhara region, Nigeria, Pakistan, and eight rural districts of Ethiopia.8,15,23,27,28 The possible reason is that those pregnant women who had a good knowledge on anemia and IFAS had better perception of IFAS and are aware of the benefits, side effects, and the complications, if missed.
| Variables                        | Adherence status | Crude adjusted |                  |                  |
|---------------------------------|------------------|----------------|------------------|------------------|
|                                 | Not adhered (%)  | Adhered (%)     | OR (95% CI)      | OR (95% CI)      |
| **Age**                         |                  |                |                  |                  |
| 15–24                           | 74 (61.7)        | 46 (38.3)      |                  |                  |
| 25–34                           | 126 (54.1)       | 107 (45.9)     | 1.36 (0.87–2.14) | 0.85 (0.50–1.46) |
| ≥35                             | 24 (55.8)        | 19 (44.2)      | 1.27 (0.62–2.59) | 1.13 (0.49–2.59) |
| **Mother education**            |                  |                |                  |                  |
| Cannot read and write           | 60 (51.7)        | 56 (48.4)      |                  |                  |
| Primary (1–8)                   | 86 (56.2)        | 67 (43.8)      | 0.83 (0.51–1.35) | 1.04 (0.51–2.13) |
| Secondary and above             | 78 (61.4)        | 49 (38.6)      | 0.67 (0.40–1.12) | 0.89 (0.44–1.81) |
| **Occupation of mother**        |                  |                |                  |                  |
| Housewife                       | 54 (55.7)        | 43 (44.3)      |                  |                  |
| Daily labor                     | 21 (67.7)        | 10 (32.3)      | 0.59 (0.25–1.40) | 0.47 (0.18–1.23) |
| Merchant                        | 53 (61.6)        | 33 (38.4)      | 0.78 (0.43–1.41) | 0.77 (0.39–1.51) |
| Government employee             | 96 (52.7)        | 86 (47.3)      | 1.12 (0.68–1.84) | 0.82 (0.46–1.47) |
| **Frequency of ANC**            |                  |                |                  |                  |
| <4 visit                         | 54 (71.1)        | 22 (28.9)      |                  |                  |
| ≥4 visit                         | 170 (53.1)       | 150 (46.9)     | 2.16 (1.25–3.72) | 2.51 (1.17–5.37)*|
| **Gravida**                     |                  |                |                  |                  |
| Primigravida                    | 143 (54.2)       | 121 (45.8)     |                  |                  |
| Multigravida                    | 81 (61.4)        | 51 (38.6)      | 0.74 (0.48–1.13) | 0.99 (0.58–1.68) |
| **Gestational age**             |                  |                |                  |                  |
| First trimester                 | 3 (37.5)         | 5 (62.5)       |                  |                  |
| Second trimester                | 187 (55.5)       | 150 (44.5)     | 0.48 (0.11–2.04) | 0.44 (0.79–2.44) |
| Third trimester                 | 34 (66.7)        | 17 (33.3)      | 0.30 (0.06–1.40) | 0.25 (0.42–1.54) |
| **Time of registration**        |                  |                |                  |                  |
| ≥16 weeks (late)                | 127 (59.6)       | 86 (40.4)      |                  |                  |
| <16 weeks (early)               | 97 (53.0)        | 86 (47.0)      | 1.30 (0.87–1.95) | 1.37 (0.84–2.22) |
| **Counseling on IFAS**          |                  |                |                  |                  |
| No                              | 46 (64.8)        | 25 (35.2)      |                  |                  |
| Yes                             | 178 (54.8)       | 147 (45.2)     | 1.52 (0.89–2.59) | 0.98 (0.52–1.82) |
| **Previous history of anemia**  |                  |                |                  |                  |
| No                              | 198 (59.1)       | 137 (40.9)     |                  |                  |
| Yes                             | 26 (42.6)        | 35 (57.4)      | 1.94 (1.12–3.38) | 1.87 (1.01–3.47)*|
| **Current anemia**              |                  |                |                  |                  |
| No                              | 142 (59.7)       | 96 (40.3)      |                  |                  |
| Yes                             | 82 (51.9)        | 76 (48.1)      | 1.37 (0.91–2.05) | 0.98 (0.59–1.65) |
| **Waiting time in the health facility** |          |                |                  |                  |
| 0–60 min                        | 187 (58.8)       | 131 (41.2%)    |                  |                  |
| >60 min                         | 37 (47.4%)       | 41 (52.6%)     | 1.58 (0.96–2.60) | 1.02 (0.48–2.16) |
| **Obtain adequate IFA tablets** |                  |                |                  |                  |
| No                              | 60 (63.8%)       | 34 (36.2%)     |                  |                  |
| Yes                             | 164 (54.3)       | 138 (45.7%)    | 1.48 (0.92–2.39) | 0.72 (0.40–2.31) |
| **Distance from health facility** |                  |                |                  |                  |
| ≤30 min                         | 131 (62.7)       | 78 (37.3)      |                  |                  |
| >30 min                         | 93 (49.7)        | 94 (50.3)      | 1.69 (1.13–2.53) | 1.12 (0.66–1.90) |
| **Knowledge of anemia**         |                  |                |                  |                  |
| Poor                            | 164 (65.3)       | 87 (34.7)      |                  |                  |
| Good                            | 60 (41.4)        | 85 (58.6)      | 2.67 (1.75–4.06) | 2.30 (1.40–3.77)**|
| **Knowledge of iron**           |                  |                |                  |                  |
| Poor                            | 121 (69.1)       | 54 (30.9)      |                  |                  |
| Good                            | 103 (46.6)       | 118 (53.4)     | 2.56 (1.69–3.89) | 2.28 (1.36–3.82)**|

(Continued)
Table 4. (Continued)

| Variables | Adherence status | Crude adjusted |
|-----------|------------------|----------------|
|           | Not adhered (%)  | Adhered (%)     | OR (95% CI) | OR (95% CI) |
| Monthly income | <500             | 39 (44.8)       | 48 (55.2)   | 1           | 1           |
|           | 500–1000         | 94 (63.1)       | 55 (36.9)   | 0.47 (0.27–2.74) | 0.60 (0.31–1.14) |
|           | >1000            | 91 (56.9)       | 69 (43.1)   | 0.61 (0.36–1.04) | 0.89 (0.44–1.81) |

OR: odds ratio; CI: confidence interval; IFAS: iron–folic acid supplementation; 1: reference variable.
Bold values indicate significant association in multiple logistic regressions.
*p < 0.05, **p < 0.01.

Conclusion

The finding of this study showed that less than half of the pregnant women were adherent to IFAS. And frequency of ANC visits, previous history of anemia, knowledge of anemia, and knowledge of IFAS were found to be significantly associated with adherence to IFAS.

Limitations of the study

As both dependent and independent variables were determined at one point in time, it is impossible to indicate which comes first.

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.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iD

Addisu Alemayehu Gube https://orcid.org/0000-0002-8389-9554

References

1. Ibrahim ZM, El-hamid SABD, Mikhail H, et al. Assessment of adherence to iron and folic acid supplementation and prevalence of anemia in pregnant women. Med J Cairo Univ 2011; 79(2): 2422–2424.
2. King JC. Physiology of pregnancy and nutrient metabolism. Am J Clin Nutr 2000; 71(5 Suppl): 1218S–1225S.
3. Ogundipe O, Hoyo C, Oneko O, et al. Factors associated with prenatal folic acid and iron supplementation among 21, 889 pregnant women in Northern Tanzania: a cross-sectional hospital-based study. BMC Public Health 2012; 12(1): 481.
4. Stoltzfus RJ. Iron interventions for women and children in low income countries. J Nutr 2011; 141(4): 756S–762S.
5. Hanich S, Ha TT, Simpson JA, et al. The effect of intermittent antenatal iron supplementation on maternal and infant outcomes in Rural Viet Nam: a cluster randomised trial. PLoS Med 2013; 10: e1001470.
6. World Health Organization. Postpartum care of the mother and newborn: a practical guide. Geneva: World Health Organization, 1998.
7. Central Statistical Agency (CSA) [Ethiopia] and ICF. 2016 Ethiopia Demographic and Health Survey Key Findings. Addis Ababa; Rockville, MD: Central Statistical Agency (CSA) [Ethiopia] and ICF; https://dhsprogram.com/pubs/pdf/FR328/FR328.pdf
8. Mithra P, Unnikrishnan B, Thapar R, et al. Compliance with iron-folic acid (IFA) therapy among pregnant women in an urban area of south India. Air Health Sci 2013; 13: 880–885.
9. WHO. Guideline: Daily iron and folic acid supplementation in pregnant women. Geneva: World Health Organization, 2012.
10. World Health Organization. World Malaria Report, 2012, https://www.who.int/malaria/publications/world_malaria_report_2012/wmr2012_factsheet.pdf
11. Steiner J and Ema F. The language of medication taking. Ann Intern Med 2014; 132: 926–930.
12. Gebre A, Mulugeta A and Etana B. Assessment of factors associated with adherence to iron-folic acid supplementation among urban and rural pregnant women in north western zone of Tigray, Ethiopia: comparative Study. Int J Food Sci Nutr 2015; 4(2): 161–168.
13. Federal Democratic Republic of Ethiopia. National Nutrition Programme, 2015, https://extranet.who.int/nutrition/gina/sites/default/filesstore/ETH%202013%20National%20Nutrition%20Programme.pdf
14. Neupane N, Sharma S and Kaphle HP. Factors affecting compliance of iron and folic acid among pregnant women attaining western regional hospital, Pokhara, Nepal. Int J Res Current Develop 2015; 1(1): 43–57.
15. Ugwu EO, Olibe AO, Obi SN, et al. Determinants of compliance to iron supplementation among pregnant women in Enugu, Southeastern Nigeria. Niger J Clin Pract 2014; 17(5): 608–612.
16. Areaga Sadore A, Abebe Gebretsadik L and Aman Hussen M. Compliance with iron-folate supplement and associated factors among antenatal care attendant mothers in Misha District, South Ethiopia: community based cross-sectional study. J Environ Public Health 2015; 2015: 781973–781978.
17. Shewasindic S and Negash S. Adherence and associated factors of prenatal iron folic acid supplementation among
pregnant women who attend antenatal care in health facility at Mizan-Aman Town, Bench Maji Zone Ethiopia 2015. *J Preg Child Health* 2017; 4: 335.

18. Dawe D. Iron supplementation compliance among pregnant women in Bicol, Philippines. *Public Health Nutr* 2014; 11: 76–82.

19. Mekonnen A, Awoke Z and Goba G. Adherence and associated factors on iron folate supplement use among pregnant women attending antenatal care in selected health facilities of Bahir Dar town Northwest Ethiopia. *World J Pharmaceut Life Sci* 2015; 3(1): 79–83.

20. Abdullahi H, Gasim GI, Saeed A, et al. Antenatal iron and folic acid supplementation use by pregnant women in Khartoum, Sudan. *BMC Res Notes* 2014; 7(1): 498.

21. Jikamo B and Samuel M. Non-adherence to iron/folate supplementation associated factors among pregnant women who attending antenatal care visit in selected public health institutions at hosanna town Southern Ethiopia, 2016. *J Nutr Disorders Ther* 2016; 8: 230.

22. Gebre A, Debie A, Berhane A, et al. Determinants of compliance to iron folic acid supplementation among pregnant women in pastoral communities of Afar region: the cases of Mille and Assiata districts, Afar, Ethiopia. *Med Res Chron* 2017; 4(4): 352–362.

23. Taye B, Abeje G and Mekonen A. Factors associated with compliance of prenatal iron folate supplementation among women in Mecha District, Western Amhara: a cross-sectional study. *Pan African Med J* 2015; 20: 43.

24. Siabani S, Siabani S, Siabani H, et al. Determinants of compliance with iron and folate supplementation among pregnant women in West Iran: a population based cross-sectional study. *J Family Reprod Health* 2018; 12(4): 197–203.

25. Dutta AJ, Patel PB and Bansal RK. Compliance to iron supplementation among pregnant women: a cross-sectional study in Urban Slum. *Nat J Community Med* 2014; 5(4): 457–462.

26. Getachew M, Abay M, Zelalem H, et al. Magnitude and factors associated with adherence to Iron-folic acid supplementation among pregnant women in Eritrean refugee camps, northern Ethiopia. *BMC Pregnancy Childbirth* 2018; 18: 83.

27. Nisar Y, Bin Alam A, Aurangzeb B, et al. Perceptions of antenatal iron-folic acid supplements in urban and rural Pakistan: a qualitative study. *BMC Pregnancy Childbirth* 2014; 14(1): 1–12.

28. Gebremedhin S, Samuel A, Mamo G, et al. Coverage, compliance and factors associated with utilization of iron supplementation during pregnancy in eight rural districts of Ethiopia: a cross-sectional study. *BMC Public Health* 2014; 14: 607.