Journal of Midwifery & Reproductive Health

JMRH.mums.ac.ir

Rural-Urban Differential of Iron Supplementation Compliance during Pregnancy among Reproductive aged Women in Ethiopia

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ARTICLE INFO

Article type:
Original article

Article History:
Received: 16-Jun-2022
Accepted: 04-Sep-2022

Key words:
Compliance
Iron Use
Rural–urban
Ethiopia

ABSTRACT

Background & aim: The global burden of iron deficiency anemia remains substantial, accounting for 41.8% of the population. This study assessed the rural–urban differential in iron supplementation compliance during pregnancy among reproductive-aged women.

Methods: A comparative cross-sectional study was conducted among women aged 15-49 in all parts of Ethiopia. The study was conducted from January 18 to June 27, 2016. After data related to the compliance with iron supplementation were obtained from the demographic survey, a mixed-effects logistic regression model was performed on a weighted sample of 3096 (563 urban and 2533 rural). Significant relationships were determined using multivariable logistic regression analysis.

Results: The general proportion of iron supplementation compliance was 15.07% (95% CI= 13.8%-16.4%). However, the proportion of adherence to iron among urban and rural women was 17.7% (95% CI=14.8%-21.1%) and 11.2% (95% CI=10.1% -12.5%), respectively. Urban areas were associated with exposure to media (AOR=2.04, 95% CI, 1.07, 3.89) and frequent ANC≥4 (AOR=2.31, 95% CI, 1.10, 4.86). However, those with a high school education level were 65% less likely to adhere to iron supplementation. Additionally, for Rural, the odds of iron supplementation adherence were higher for primary (AOR=1.39, 95% CI, 1.03, 1.89) and secondary education (AOR=1.77, 95% CI, 1.02, 3.08), unemployed women (AOR=1.35, 95% CI, 1.04, 1.76), first ANC registration at 1st 13 months (AOR=3.03, 95% CI, 1.41, 6.54), and 2nd trimester (AOR=2.82, 95% CI, 1.34, 5.95).

Conclusion: The proportion of iron use adherence through gestation is low in both urban and rural Ethiopia compared to the national recommendation.

► *Please cite this paper as*:
Assefaw Geremew M, Tefera Z, Gashaw W, Ayalew S, Habtie E. Rural- Urban Differential of Iron Supplementation Compliance during Pregnancy amid Reproductive aged Women in Ethiopia, Further Analysis of EDHS 2016. Journal of Midwifery and Reproductive Health. 2023; 11(2): 3704-3712. DOI: 10.22038/JMRH.2023.66128.1927

Introduction

The burden of iron deficiency anemia throughout the world is still high, accounting for 41.8%. This indicates that iron deficiency anemia is the most prevalent but neglected case in the world and affects both developed and underdeveloped countries (1).

Approximately 57.2% of women residing in rural areas suffered from iron deficiency anemia in India in 2018(2). Evidence from nationally representative surveys of some Asian countries shows that the prevalence of iron deficiency anemia is highest in rural areas compared to urban areas (53.6 versus 50.5)(3).

According to 2016, the EDHS reported that the proportion of anemia among pregnant women who resided in rural areas was higher than that among pregnant women who resided in urban areas (25% versus 16%)(4). In addition, reports from a study performed in the Bahir Dar City Administration, Northwest Ethiopia, show that the prevalence of iron deficiency anemia in rural women was 11.1% (5).

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The rise in physiological need for iron during pregnancy is difficult to achieve with the usual nutrition. Therefore, pregnant women should routinely receive iron supplements. Iron is the best element that is needed for hemoglobin production, which is important to carry oxygen needed throughout the body (6). However, the effectiveness of such interventions depends on the adherence to the tablets (7).

According to the WHO and Ethiopian national guidelines for the control and prevention of micronutrient deficiencies, all pregnant mothers must take at least 30-60 mg of elemental iron plus 400 µg of folic acid, one supplement daily starting as early as possible and taken throughout the pregnancy period. These supplements are essential to balance the rise in physiological demand during pregnancy and lactation (8). The most common issue, particularly in developing nations, is anemia prevalence. In eastern Ethiopia, the prevalence of anemia during pregnancy was 33.1%. (9). additionally, according to the DHS study, 41% of pregnant women in Ethiopia had anemia overall, of whom 20% had moderate anemia, 18% had severe anemia, and 3% had light anemia. (10). Several studies have found a strong correlation between the use of iron supplements and characteristics such as parity, residency, parity, past pregnancy complications, and educational status. (5,6,9–12). The report did not address the actual difference in the proportion of women who adhere to iron supplementation between those who live in rural and urban areas, although numerous studies on this topic that were conducted in various regions of Ethiopia show the combined prevalence and significant factors for adherence to iron supplementation (13,14). Therefore, the purpose of this study was to identify the magnitude differential of adherence to iron supplementation among urban and rural pregnant mothers and its predictors independently by using data from the Ethiopian demographic survey in 2016.

Materials and Methods

Nine regional states and two city administrations around the nation participated in the nationwide poll. Ethiopia's DHS 2016 data collection period ran from January 18 to June 27, 2016.

A community-based comparative prevalence study was conducted among women who received prophylactic iron during pregnancy of the last live birth prior to the demographic survey in Ethiopia.

All women of reproductive age (15–49) who had prenatal care and took iron during the pregnancy of their most recent live birth prior to the survey and provided information on iron supplements were included in the Ethiopian demographic survey.

The study included all women of reproductive age who took preventive iron and remembered how many days they took the supplement throughout their pregnancies five years prior to the survey. Women who had not taken iron during a prior pregnancy and who could not recollect how many iron tablets they had taken were not included.

The 2016 Ethiopian Demographic Survey, a countrywide survey that was conducted at the request of the government statistics office, served as the primary source of secondary data. Data from individual women datasets were used in this study, and the survey used an interview-administered questionnaire.

The data for the survey were gathered at the national level using a sampling frame with two steps. The study unit at the beginning of the process was a list of enumeration areas and the 2007 housing and population census. A total of 202 urban and 443 rural EAs were included in the sample, which had a probability proportionate to the size of the EA and independent selection within each sampling stratum. At the second stage, a specified number of 28 households were picked randomly from the newly produced household listing with an equal likelihood. The study included a weighted sample of 3,096 pregnant women out of a total of 15,683 respondents to the 2016 EDHS.

Among the most recent live births, compliance with iron supplementation through gestation served as the outcome variable.

The survey was used to gather information from pregnant women about the outcome variable by asking them how many days they took an iron supplement during their pregnancy. Adherence to iron supplementation during pregnancy was the dependent variable for this study.

The World Health Organization advises all expectant women to take at least one IFAS tab daily for at least three months (90 days). Women who took iron consistently for 90 or more days were therefore regarded as adherent, whereas those who did not, were considered nonadherent.

Sociodemographic variable included age, religion, women's educational level, women's occupation, husband's educational level, husband occupation, family size, media exposure, and wealth index.

Obstetric characteristics consisted of age at first birth, total number of children, total number of live children, past abortion, parity, first antenatal care, and ANC frequency.

To account for disproportionate sample and nonresponse rates, the data were weighted. STATA version 14 was used for cross-tabulations and summary statistics. We expect women in the same cluster and enumeration area to be more similar to women in the rest of the region, which contradicts the classic regression model's assumption that observations are independent and that variance is equal across clusters.

To prevent this, a mixed effect logistic regression model was fitted. In the bivariate analysis, variables with a P value of 0.2 were chosen for the multivariable mixed-effect logistic regression model. In the multivariable analysis, an adjusted odd ratio (AOR) with a 95 percent confidence interval (CI) was used to indicate a significant association.

The National Ethics Review Committee of the Federal Democratic Republic of Ethiopia, the Ministry of Science and Technology, and the Institutional Review Board of ICF International all examined and approved the 2016 EDHS proposal. Following a thorough description of the survey, each study participant's informed consent was obtained. When we obtained the data, they were anonymous. The EDHS program granted us permission to view and utilize the data.

Results

Women's socioeconomic and demographic characteristics

The survey included a total of 3096 weighted respondents, including 563 (18.2%) and 2533 (81.8%) women from urban and rural inhabitants, respectively. Women predominated both in urban and rural settings and were orthodox, with 370 (65.6%) and 1,130 (45.4%), respectively (Table 1).

Reproductive and obstetric characteristics

The majority of rural women were 1940 (76.6 percent) who became parents for the first time under 20 years old. Only 282 (50.1%) respondents who gave birth to a child under the age of 20 years were from urban areas (Table 2).

Prevalence of women's compliance with iron supplementation

The overall proportion of pregnant women's use of iron as prescribed was 15.07% (95% CI= 13.8%-16.4%). Nevertheless, the percentage of pregnant women who used iron in both urban and rural settings was 17.7% (95% CI=14.8%-21.1%) and 11.2% (95% CI=10.1% -12.5%), respectively.

Factors associated with adherence to iron among women residing in urban areas

Women's exposure to media, number of ANC follow-ups, and secondary level of education were all substantially linked to how often urban women took iron supplements while pregnant.

Pregnant women with a secondary education were 2.8 times less likely to take iron supplements consistently than pregnant women without a formal education (AOR=0.35, 95%, CI, 0.14-0.89). In contrast, pregnant women who were exposed to media were twice as likely to stick to iron supplementation as those who were not. (AOR=2.04 95% CI, 1.07-3.89). When compared to women who attended fewer than four antenatal appointments, those who attended four or more antenatal appointments had a 2-fold (AOR=2.31, 95% CI, 1.10-4.86) higher likelihood of adhering to iron supplementation (Table 3).

Table 1. Sociodemographic characteristics of urban and rural pregnant women in Ethiopia

Variables	Urban (N=563) (%)	Rural (N=2533) (%)	Total (N=3096) (%)
Age			
15-24	110 (19.5)	719 (28.4)	829 (26.8)
25-34	364 (64.7)	1,225 (48.4)	1,590 (51.4)
35-49	89 (15.8)	589 (23)	678 (21.9)
Marital status			
Single	48 (8.4)	134 (5.3)	182 (5.87)
Married	516 (91.56)	2,399 (94.7)	2,914 (94)
Household head			
Male	421(74.7)	2236 (88.3)	2,657 (85.8)
Female	142 (25.3)	297 (11.7)	439 (14.2)
Women's Educational level			
No education	123 (21.9)	1548 (61)	1,671 (54)
Primary	174 (30.98)	829 (32.7)	1,003 (32.4)
Secondary	135(24)	129 (5.1)	264 (8.6)
Higher	131(23.1)	27 (1.1)	157 (5.1)
Women's Occupation			
Unemployed	|237 (42)	|1,263 (49.86)	1,500 (48.45)
Employed	326 (58)	1,270 (50)	1,596 (51.55)
Husband's educational level (n1=516 and n2=2383)			
No education	90(17.4)	1,129 (47.1)	1,215 (41.7)
Primary	139 (27)	986 (41.1)	1,126 (38.6)
Secondary	134 (26)	189 (7.9)	322 (11.1)
Higher	153 (29.6)	79 (3.3)	232 (8)
Husband's occupation			
Unemployed	19 (3.61)	145 (6.07)	164 (5.63)
Employed	496 (96.39)	2,244 (93.9)	2,740 (94.37)

Table 2. Reproductive and obstetric characteristics of urban and rural pregnant women in Ethiopia

Variables	Urban	Rural	Total
Mother's age at 1st birth			
Less than 20	282 (50.1)	1,940 (76.6)	2222 (71.8)
20 to 24	190 (33.8)	445 (17.6)	635 (20.5)
25 to 34	89 (15.8)	144 (5.7)	233 (7.5)
≥ 35	2 (0.29)	5 (0.18)	6.2 (0.20)
Number of children ever born			
1 to 3	500 (88.8)	1,608 (63.5)	2,108 (68.1)
≥4	63 (11.2)	925 (36.5)	988 (31.9)
Number of live children			
≤4	517 (91.86)	1,756 (69.33)	2,273 (73.43)
>4	46 (8.14)	777 (30.67)	823 (26.57)
Abortion			
No	514 (91.3)	2,268 (89.5)	2,782 (89.9)
Yes	49 (8.7)	265 (10.5)	313 (10.1)
Time of ANC initiation (n1=550 and n2=2237)			
First trimester	283 (51.5)	714(31.9)	997 (35.8)
Second trimester	234 (42.5)	1,289 (57.6)	1,523 (54.7)
Third trimester	33 (6)	234 (10.5)	267 (9.5)
Number of ANC (n1=560 and n2=2528)			
<4	155 (27.68)	1,382 (54.68)	1,537 (49.78)
≥4	405 (72.32)	1,146 (45.32)	1,550 (50.22)
Anemia			
Not-anemic	449 (83.8)	1,873 (75.6)	2,323 (77)
Anemic	87 (16.2)	605 (24.4)	692 (23)

Table 3. Bivariate and multivariate logistic regression of factors associated with iron supplementation adherence of pregnant women in the urban area of Ethiopia

Variables	Adherence to iron Urban=563		COR (95%CI)	AOR (95%CI)
	Yes (%)	No (%)		
Women's educational level				
No education	17 (13.8)	106 (86.2)	1	1
Primary	34 (19.4)	141 (80.6)	1.47(0.78-2.77)	0.92 (0.42 -1.10)
Secondary	16 (11.9)	119 (88.1)	0.81 (0.39-1.68)	**0.35 (0.14-0.89)**
Tertiary	33 (25)	98 (75)	2.02 (1.06-3.84)	0.72 (0.28-1.87)
Media exposure				
Not-exposed	18 (10.7)	151 (89.3)	1	1
Exposed	82 (20.8)	312 (79.2)	2.2 (1.28- 3.83)	**2.04 (1.07-3.89)**
Number of live children				
≤4	95 (18.4)	422 (81.60	1	
>4	5 (10.9)	41(89.1)	0.52 (0.20-1.37)	1.00 (0.31-3.21)
Time of 1st ANC				
1st TM	58 (20.5)	225 (79.5)	12.58 (1.09-145.9)	4.28 (0.33-55.59)
2nd TM	41 (17.5)	193 (82.5)	10.18 (0.87-118.8)	3.67 (0.28-47.63)
3rd TM	66 (67.4)	32 (32.6)	1	1
Number of ANC				
<4	11 (7.1)	144 (92.9)	1	
≥4	89 (22)	316 (78)	3.58 (1.86-6.86)	**2.31 (1.10-4.86)**

Factors influencing rural-area women's adherence to iron intake

Women's educational and occupational status, first ANC registration, and number of ANC visits were significantly associated with iron adherence among rural pregnant women.

Women with primary and secondary education levels were 1.39 (95% CI, 1.03-1.88) and 1.77 (1.02-3.08) times more likely to adhere to iron supplementation during pregnancy than women without formal education, respectively.

Compared to women who did not work, those who had an occupation had a 1.35 (95% CI, 1.04-1.76) times higher likelihood of adhering to iron supplementation. Conversely, adherence to iron supplements remained 3.03 (95% CI, 1.41-6.54) and 2.82 (95% CI, 1.34-5.95) times greater in women with their first ANC in the first and second trimester of pregnancy compared to those with their first ANC in the third trimester. Similarly, compliance with iron supplementation throughout pregnancy is 1.46 (95% CI, 1.11-1.94) times more likely for women who attend four or more prenatal care visits than for those who only attend one or two. Moreover, compliance with iron supplementation during pregnancy was 1.46 (95% CI, 1.11-1.94) times higher for women who attended four or more prenatal care visits than for those who only attended one or two visits (Table 4).

Determination of all women's compliance with iron intake

Number of family members 5 or more, number of ANC four or more, and first ANC in the first and second trimesters were strongly connected with women's compliance with iron during pregnancy.

Pregnant women with five or more family members were 27% less likely to adhere to iron supplements than those with fewer than five family members (AOR=0.73, 95% CI, 0.54-0.99). The odds of iron supplement adherence were 5 times (AOR=5.18, 95% CI, 2.18-12.37) and 4 times (AOR=4.19, 95% CI, 1.78-9.84) higher among women with first ANC during the first and second trimesters than among women with antenatal registration in late pregnancy, respectively.

Pregnant women who attended four or more ANC visits had nearly twice as high an odds ratio (AOR=1.98, 95% CI, 1.51-2.62) of adhering to iron supplementation as those who attended fewer ANC visits (Table 5).

Table 4. Bivariate and multivariate logistic regression of factors associated with iron supplementation adherence of pregnant women in Ethiopia

Variables	Adherence to iron Total =3096		COR (95%CI)	AOR (95%CI)
	Yes (%)	No (%)		
Women's educational level				
No formal education	166 (9.9)	1504 (90.1)	1	1
Primary	140 (14)	863 (86)	1.47 (1.16 -1.88)	1.32 (0.97-1.79)
Secondary	40 (15.1)	225 (84.9)	1.59 (1.09-2.31)	1.02 (0.61-1.68)
Higher education	38 (24.2)	119 (75.8)	2.87 (1.93-4.28)	1.17 (0.62-2.23)
Number of family numbers				
1-4	160 (14.6)	936 (85.4)	1	1
≥5	224 (11.2)	1,775 (88.8)	0.82 (0.67-1.00)	0.73 (0.54-0.99)
Media exposure				
Not exposed	247 (10.5)	2,096 (89.5)	1	1
exposed	137 (18.2)	616 (81.8)	1.89 (1.51-2.37)	1.24 (0.92-1.70)
Wealth index				
Poor	132 (11.4)	1,028 (88.6)	1	1
Middle	53 (12.2)	554 (87.8)	0.75 (0.54-1.05)	0.71(0.50-1.03)
Rich	199 (15)	1,130 (85)	1.37 (1.08-1.74)	0.85(0.62-1.16)
Number of children				
1-3	274 (13)	1,833 (87)	1	1
≥4	110 (11.1)	878 (88.9)	0.83 (0.66-1.06)	1.33(0.91-1.95)
Time of first ANC				
First TM	172 (17.2)	825 (82.8)	9.47 (4.08-22.0)	5.18(2.18-12.37)
Second TM	191 (12.5)	1,331 (87.5)	6.51(2.81-15.07)	4.19(1.78-9.84)
Third TM	6(2.2)	261 (97.8)	1	1
Number of ANC				
<4	110 (28.4)	1,427 (71.6)	1	1
≥4	275 (17.7)	1,276 (82.3)	2.80 (2.2-3.54)	1.98(1.51-2.62)

Table 5. Bivariate and multivariate logistic regression of factors associated with iron supplementation adherence of pregnant women in Ethiopia

Variables	Adherence to iron Total =3096		COR (95%CI)	AOR (95%CI)
	Yes (%)	No (%)		
Women educational				
No formal education	166 (9.9)	1504 (90.1)	1	1
Primary	140 (14)	863 (86)	1.47 (1.16 -1.88)	1.32 (0.97-1.79)
Secondary	40 (15.1)	225 (84.9)	1.59 (1.09-2.31)	1.02 (0.61-1.68)
Higher education	38 (24.2)	119 (75.8)	2.87 (1.93-4.28)	1.17 (0.62-2.23)
Families numbers				
1-4	160 (14.6)	936 (85.4)	1	1
≥5	224 (11.2)	1,775 (88.8)	0.82 (0.67-1.00)	0.73 (0.54-0.99)
Media exposure				
Not exposed	247 (10.5)	2,096 (89.5)	1	1
exposed	137 (18.2)	616 (81.8)	1.89 (1.51-2.37)	1.24 (0.92-1.70)
Wealth index				
Poor	132 (11.4)	1,028 (88.6)	1	1
Middle	53 (12.2)	554 (87.8)	0.75 (0.54-1.05)	0.71(0.50-1.03)
Rich	199 (15)	1,130 (85)	1.37 (1.08-1.74)	0.85(0.62-1.16)
Number of children				

Variables	Adherence to iron Total =3096		COR (95%CI)	AOR (95%CI)
	Yes (%)	No (%)		
1-3	274 (13)	1,833 (87)	1	1
≥4	110 (11.1)	878 (88.9)	0.83 (0.66-1.06)	1.33(0.91-1.95)
Time of first ANC				
First TM	172 (17.2)	825 (82.8)	9.47 (4.08-22.0)	5.18(2.18-12.37)
Second TM	191 (12.5)	1,331 (87.5)	6.51(2.81-15.07)	4.19(1.78-9.84)
Third TM	6(2.2)	261 (97.8)	1	1
Number of ANC				
<4	110 (28.4)	1,427 (71.6)	1	1
≥4	275 (17.7)	1,276 (82.3)	2.80 (2.2-3.54)	1.98(1.51-2.62)

Discussion

In comparison to studies conducted in Kakamaga, Kenya (60.6%)(15), the Arimachiho Health Center, Ethiopia (28.7%)(16), and the Diredewa Health Center, Ethiopia (71.8%), this study found that compliance with iron supplementation in pregnancy was low (15.07% (95% CI= 13.8%-16.4%).(17) Since the majority of the articles were written about pregnant women who visited the hospital for antenatal care follow-up, this could explain the potential discrepancy. To prevent iron deficiency anemia, these pregnant women were informed of the advantages of receiving iron.

According to our research, pregnant women in urban and rural areas adhered to iron supplementation at rates of 17.7% (95% CI=14.8%-21.1%) and 11.2% (95% CI=10.1% - 12.5%), respectively. According to this finding, urban women were more likely to take their iron supplements (17.7%) than rural women (11.2%), who were less likely to do so. This gap might be explained by the fact that women in urban regions have easier access to media, health care, and better education than women in rural areas. However, the difference was not statistically significant, which conflicts with an Indian study that found that pregnant women who lived in cities were 35% more likely to adhere to iron supplementation than pregnant women who lived in rural areas (7), and in Nigeria, urban pregnant women were 56% more likely to be adherent than rural pregnant women (6). However, this research was in line with a comparative cross-sectional study performed in Tigray, Ethiopia, which found that pregnant women living in urban and rural areas did not follow iron recommendations significantly differently (18).

In urban women, pregnant women with a secondary education were 2.8 times less likely to adhere to iron supplementation than pregnant women without a formal education (AOR= 0.35, 95% CI, 0.14-0.59). Conversely, women with only a primary or secondary education in rural areas were 1.39 and 1.77 times more likely to adhere to iron supplementation than women with no formal education (AOR=1.39, 95% CI, 1.03-1.88 and AOR=1.77 (1.02-3.08), respectively).

The difference between the two could be explained by the reality that more educated women in cities may be aware of iron's side effects, particularly the fact that it can cause nausea and vomiting in the first trimester. The research conducted at the public health center in the Yeka subcity of Addis Abeba, Ethiopia, is similar to the findings on women's educational status in rural areas. (19).

In addition, women exposed to media in the study's urban setting were twice as likely to adhere to iron supplementation throughout pregnancy as women who were not (AOR=2.041, 95% CI, 1.07-3.89). However, in rural regions, women's adherence to iron supplementation was not significantly influenced by their media exposure status.

When compared to women who attended fewer than four prenatal visits, women who attended four or more antenatal visits during their pregnancy were 2.3 times as likely to comply with iron supplementation (AOR=2.31, 95% CI, 1.10-4.86). Similar to the urban region, the odds of pregnant women in rural areas adhering to iron supplementation were 1.46 times greater than those in urban areas among those attending four or more prenatal visits (AOR=1.46, 95% CI, 1.11-1.94). The results were in line with previous research in West Dembia,

Ethiopia (20), Tigray, Ethiopia (16), and Felegehiwot Hospital, Ethiopia (11).

For women in rural areas, the chances of adhering to iron supplementation among women with occupations were 1.35 times greater than for women without occupations (AOR=1.35, 95% CI, 1.04-1.76).

Pregnant women who registered their first antenatal care in the first and second trimesters were 3 times and 2.8 times more likely to adhere to iron supplementation than those who registered their first ANC in the third trimester (AOR=3.03, 95% CI, 1.41, 6.54 and AOR=2.82, 95% CI, 1.34, 5.95, respectively). This is consistent with the findings of all pregnant women, which showed that the odds of adherence to iron supplementation were 5 and 4 times higher for pregnant women who started their first ANC in the 1st and 2nd trimesters, respectively, than for women who started their ANC in the third trimester (AOR=5.18, 95% CI, 2.18, 12.37 and AOR=4.19, 95% CI, 1.78, 5.95, respectively). The result is consistent with the study performed at Tikur Ambessa Hospital, Ethiopia (12), northwest Tigray, Ethiopia (20).

We have made use of secondary data that came from the national survey. As a result, some significant independent variables were left out of the study.

Conclusion

This study underlined several key findings. Iron supplementation compliance was low among pregnant women in both urban and rural settings. In addition, women's compliance with iron supplementation was linked to their educational status, media access, and ANC follow-up frequency for urban women.

Women's educational status, employment position, early prenatal care registration, and frequent antenatal care were all significant determinants in pregnant women adhering to iron supplementation in rural women.

Increased prenatal care follow-up and early antenatal care registration were positively statistically significant predictors of iron supplementation compliance for both resident women. However, increased family size was statistically significant as a negative predictor.

The study's conclusions suggest that programs that promote health and educate people about nutrition should emphasize the relevance of iron tablet adherence in both urban and rural pregnant women to enhance iron adherence.

To determine the true determining elements and evaluate iron adherence through follow-up research, it is preferable to include all required or significant variables.

Acknowledgement

To that end, we would like to express our deepest gratitude to the DHS program at Wollo University, the College of Medicine and Health Science, and the Department of Midwifery.

Conflicts of interest

Authors declared no conflicts of interest.

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