Reproductive Health

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Compliance with iron-folate supplementation among pregnant women in Southern Ethiopia: a multi-center cross-sectional study

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Abstract

Background Iron-folate supplementation is a vital and economical approach to preventing iron deficiency anemia in pregnant women. The World Health Organization targets 70% compliance, while Ethiopia's 2030 National Nutrition Program-II aims for 50% of pregnant women receiving iron-folate for 90 days by 2023. Despite various initiatives, compliance in Ethiopia continues to be low. This study examined compliance with iron-folate supplementation and its influencing factors among pregnant women in Southern Ethiopia.

Methods A multi-center cross-sectional study was conducted among 604 systematically selected pregnant women from April 1 to 30, 2022, using structured interviewer-administered questionnaires. Data were collected via the open data kit application and analyzed in the SPSS version 25 software. Bivariable and multivariable analyses were used to identify factors associated with compliance. An odds ratio with a 95% confidence interval was used to assess the direction and strength of the association.

Results Iron-folate supplementation compliance was 47.7% [95% CI 43.71%, 51.68%]. Being an urban dweller [AOR: 2.8, 95% CI 1.70, 4.86], attending primary education [AOR: 2.0, 95% CI 1.13, 3.75], having secondary education or more [AOR: 5.3, 95% CI 2.83, 10.22], being multiparous [AOR: 1.9, 95% CI 1.05, 3.52], receiving home visits [AOR: 2.0, 95% CI 1.08, 3.83], receiving counseling on iron-folate [AOR: 2.5, 95% CI 1.30, 4.78], possessing good knowledge of iron-folate [AOR: 3.1, 95% CI 2.04, 4.72], and having a good understanding of anemia [AOR: 3.2, 95% CI 2.12, 4.88] were significantly associated with compliance.

Conclusion Iron-folate supplementation compliance among pregnant women in Southern Ethiopia is progressing towards the 2030 national nutrition program target, although it remains below World Health Organization recommendations. Therefore, it is crucial to strengthen home visits and counseling to enhance knowledge of Iron-folate and anemia, as well as ensure consistent intake of iron-folate.

Keywords Compliance, Iron-folate supplementation, Pregnant women, Ethiopia

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Background

Anemia during pregnancy is defined by the World Health Organization (WHO) as hemoglobin levels less than 11 mg/dL. The most prevalent causes of anemia during pregnancy are iron, folate, and vitamin B-12 deficits [1]. During pregnancy, there is a 2–threefold increase in iron and a 10–20 fold increase in folate requirements. Thus, pregnant women are more likely to develop an iron and folate deficit due to increased iron and folate requirements caused by physiological and hormonal changes, as well as fetal demand [2, 3]. Diet alone will not suffice to meet the increased need for these nutrients. As a result, iron and folic acid deficiencies can emerge if iron and folic acid are not supplied in the food during pregnancy [4].

Anemia is a serious condition that endangers both the mother and child, potentially leading to maternal and infant mortality. Pregnant women with iron deficiency face heightened risks of infection, miscarriage, intrauterine growth restriction, low birth weight, preterm birth, pre-eclampsia, and increased maternal and perinatal mortality. Anemia during pregnancy may also cause cardiovascular dysfunction, impair physical and mental performance, reduce immune function, diminish prepartum blood reserves, and increase the likelihood of postpartum blood transfusion. Additionally, folate deficiency can lead to anemia in the mother and birth defects in the fetus [1, 5–7].

Pregnancy offers a significant challenge since micronutrient intake throughout preconception and pregnancy influences fetal development and the mother's health. Inadequate diet and dietary practices during pregnancy can result in iron and folate deficits, with poor health consequences for both the mother and the fetus or baby [8]. Iron-folate supplementation (IFS) is a highly effective and cost-efficient strategy to reduce maternal anemia by 70% and iron-deficient anemia by 57% in pregnant women [9–11]. The WHO recommends a daily oral intake of 30 to 60 mg of elemental iron and 400 μg (0.4 mg) of folic acid for pregnant women to achieve 70% compliance and prevent maternal anemia, puerperal sepsis, low birth weight, and preterm birth [10].

WHO defines compliance with IFS as taking 65% or more of prescribed doses, equating to at least four days of supplementation per week [10]. The major concern with IFS during pregnancy in Sub-Saharan African countries is compliance, as a population-based study found that only 28.7% of pregnant women used iron supplements for 90 days or more [12, 13]. According to the Ethiopian Mini-Demographic and Health Survey (EDHS) 2019, national compliance with IFS for pregnant women for the stated duration of ≥ 90 days was 11% [14]. In 2017, only 25% of pregnant women in Arba Minch town, the administrative center of Gamo Zone, took the supplement for at least 90 days [15]. Non-compliance to IFS results in anemia during pregnancy [7]. According to the EDHS 2016, 24% of women of reproductive age (15 – 49 years) and 29.1% of pregnant women were anemic [16].

The 2030 National Nutrition Program-II of Ethiopia targets to reduce the prevalence of anemia in women of childbearing age to 18% by 2024 and 12% by 2029; to reduce the prevalence of anemia among pregnant women to 14%; and to increase the compliance of IFS for at least 90 days during pregnancy to 40% by 2020, 50% by 2023 and 90% by 2029 [17]. Despite the efforts made in Ethiopia, IFS compliance is very low both at the national and regional levels [14].

Studies have identified factors influencing compliance with iron-folate supplementation. These include socio-demographic factors like age, education, marital and occupational status, family size, and wealth [18–25]; obstetric factors such as gravidity, parity, antenatal care visits, and anemia history [4, 9, 11, 15, 21, 22, 26–36]; health service factors like distance to facilities, counseling, availability of supplements, and facility type [4, 20, 23, 25, 27–29, 33, 34, 36, 37]; and client-related factors including knowledge of anemia and supplements, perceptions, family support, fear of side effects, and forgetfulness [4, 9, 11, 20, 21, 23, 26, 30, 31, 34, 37–40].

The current evidence on compliance with IFS and the factors that contribute to it in Ethiopia, especially in the Gamo Zone, is limited. It is important to gain a better understanding of the problem by examining previously unexplored factors such as health extension workers' home visits and other health service-related factors. Therefore, this study examined compliance with IFS and its influencing factors among pregnant women receiving antenatal services in Gamo Zone, Southern Ethiopia.

Methods

Study design, setting, and periods

A multi-center cross-sectional study was conducted among pregnant women receiving antenatal services at selected public health facilities in Gamo Zone, Southern Ethiopia, from April 1 to 30, 2022. The administrative center of Gamo Zone is Arba Minch town, located 505 km south of Addis Ababa, the capital city of Ethiopia. Gamo Zone has one general hospital, five primary hospitals, fifty-seven health centers, and three hundred three health posts offering maternal and child care services. The health department in the Zone reports 376,413 women of childbearing age in 2022. Of those, 55,897 pregnant women who receive antenatal care (ANC) across all facilities, and 54,669 pregnant women receive IFS in these health facilities [41].

Population

All pregnant women who attended ANC in public health facilities of Gamo Zone were the source population. Whereas, randomly selected pregnant women who had at least one ANC in selected public health facilities of Gamo Zone and who fulfilled eligibility criteria were the study population. All pregnant women who attended ANC in public health facilities of Gamo Zone and who took IFS for at least one month before the study period were included in the study. Pregnant women not able to respond to the interview during the data collection period due to serious illness, and those whose age was < 18 years were excluded from the study.

Sample size determination and sampling procedure

The sample size was determined using a proportion of compliance to IFS by the single population proportion formula. The assumptions to be considered during the determination of the sample size were: 52.9% proportion of compliance to IFS in West Dembia district, Northwest Ethiopia [31], 95% confidence level, and a 5% margin of error. After considering the design effect of 1.5 and a 5% non-response rate, a sample size of 604 was taken for conducting the study. A multistage sampling technique was used to select study participants. First, a total of 63 public health facilities providing maternal and child health care services in Gamo Zone were stratified into 57 health centers and 6 hospitals. Out of those stratified health facilities, 2 hospitals and 11 health centers were selected for the study using the lottery method. The number of participants to be included in the study from each selected health facility was determined using proportional allocation based on the average monthly client size attending ANC and those receiving iron and folic acid supplements IFS, as recorded in the ANC registration books. The total average client size for these facilities was 1462 pregnant women. Participants were then selected using a systematic random sampling technique. The sampling interval (K) was calculated by dividing the total average monthly client size of 1462 pregnant women by the total calculated sample size of 604 pregnant women for the study. This resulted in a sampling interval (K) of approximately 2.4, which we rounded down to 2 for practical implementation. The first participant was randomly chosen, and subsequent participants were selected based on this interval until the required sample size was achieved (Fig. 1).

Study variables

IFS compliance was the dependent variable. Sociodemographic and economic factors such as age, residence, marital status, women's and husbands' education, women's and husbands' occupational status, family size, and household wealth index; obstetric and gynecologic-related factors such as initiation time of ANC service, number of ANC visit, gravidity, parity, history of stillbirth and abortion, history of anemia and anemia during current pregnancy; health service-related factors such as distance to health facilities, IFS counseling, availability of IFS, types of health facility, health extension workers' provision of health education and counseling during home-to-home visit; and client-related factors such as knowledge of anemia, knowledge of IFS, perception towards anemia and IFS, forgetfulness, fear of side effect, presence of any disease before and during pregnancy were independent variables.

Data collection instrument and procedure

A questionnaire was adapted after reviewing relevant literature to collect data on socio-demographic and economic characteristics, obstetric and gynecologic, health service-related, and client-related factors. It was prepared first in English and then translated into Amharic. Data were collected by face-to-face interview technique using a pretested semi-structured interviewer-administered questionnaire with mobile data collection platform open data kit (ODK) software by fourteen Midwives who have exposure to providing maternal and child health care services and two health officers supervised the overall data collection process. Pregnant women were screened at the registration counter, and those eligible for the study were interviewed following our sampling technique before their consultation with health providers for the current ANC visit. We ensured their voluntary participation without any hesitation regarding the services provided during their visit, regardless of their involvement in the study. The specific questionnaire that we employed for our study can be located within the supplementary file provided (S1 File).

Operational definitions

Compliance to IFS: If the pregnant mother took the supplement at least four days per week in the month preceding the study [20, 23, 40]. Compliance was assessed through self-reported information from participants, supplemented by pharmacy records documenting medication withdrawals.

IFS Knowledge: This was assessed by asking women eight questions related to IFS knowledge, including topics such as the Iron/Folate drug, the health benefits of IFS for the fetus and child, beliefs about the risks of taking IFS, and knowledge of the duration for which IFS should be taken. Participants who scored at or above the mean on these questions were classified as

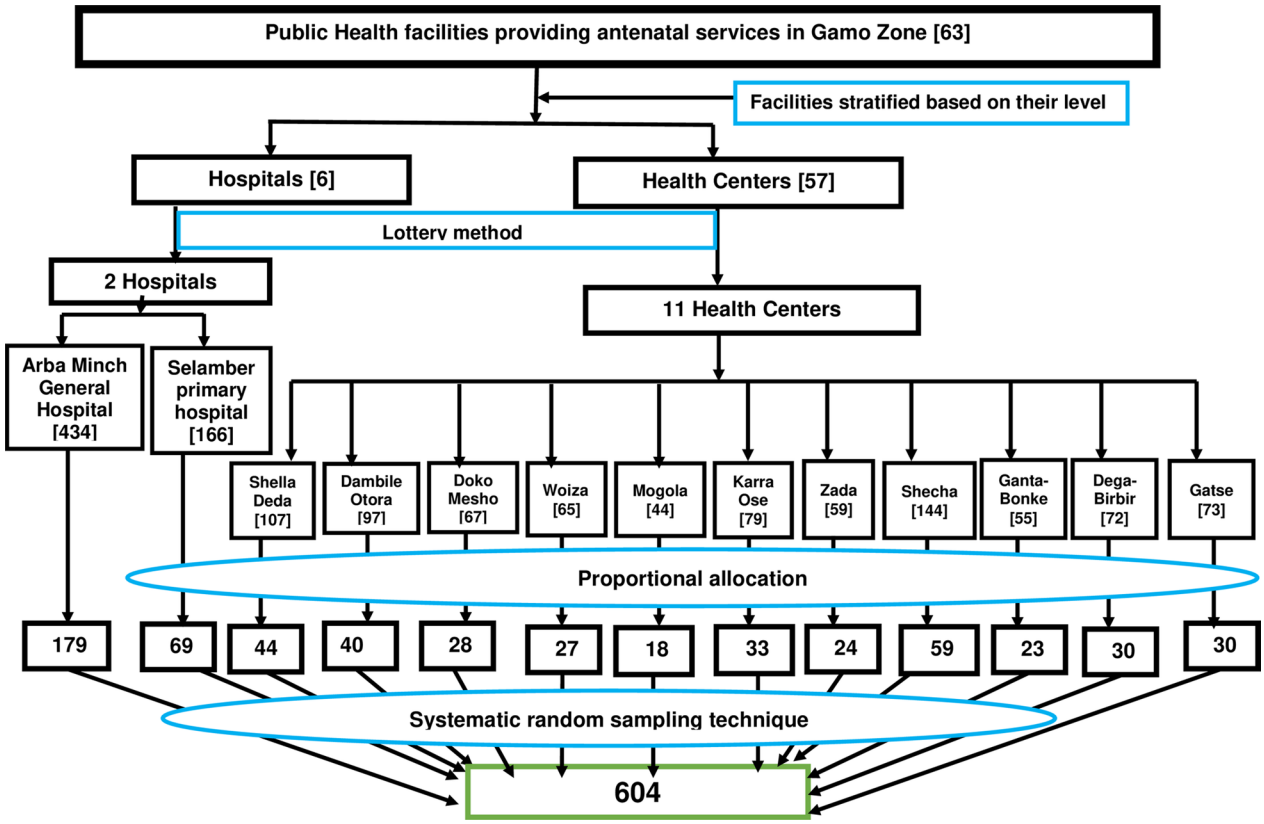

Fig. 1 Schematic presentation of sampling procedure to get study participants from each public health facilities of Gamo Zone, Southern Ethiopia, 2022

having "good knowledge," while those scoring below the median were categorized as having "poor knowledge" [9, 37, 38].

Knowledge of anemia: It was measured through six questions about anemia, including awareness of the illness, its causes, consequences during pregnancy, susceptibility factors, and prevention methods. Women who scored at or above the mean on these questions were considered knowledgeable about anemia [30, 37, 38].

Perceptions toward anemia and IFS: This was evaluated using ten closed-ended items rated on a 5-point Likert scale ("1 = strongly agree," "2 = agree," "3 = not sure," "4 = disagree," and "5 = strongly disagree"). A combined score based on the mean of these ten questions was calculated and classified as "positive" if the score was below the mean value and "negative" if the score was equal to or greater than the mean value [43].

Household wealth index: Women answered 25 closed-ended questions to determine the wealth index level of their households. A correct response received a score of "1", while an incorrect response received a score of "0" [42]. The data was then analyzed using principal component analysis (PCA) to reduce the 25 elements to a single factor known as the household wealth index level [16]. Finally, it was divided into five quintiles.

Data quality assurance

The training was given intensively for data collectors and supervisors for one day. Moreover, clarity, wording, logical sequence, and skipping patterns of the questions were checked and necessary corrections were made. A reliable tool with Cronbach's Alpha of 0.842 also was used to determine the wealth index of families [42]. Supervision was carried out on daily bases. The questionnaires were checked for completeness and consistency, and necessary corrections were made accordingly.

Data processing and analysis

Data were collected using the ODK mobile data collection platform. The dataset was then downloaded as an Excel files from the ODK aggregate server and imported into SPSS version 25.0 for data cleaning and analysis. Descriptive statistics were computed, with means/medians and standard deviations/interquartile ranges for continuous variables, and frequencies and proportions for categorical ones. After verifying assumptions,

a household wealth index was created using PCA and divided into five quintiles. The outcome variable "proportion of compliance to IFS" was calculated by dividing the number of pregnant women who took IFS at least four days per week in the month preceding the study by the total sample size of 604 pregnant women, and then multiplying the result by 100 percent.

Bivariable logistic regression assessed associations between independent and dependent variables, presenting crude odds ratios (COR) with 95% confidence intervals (CI). Variables with a $p \leq 0.25$ in the bivariable analysis, including Residence, Woman's Education, Woman's Occupation, Husband's Occupation, Gravidity, Parity, ANC Starting Time, Frequency of ANC Visits, Distance from the Health Facility, Health Extension Workers' Visits, Counseling on IFS, Knowledge of IFS, Knowledge of Anemia, and Perception Toward Anemia and IFS, were included in a multivariable logistic regression model using the enter method. This model aimed to evaluate adjusted associations and report adjusted odds ratios (AOR) with 95% CIs. Statistical significance was set at $p < 0.05$. Multi-collinearity was checked, showing the highest variable inflation factor (VIF), indicating no multi-collinearity. The Hosmer–Lemeshow goodness of fit test confirmed model fitness.

Results

Socio-demographic and economic characteristics

In this study, 604 pregnant women were successfully interviewed, with a response rate of 100%. Most of the participants, 380 (62.9%), were between the ages of 25 and 34. The participants' mean (± SD) age was 26.62 (± 5.14), with ages ranging from 18 to 40 years. Out of the participants, 566 (93.7%) were married. and 492 (81.5%) were Gamo by ethnicity. Of the participants, 352 (58.3%) were protestant and 220 (36.4%) were Ethiopian Orthodox in religion. Nearly half, of the participants, 307 (50.8%), were rural dwellers. Regarding women's and husbands' educational status, 278 (46%) and 369 (61%) had secondary and above education levels, respectively. Concerning occupational status, 290 (48%) women and 391 (64.7) husbands were employed. Nearly half of the participants, 314 (52%), had four or more members in the family. In terms of household wealth, 145 (24%) were the poorest, while 113 (18.7%) were the richest (Table 1).

Table 1 Demographic and economic characteristics of pregnant women attending ANC in public health facilities of Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Variables	Compliance status		Total, n (%)
	Compliance, n (%)	Non-compliance, n (%)	
Age (in years)			
18–24	94 (32.6)	83 (26.3)	177 (29.3)
25–34	169 (58.7)	211 (66.8)	380 (62.9)
≥ 35	25 (8.7)	22 (7.0)	47 (7.8)
Marital status			
Single	9 (3.1)	10 (3.2)	19 (3.1)
Married	270 (93.8)	296 (93.7)	566 (93.7)
Divorced	6 (2.1)	6 (1.9)	12 (2.0)
Widowed	3 (1.0)	4 (1.3)	7 (1.2)
Residence			
Rural	108 (37.5)	199 (63.0)	307 (50.8)
Urban	180 (62.5)	117 (37.0)	297(49.2)
Women's education			
No formal education	41 (14.2)	107 (33.9)	148 (24.5)
Primary education	67 (23.3)	111 (35.1)	178 (29.5)
Secondary and above	180 (62.5)	98 (31.0)	278 (46.0)
Husbands' education			
No formal education	19 (6.6)	26 (8.2)	45 (7.5)
Primary education	81 (28.1)	109 (34.5)	190 (32.5)
Secondary and above	188 (65.3)	181 (57.3)	369 (61.0)
Women's occupation			
Unemployed	124 (43.1)	190 (60.1)	314 (52.0)
Employed	164 (56.9)	126 (39.9)	290 (48.0)
Husbands' occupation			
Unemployed	77 (26.7)	136 (43.0)	213 (35.3)
Employed	211 (73.3)	180 (57.0)	391 (64.7)
Family size			
< 4	134 (46.2)	156 (53.8)	290 (48.0)
≥ 4	154 (49.0)	160 (51.0)	314 (52.0)
Household wealth index			
Poorest	65 (44.8)	80 (55.2)	145 (24.0)
Poorer	44 (51.2)	42 (48.8)	86 (14.2)
Middle	60 (51.3)	57 (48.7)	117 (19.4)
Richer	73 (49.3)	70 (50.7)	148 (23.7)
Richest	46 (40.7)	67 (59.3)	113 (18.7)

Obstetric characteristics of study participants

Most of the participants, 454 (75.2%), were multigravida mothers. Nearly one-third of participants, 205 (33.9%), were primiparous mothers and 218 (36.1%) were multiparous. Of the participants, 519 (85.9%) and 572 (94.7%) had no history of abortion and stillbirth, respectively. In terms of ANC service initiation, 321 (53.1%) participants began using ANC services at ≤ 16 weeks of gestation. Most of the study participants, 424 (70.2%), had less than four antenatal care visits (Table 2).

Table 2 Obstetric characteristics of pregnant women attending ANC in public health facilities of Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Variables	IFS[a] Compliance status		Total, n (%)
	Compliance, n (%)	Non-compliance, n (%)	
Gravidity			
Primigravida	60 (20.8)	90 (28.5)	150 (24.8)
Multigravida	228 (79.2)	226 (71.5)	454 (75.2)
Parity			
Nulliparous	74 (25.7)	107 (33.9)	181 (30.0)
Primiparous	100 (34.7)	105 (33.2)	205 (33.9
Multiparous	114 (39.6)	104 (32.9)	218 (36.1)
Stillbirth			
Yes	14 (4.9)	18 (5.7)	32 (5.3)
No	274 (95.1)	298 (94.3)	572 (94.7)
Abortion			
Yes	40 (13.9)	45 (14.2)	85 (14.1)
No	248 (86.1)	271 (85.8)	519 (85.9)
ANC[b] starting time			
≤ 16 weeks	167 (58)	154 (48.7)	321 (53.1)
> 16 weeks	121 (42.0)	162 (51.3)	283 (46.9)
ANC visits			
< 4 times	192 (66.7)	232 (73.4)	424 (70.2)
≥ 4 times	96 (33.7)	84 (26.6)	180 (29.8)

[a] Iron-folate supplementation

[b] Antenatal care

Table 3 Health service-related characteristics of pregnant women attending ANC in public health facilities of Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Variables	IFS[a] Compliance status		Total, n (%)
	Compliance, n (%)	Non-compliance, n (%)	
Distance from health facility			
≤ 30 min	221 (76.7)	194 (61.4)	415 (68.7)
> 30 min	67 (23.3)	122 (38.6)	189 (31.3)
Health extension worker home-to-home visit			
Yes	165 (57.3)	122 (38.6)	287 (47.5)
No	123 (42.7)	194 (61.4)	317 (52.5)
Counseling about IFS			
Yes	157 (54.5)	108 (34.2)	265 (43.9)
No	131 (45.5)	208 (65.8)	339 (56.1)
Types of Health facility for ANC[b] service utilization			
Health center	134 (45.6)	160 (54.4)	294 (48.7)
Health post	29 (48.3)	31 (51.7)	60 (9.9)
Private clinic	9 (52.9)	8 (47.1)	17 (2.8)
Hospital	116 (40.2)	117(37.1)	233 (38.6)
Availability of IFS			
Yes	247 (85.8)	269 (85.1)	516 (85.4)
No	41 (14.2)	47 (14.9)	88 (14.6)

[a] Iron-folate supplementation

[b] Antenatal care

Health service-related characteristics of study participants

Regarding the distance of health facilities from participants' house, 415 (68.7%) reach health facilities for ANC services within 30 min. Out of the participants, 287 (47.5%) were visited by health extension workers (HEWs), and 265 (43.9%) had received counseling about IFS from HEWs. Nearly half of the participants, 294 (48.7%), obtain ANC services from a health center. The majority of the participants, 516 (85.4%), responded that IFS is available in nearby health facilities (Table 3).

Client-related factors of study participants

Of the participants, 285 (47.2%) and 371 (61.4%) had good knowledge of IFS and anemia, respectively. More than half of the participants, 342 (56.6%), had positive perceptions towards anemia and IFS. Out of the respondents, 273 (45.2%) and 376 (62.3%) were afraid of side effects and forgot to take tables, respectively. Most of the participants, 409 (67.7%), had no history of any disease before and during pregnancy. The majority of the respondents, 515 (85.3%), had no history of anemia and anemia during pregnancy. Nearly half of the participants, 293 (48.5%), had partner and family support (Table 4).

Proportion of IFS compliance

The proportion of IFS compliance was found to be 47.7% (95% CI 43.71%, 51.68%) while 52.3% of pregnant women were non-compliant (Fig. 2).

Factors associated with compliance to IFS

In multivariable analysis, residence, education, parity, health extension workers' home visits, IFS counseling, knowledge of IFS, and knowledge of anemia were significantly associated with IFS compliance.

For pregnant women, residing in an urban area increased compliance to IFS approximately 2.8 times compared to those in rural settings (AOR: 2.8, 95% CI 1.70, 4.86), while those who attended primary education exhibited twice the likelihood of adherence compared to individuals with no formal education (AOR: 2.0, 95% CI 1.13, 3.75); furthermore, a significant 5.3-fold increase in adherence was observed for those who completed secondary education and above compared to their counterparts without formal education (AOR: 5.3, 95% CI 2.83, 10.22). Additionally, multiparous women demonstrated a 1.9 times higher likelihood of

Table 4 Client-related characteristics of pregnant women attending ANC in public health facilities of Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Variables	IFS[a] compliance status		Total, n (%)
	Compliance, n (%)	Non-compliance, n (%)	
Knowledge on IFS			
Good	174 (60.4)	111 (35.1)	285 (47.2)
Poor	114 (39.6)	205 (64.9)	319 (52.8)
Knowledge on anemia			
Good	224 (77.8)	147 (46.5)	371 (61.4)
Poor	64 (22.2)	169 (53.5)	233 (38.6)
Perception toward anemia and IFS			
Positive	177 (61.5)	165(52.2)	342 (56.6)
Negative	111(38.5)	151 (47.8)	262 (43.4)
Fear of side effects			
Yes	133 (46.2)	140 (44.3)	273 (45.2)
No	155 (53.8)	176 (55.7)	331 (54.8)
Forgetfulness of taking a tablet			
Yes	181 (62.8)	195 (61.7)	376 (62.3)
No	107 (37.2)	121 (38.3)	228 (37.7)
Partner and family support			
Yes	142 (48.5)	151 (51.5)	293 (48.5)
No	146 (46.9)	165 (53.1)	311 (51.5)
History of any disease before and pregnancy			
Yes	96 (33.3)	99 (31.3)	195 (32.3)
No	192 (66.7)	217 (68.7)	409 (67.7)
History of anemia and anemia during pregnancy			
Yes	45 (50.6)	44 (49.4)	89 (14.7)
No	243 (47.2)	272 (52.8)	515 (85.3)

[a] Iron-folate supplementation

compliance in contrast to nulliparous women (AOR: 1.9, 95% CI 1.05, 3.52), while those who received home-to-home visits from health extension workers were twice as likely to adhere compared to those who did not receive such visits (AOR: 2.0, 95% CI 1.08, 3.83). In addition, adherence was 2.5 times greater for pregnant women who had received counseling on IFS compared to those who had not (AOR: 2.5, 95% CI 1.30, 4.78), and participants with good knowledge on the subject were nearly three times more likely to follow the supplementation guidelines compared to those with poor knowledge (AOR: 3.1, 95% CI 2.04, 4.72), while similarly, women who possessed a strong understanding of anemia demonstrated a 3.2 times higher compliance compared to their less informed peers (AOR: 3.2, 95% CI 2.12, 4.88) (Table 5).

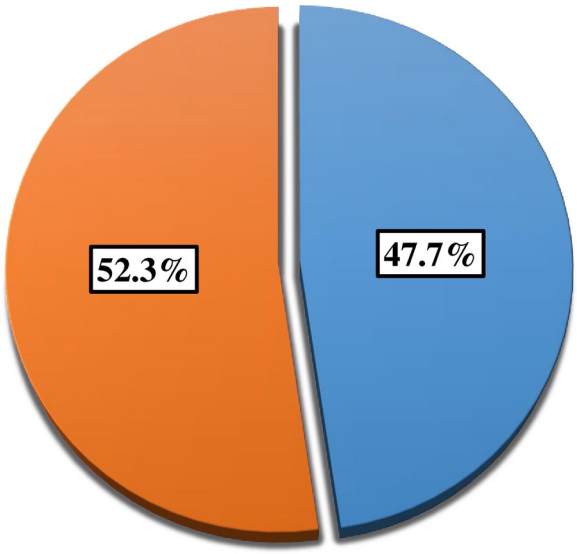

Fig. 2 IFS compliance status among pregnant mothers attending ANC in public health facilities of Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Discussion

Despite the fact that IFS is vital and affordable for preventing and managing iron deficiency anemia in pregnant women, noncompliance remains a major public health challenge, particularly in sub-Saharan Africa, with Ethiopia being a notable example [9, 31, 37, 38]. This study focuses on examining compliance with IFS and its influencing factors among pregnant women receiving antenatal services in Gamo Zone, Southern Ethiopia.

This study revealed that, the proportion of IFS compliance was 47.7%. This finding aligns with studies undertaken in various parts of Ethiopia: Aykel Town (47.6%), Debre Tabor (44.0%), North Wollo (43.1%), Debay Tilatgen (52.8%), Western Dembia (52.9%), Gondar (55.3%) and Burji [9, 29, 31, 33, 37, 38]. This finding is lower as compared to studies done in Eastern Nepal (58.3%), India (81.7%), and different parts of Ethiopia; Dangila (76.9%), Dire Dawa (71.8%), North Shewa (60.8%), Addis Ababa (71.3%) [11, 18, 35, 36, 44–47]. This finding is also lower as compared to WHO recommendations [10]. Conversely, this finding is higher than studies reported from Malawi (37%), Kenya (32.7%), Tanzania (20.3%), and different parts of Ethiopia: Afar region (22.9%), Lay Armachio district (28.7%) and Hawassa (38.3%) [4, 22–24, 34, 40, 48]. Variations in a study setting, socioeconomic and cultural conditions, literacy level, and geographical disparities across study participants could all explain the disparity. This finding implies the need to work intensively to achieve the national nutrition program targets and WHO recommendations on IFS compliance.

Table 5 Bivariable and multivariable analysis of factors affecting IFS compliance among pregnant women in Gamo Zone, Southern Ethiopia, 2022 (n = 604)

Variables	IFS[a] compliance status		COR[b] (95% CI[c])	AOR[d] (95% CI)	P-value
	Compliance, n (%)	Non-compliance, n (%)			
Residence					
Rural	108 (35.2)	199 (64.8)	1	1	
Urban	180 (50.4)	177 (49.6)	2.8 (2.04, 3.94)	2.8 (1.70, 4.86)	0.001*
Woman's education					
No formal education	41 (27.7)	107 (72.3)	1	1	
Primary	67 (37.6)	111 (62.4)	1.5 (0.98, 2.52)	2.0 (1.13, 3.75)	0.018*
Secondary and above	180 (64.7)	98 (35.3)	4.7 (3.10, 7.41)	5.3 (2.83, 10.22)	0.001*
Woman's occupation					
Unemployed	124 (39.5)	190 (60.5)	1	1	
Employed	164 (56.6)	126 (43.4)	1.9 (1.44, 2.76)	1.1 (0.70, 1.69)	0.701
Husband's occupation					
Unemployed	77 (36.2)	136 (63.8)	1	1	
Employed	211 (54)	180 (46)	2.1 (1.47, 2.92)	1.1 (0.67, 1.92)	0.632
Gravidity					
Primigravida	60 (40)	90 (60)	1	1	
Multigravida	228 (50.2)	226 (49.8)	1.5 (1.04, 2.20)	1.3 (0.73, 2.32)	0.373
Parity					
Nulliparous	74 (40.9)	107 (59.1)	1	1	
Primiparous	100 (48.8)	105 (51.2)	1.3 (0.92, 2.06)	1.4 (0.77, 2.55)	0.271
Multiparous	114 (52.3)	104 (47.7)	1.5 (1.07, 2.36)	1.9 (1.05, 3.52)	0.034*
ANC[e] starting time					
≤ 16 weeks	167 (52)	154 (48)	1.4 (1.05, 2.00)	1.1 (0.73, 1.69)	0.62
> 16 weeks	121 (42.8)	162 (57.2)	1	1	
Frequency of ANC visits					
< 4 times	192 (45.3)	232 (54.7)	1	1	
≥ 4 times	96 (53.3)	84 (46.7)	1.3 (0.97, 1.96)	1.2 (0.76, 1.90)	0.43
Distance from health facility					
≤ 30 min	221 (53.3)	194 (46.7)	2.0 (1.45, 2.96)	1.2 (0.79, 1.95)	0.36
> 30 min	67 (35.4)	122 (64.6)	1	1	
Health extension workers' visits					
Yes	167 (57.8)	122 (42.2)	2.1 (1.54, 2.95)	2.0 (1.08, 3.83)	0.028*
No	123 (38.8)	194 (61.2)	1	1	
Counseling on IFS					
Yes	157 (59.2)	108 (40.8)	2.3 (1.66, 3.21)	2.5 (1.31, 4.78)	0.006*
No	131 (38.6)	208 (61.4)	1	1	
Knowledge on IFS					
Poor	114 (35.7)	205 (44.3)	1	1	
Good	174 (61.1)	111 (38.9)	2.8 (2.03, 3.92)	3.1 (2.04, 4.72)	0.001*
Knowledge on anemia					
Poor	64 (27.5)	169 (72.5)	1	1	
Good	224 (60.4)	147 (39.6)	4.0 (2.82, 5.74)	3.2 (2.12, 4.88)	0.001*
Perception toward anemia and IFS					
Negative	111 (42.4)	151 (57.6)	1	1	
Positive	177 (51.8)	165 (48.2)	1.4 (1.06, 2.02)	1.2 (0.79, 1.90)	0.361

[a] Iron-folate supplementation

[b] Crude odds ratio

[c] Confidence interval

Table 5 (continued)

[d] Adjusted odds ratio

[e] Antenatal care

[*] Significant at P < 0.05

Being an urban resident was strongly associated with IFS compliance in this study. The odds of IFS compliance were nearly three-fold greater for pregnant women who live in an urban area compared to their complements. The finding is consistent with studies carried out in Malawi and Ethiopia [22, 29, 48]. The reason could be that pregnant women in urban areas have more access to health information regarding the benefits of IFS than pregnant women in rural areas, making them more compliant. It could be because pregnant women in rural areas sometimes forget to take their supplements; after all, their days are filled with tiring and laborious work.

The educational status of pregnant women was found to be significantly linked with compliance with IFS in this study. When compared to women who are not formally educated, women who attend primary school and above have a higher likelihood of complying with IFS. This finding is supported by research from Iran and Ethiopia [2, 24, 45]. This could be explained by the potential impact of education on self-care skills since more educated women are more likely to understand and address their own needs. Women's access to health information is improved through education, as is their understanding of the importance of IFS. In addition, not attending formal education may limit women's access to information regarding the benefits of supplementation by reading, interpreting, and implementing messages from healthcare experts.

This study revealed that, being multiparous was linked with IFS compliance. Multiparous women are more likely to comply with IFS than nulliparous women. The finding is consistent with findings from different regions of Ethiopia [26, 49]. The possible explanation might be that multiparous women have more exposure to IFS, and better knowledge and understanding of care during their pregnancies because of their repetitive follow-ups at the health facilities.

In this study, receiving IFS advice during pregnancy was substantially associated with better IFS compliance. The odds of IFS compliance were more than two-fold higher for women who had received IFS counseling as compared to their counterparts. This finding is supported by studies from Senegal, Uganda, and other parts of Ethiopia [11, 26–28, 37, 38, 50]. This might be due to getting advice on IFS might increase knowledge, attitude, and practice toward its compliance. Also, women who received IFS counseling may comprehend the benefits, potential side effects, purposes, dosage, and duration of supplementation, making them more compliant with supplementation.

In the current study, having a weekly health extension worker's home-to-home visit was associated with IFS compliance. When compared to their counterparts, pregnant women visited weekly by health extension workers were nearly twice as likely to comply with IFS. The reason might be having a home-to-home visit by health extension workers might increase access to better health education and counseling regarding perceived risk, what to eat with the supplementation, when to take the supplementation, and what to avoid during supplementation for improving absorption and benefits of IFS. Moreover, this could be attributed to health extension workers' home-to-home visits, which could provide better anemia counseling to mothers and hence enhance compliance.

In the current study, knowledge of IFS was associated with IFS compliance. The odds of compliance to IFS were nearly three-fold greater for participants who had good knowledge of IFS as compared to their complements. This finding is in line with studies from Kenya and other parts of Ethiopia [4, 9, 11, 26, 31, 38, 50]. Participants with greater knowledge of iron-folate supplements may be better aware of the advantages of taking the pill, how to take the tablet, side effects, and issues if missed. Another reason is that having a good understanding of IFS helps mothers have a better perspective on taking the supplement effectively for both the prevention and management of anemia during pregnancy. This, in turn, may increase practice toward IFS compliance.

According to this study, having a solid understanding of anemia was significantly associated with IFS compliance. When compared to their counterparts, pregnant women who had a good knowledge of anemia had nearly three times the likelihood of IFS compliance. This finding is supported by studies from Tanzania and Ethiopia [11, 31, 34, 38, 50]. A possible explanation for this is that having an extensive understanding of anemia may assist women in having a better view of the prevention and treatment of anemia through regular supplementation during pregnancy. Another reason could be receiving counseling about IFS benefits at the community level from healthcare providers through regular home visits. This highlights the crucial role that knowledge, awareness creation, and IFS-related intervention play.

This study has some limitations that should be considered when interpreting the findings. It was an interview-based study relying primarily on the recall capacity of

pregnant women, introducing a risk of recall bias that may have led to erroneous responses and affected the results. Compliance was assessed based solely on self-reported information from participants, supplemented by pharmacy records documenting medication withdrawals, yet we did not conduct pill counts to verify compliance. Furthermore, although we confirmed the presence of anemia during pregnancy, we did not measure serum hemoglobin levels.

Conclusion

The compliance with IFS among pregnant women residing in the Gamo zone of Ethiopia is making progress in alignment with the targets set by the national nutrition program for the year 2030. However, despite this positive trend, the level of compliance still falls short of the recommendations provided by the World Health Organization. Being an urban resident, having a higher educational status, being multiparous, receiving home-to-home visits from health extension workers, having good knowledge of IFS, getting IFS counseling, and having good knowledge of anemia were factors associated with IFS compliance. Hence, the provision of strengthened additional counseling services about IFS benefits, and improving knowledge about supplementation and anemia are essential strategies to enhance compliance. Rigorous community-based health education and counseling regarding IFS and anemia for improving awareness and monitoring iron-folate table count through regular home-to-home visits of community health extension workers are highly demanding. Furthermore, empowering women through education and strengthening initiatives is crucial for increasing health service use among rural women. Additional research on IFS compliance using the pill count method is needed.

Abbreviations

ANC	Antenatal care
AOR	Adjusted odds ratio
CI	Confidence interval
COR	Crude odds ratio
IFS	Iron-folate supplementation
PCA	Principal component analysis
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12978-025-01944-z.

Supplementary Material 1.

Acknowledgements

The authors express heartfelt gratitude to Arba Minch University, College of Medicine and Health Sciences, for their support of this study. We extend our profound appreciation to the Gamo Zone health department, district health offices, and town public health facilities for their cooperation during data collection. Additionally, we thank the study participants, data collectors, and supervisors for their invaluable contributions.

Author contributions

MT participated in conceptualizing the study, designing the study, collecting data, creating the analysis plan, conducting the analysis, interpreting the results, and drafting the manuscript. TM and WT provided guidance and contributed to the design and proposal development, assisted during analysis, and edited the manuscript. MG offered guidance, participated in conceptualization and data curation, designed the analysis plan, and reviewed the draft manuscript. MY also provided guidance, participated in conceptualization and data curation, designed the analysis plan, assisted in the analysis, contributed to interpreting the results, and reviewed and edited the manuscript. All authors read and approved the final manuscript.

Funding

No funding was obtained for this study.

Data availability

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

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of Arba Minch University, College of Medicine and Health Sciences with a reference number of IRB/1236/2022. The study was conducted in accordance with the Declaration of Helsinki on health research. Formal official permission and support letters were obtained from the Gamo Zone health department and selected district health offices. After explaining the objective of the study, permission was also secured from selected health facilities. Written informed consent was obtained from the study participant after providing them with the information concerning the purpose of the study, benefits and harms of participating in the study. The study participants were also told that participation in the study was completely voluntary and the information will be kept strictly confidential.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 18 October 2024 Accepted: 4 January 2025
Published online: 13 February 2025

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