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Original article

Knowledge and practices regarding anemia in pregnancy in New Delhi: Where do we stand?

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Abstract

Background: Anemia during pregnancy remains a major public health issue, contributing to increased risks of maternal and neonatal morbidity and mortality. This study aimed to determine the prevalence of anemia in pregnant women and evaluate their understanding of its causes, prevention strategies, and related health practices.

Methods: A cross-sectional survey was conducted among 545 pregnant women attending antenatal clinics at Dr. Baba Saheb Ambedkar Medical College and Hospital, Rohini, New Delhi, from January to December 2024. Data were collected through interviewer-administered questionnaires and clinical assessments, including hemoglobin measurement using a calibrated Sysmex analyzer. The questionnaire, covering sociodemographic data, anemia knowledge, and practices, was pre-tested for clarity and administered by trained assistants.

Results: The study revealed a high prevalence of anemia among pregnant women, with 84% affected and 52.5% having moderate anemia. Awareness of anemia, its prevention, and dietary sources of iron was low, with only 27.7% aware of anemia and 15% knowledgeable about prevention. Although 68.9% reported taking iron supplements, adherence to other preventive practices, including spacing iron and calcium intake (9.7%) and consuming a mixed diet (28.8%), was limited. Knowledge and preventive behaviors significantly declined as anemia severity increased ($p < 0.001$).

Conclusion: This study highlights a high prevalence of anemia and insufficient knowledge and preventive practices among pregnant women. Targeted educational and health interventions are urgently needed to raise awareness and promote effective anemia prevention behaviors.

Keywords: Anemia, Knowledge, Practices, Pregnancy, Prevalence, Prevention

Introduction

Anemia is a condition characterized by reduced hemoglobin or red blood cell count, impairing oxygen transport and causing health complications (1). This issue poses a significant public health concern, particularly affecting children, adolescent girls, and women during pregnancy and postpartum (2). Pregnant women are at heightened risk of adverse maternal and neonatal outcomes, especially in low- and middle-income countries (3).

The World Health Organization's statistics show that globally, 30% (539 million) of non-pregnant women and 37% (32 million) of pregnant women aged 15–49 suffer from anemia (4). In India, data from the National Family Health Survey-5 (NFHS-5, 2019–21) reveal that 57% of women and 25% of men aged 15–49 years are anemic. Anemia affects 61% of breastfeeding women and 52% of pregnant women. Among women who gave birth in the past five years, 88% received or purchased iron and folic acid tablets during pregnancy, but only 44% adhered to the recommended minimum of 100 days (5).

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The most common form of anemia during pregnancy is iron deficiency anemia, which develops when dietary iron cannot meet the body's increased demands, leading to lower hemoglobin and reduced oxygen supply to the mother and fetus (6, 7). Several factors contribute to anemia risk during pregnancy, including age, education, socioeconomic status, and diet. Younger women (aged 18–24 years) are at higher risk due to inadequate nutrition and increased physiological demands (8). Conversely, higher education levels are associated with greater awareness and adherence to iron supplementation.

Despite national programs such as Anemia Mukt Bharat and other initiatives aimed at reducing anemia, the NFHS-5 survey found an increase in anemia rates among women—rising from 53% (NFHS-4, 2015–16) to 57% (NFHS-5, 2019–21). Only 35.7% of pregnant women consumed the recommended ≥180 iron and folic acid tablets, with lower adherence among those with less education and in rural areas (5). Ongoing high rates of anemia are largely attributed to limited awareness, poor dietary habits, and inadequate adherence to supplementation (9).

This study aims to determine the prevalence of anemia among pregnant women in New Delhi, assess their knowledge and awareness of anemia and preventive measures, and analyze their dietary and supplementation practices. Findings will elucidate factors contributing to anemia in pregnant women and identify opportunities for targeted interventions. By comparing results with national figures like NFHS-5, the study seeks to inform policies and interventions to improve maternal health at regional and national levels.

Materials & Methods

This cross-sectional survey approved by the Institutional Ethics Committee of Dr Baba Saheb Ambedkar Medical College and Hospital with the ethical code 2322100213.

Participant Recruitment

A total of 545 pregnant women in their third trimester (≥28 weeks of gestation, confirmed by last menstrual period or ultrasound) attending the antenatal clinic were consecutively enrolled. Consecutive sampling was used to minimize selection bias, ensuring all eligible women visiting the clinic during the study period were invited to participate. Women aged 18 years or older with a singleton pregnancy who were willing to provide written informed consent were eligible to participate in this study. To minimize confounding variables and ensure a homogeneous study population, women were excluded if they had high-risk pregnancies, including those diagnosed with cardiac, renal, hepatic, or endocrine disorders such as diabetes mellitus or hypothyroidism; hypertensive disorders such as preeclampsia or gestational hypertension; active infections such as urinary tract infections or respiratory infections; bleeding disorders or antepartum hemorrhage; multiple gestations; hemoglobinopathies such as thalassemia or sickle cell disease; other chronic conditions such as tuberculosis or HIV/AIDS; incomplete or unreliable medical records; or an inability to complete the questionnaire due to language barriers or cognitive impairment.

Sample Size Calculation

The sample size was calculated based on the estimated prevalence of anemia among pregnant women in India (52%, as reported by NFHS-5, 2019–21) [International Institute for Population Sciences (IIPS) and ICF]. Using the formula for prevalence studies, where: (Z = 1.96) (95% confidence level), (P = 0.52) (expected prevalence), and (d = 0.05) (margin of error), the required sample size was approximately 384. Accounting for a 30% non-response rate and potential incomplete data, the target sample size was increased to 545 participants, which was achieved during the study period.

Data Collection

Data were collected through a combination of interviewer-administered questionnaires and clinical assessments. A structured questionnaire was developed based on a literature review and adapted to the local context, covering three domains:

Sociodemographic Details: Age, occupation, education level, family type (nuclear or joint), gravidity, and body mass index (BMI, calculated as weight in kg divided by height in m^2, measured at enrollment).

Knowledge of Anemia: Awareness of anemia, its causes, symptoms, complications, and preventive measures, including dietary sources of iron.

Practices Related to Anemia

Adherence to iron and folic acid supplementation, timing of supplement intake (e.g., spacing with calcium supplements, post-meal administration), and dietary habits (e.g., consumption of a mixed diet including iron-rich foods).

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The questionnaire was pre-tested on 30 pregnant women (not included in the final sample) to assess clarity, cultural appropriateness, and response time (approximately 15–20 minutes). Minor revisions were made to improve comprehension. The questionnaire was administered in Hindi or English by trained research assistants (two female nurses with prior experience in public health research) in a private room to ensure confidentiality. To reduce interviewer bias, assistants underwent a two-day training session on questionnaire administration, consent procedures, and ethical considerations.

Clinical and Laboratory Assessments

Blood samples (2 mL) were collected via venipuncture by trained phlebotomists under aseptic conditions during routine antenatal visits. Hemoglobin levels were measured using a Sysmex XN-1000 automated hematology analyzer (Sysmex Corporation, Japan), calibrated daily per manufacturer guidelines. The analyzer employs the sodium lauryl sulfate (SLS) method for hemoglobin estimation, with a precision of ±0.2 g/dL. Quality control was ensured through daily internal checks and monthly external quality assurance with a reference laboratory. Additional routine laboratory tests (e.g., complete blood count, peripheral smear) were performed per institutional protocols to rule out other causes of anemia.

Anemia was classified according to Indian Council of Medical Research criteria, defining severe anemia as hemoglobin levels below 7 g/dL, moderate anemia as hemoglobin levels between 7 and 9.9 g/dL, mild anemia as hemoglobin levels between 10 and 10.9 g/dL, and normal hemoglobin as levels at or above 11 g/d [Indian Council of Medical Research]:

Weight and height were measured using a calibrated digital scale (Seca 813, accuracy ±0.1 kg) and stadiometer (Seca 213, accuracy ±0.1 cm), respectively, to calculate BMI. Gestational age was verified using medical records or ultrasound reports.

Data Management

Data from questionnaires were double-entered into a secure Microsoft Excel database by two independent data entry operators to minimize errors. Discrepancies were resolved by referring to the original forms. Laboratory results were electronically extracted from the hospital's laboratory information system and merged with questionnaire data using unique participant identifiers. Personal identifiers were removed to ensure anonymity, and data were stored on a password-protected computer accessible only to the research team.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA). Continuous variables (e.g., age, hemoglobin levels, BMI) were summarized as mean ± standard deviation (SD) after confirming normality using the Shapiro-Wilk test. Categorical variables (e.g., anemia status, education level, supplement adherence) were expressed as frequencies and percentages.

To compare categorical variables between groups (e.g., anemic vs. non-anemic women), the Chi-square test was used, with Fisher's exact test applied when expected cell counts were <5. For continuous variables, group comparisons were conducted using independent t-tests for two groups (e.g., primigravida vs. multigravida) or one-way analysis of variance (ANOVA) for more than two groups (e.g., anemia severity categories), followed by post-hoc Tukey's test for significant ANOVA results.

To ensure data quality, the principal investigator regularly monitored data collection through weekly reviews of completed questionnaires, laboratory equipment was calibrated and maintained according to standard operating procedures, research assistants were trained and supervised to standardize data collection, and random audits of 10% of entered data were conducted to verify accuracy against source documents.

Results

The study included predominantly pregnant women aged 18–24 years (56.0%), most of whom were non-working (92.7%) and had completed education up to the 12th grade (44.4%). The majority lived in nuclear family setups (63.9%), with more than half being multigravida (51.2%), and 76.8% had a body mass index (BMI) within the normal range of 18.5–25 kg/m² (Table 1).

Anemia was highly prevalent, affecting approximately 84–88% of women aged 18–34 years, dropping to 57% among those older than 34 years. The anemia prevalence was similar between working and non-working women (82.5% vs. 84.2%) and was highest among women with lower educational levels

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(88% among those educated below 5th grade) compared to graduates (76%). Rates were comparable between those living in joint (87.8%) and nuclear families (81.9%), as well as between primigravida (83.0%) and multigravida women (85.0%) (Table 2).

Table 1. Sociodemographic characteristics of pregnant women

Variables	N (%)
Maternal age (years)	
18–24	305 (56.0)
25–30	215 (39.4)
31–34	18 (3.3)
>34	7 (1.3)
Occupation	
Working	40 (7.3)
Non-Working	505 (92.7)
Education	
0–5th Standard	134 (24.6)
6–8th Standard	131 (24.0)
9–12th Standard	242 (44.4)
Diploma/Graduate	38 (7.0)
Type of family	
Nuclear	348 (63.9)
Joint	197 (36.1)
Pregnancy status	
Primigravida	266 (48.8)
Multigravida	279 (51.2)
BMI (kg/m²)	
<18.5	108 (20.5)
18.5–25	404 (76.8)
>25	14 (2.7)

Table 2. Sociodemographic characteristics of pregnant women in relation to anemia

Age group (years)	Normal n (%)	Anemic n (%)
18–24	48 (15.7)	257 (84.3)
25–30	34 (15.8)	181 (84.2)
31–34	2 (11.1)	16 (88.9)
>34	3 (42.9)	4 (57.1)
Occupation		
Working	7 (17.5)	33 (82.5)
Non-Working	80 (15.8)	425 (84.2)
Educational Status		
<5th Standard	16 (11.9)	118 (88.1)
6–8th Standard	19 (14.5)	112 (85.5)
9–12th Standard	43 (17.8)	199 (82.2)
Graduate	9 (23.7)	29 (76.3)
Family Type		
Nuclear	63 (18.1)	285 (81.9)
Joint	24 (12.2)	173 (87.8)
Gravida		
Primigravida	45 (17.0)	221 (83.0)
Multigravida	42 (15.0)	237 (85.0)
BMI (kg/m²)		
<18.5	17 (15.7)	91 (84.3)
18.5–25	65 (16.1)	339 (83.9)
>25	2 (14.3)	12 (85.7)

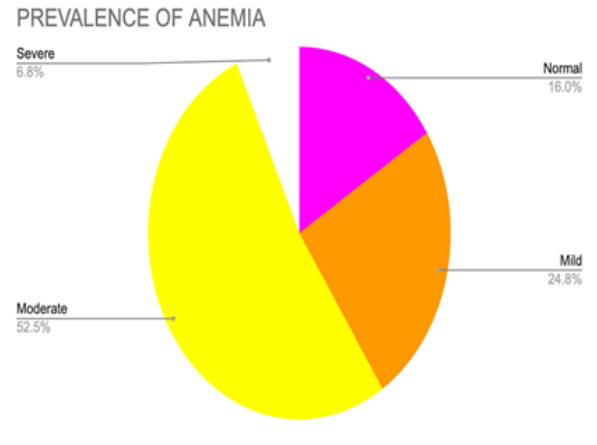

Figure1 Prevalence of anemia

Overall, 84% of the participants were anemic, with moderate anemia being most common (52.5%), followed by mild (24.8%) and severe anemia (6.8%) (Fig 1).

Regarding awareness, only 27.7% of participants knew about anemia during pregnancy, with awareness significantly declining as anemia severity increased—from 37.9% among non-anemic women to just 5.4% in those with severe anemia ($p < 0.001$) (Table 3). Knowledge about anemia prevention was even lower at 15%, with 28.7% of non-anemic women aware of preventive measures, while none of the severely anemic women had this awareness ($p < 0.001$) (Table 4). Awareness of dietary sources of iron was reported by 35.7% of participants and was significantly associated with anemia severity ($p = 0.04$) (Table 5).

In terms of practices, 68.9% reported taking iron supplements during pregnancy; however, adherence dramatically declined with the severity of anemia—from 97.7% in non-anemic women to only 10.8% in those severely anemic ($p < 0.001$) (Table 6). Proper timing between iron and calcium intake was maintained by only 9.7%, with better adherence among non-anemic women (18.4%) compared to those with moderate or severe anemia (6–8%) (Table 7). Additionally, 65.5% took iron supplements one hour after meals, a practice less frequent among women with moderate (56.2%) and severe anemia (16.2%) ($p < 0.001$). Just 28.8% followed a mixed diet, and folic acid intake prior to pregnancy was notably rare (Table 8).

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Table 3. Knowledge about "anemia in pregnancy"

Degree of Anemia	Numbers (n=151)	Percentage (27.7%)	P Value
Normal	33	37.9	<0.001
Mild	47	34.8	
Moderate	69	24.1	
Severe	2	5.4	

Table 4. Knowledge about "how to prevent anemia"

Degree of Anemia	Numbers (n=82)	Percentage (15%)	P Value
Normal	25	28.7	<0.001
Mild	27	20	
Moderate	30	10.6	
Severe	0	0	

Table 5. Knowledge of "dietary sources of iron"

Degree of anemia	Aware (N=195)	Percentage (35.7%)	P Value
Normal	39	44.8	0.04
Mild	56	41.5	
Moderate	89	31.1	
Severe	11	29.7	

Table 6. Practice of iron intake in pregnancy

Degree of anemia	Taken (N=376)	Percentage (68.9%)	P Value
Normal	85	97.7	<0.001
Mild	117	86.7	
Moderate	170	59.4	
Severe	4	10.8	

Table 7 . Practice of maintaining gap between iron and calcium intake

Degree of anemia	Yes (N=53)	Percentage (9.7%)	P Value
Normal	16	18.4	0.012
Mild	15	11.1	
Moderate	19	6.6	
Severe	3	8.1	

Table 8. Practice of taking iron 1 hour after meals

Degree of Anemia	Numbers (N=357)	Percentage (65.5%)	P Value
Normal	79	90.8	<0.001
Mild	113	83.7	
Moderate	159	56.2	
Severe	6	16.2	

Overall, these findings reveal significant deficiencies in both knowledge and preventive behaviors related to anemia among pregnant women, with the gaps widening alongside the severity of anemia (Fig 2).

Discussion

Our study revealed a strikingly high prevalence of anemia among pregnant women aged 18–34 years, ranging between 84% and 88%, with a notable decline among those older than 35 years. This pattern likely reflects the demographic profile of our hospital attendees, predominantly aged 20–35 years. Similar trends were reported by Vanamala et al., who identified women aged 20–30 years as the most affected group (10).

Employment status did not significantly affect anemia prevalence, which remained comparably elevated at around 82–84% for both working and non-working women. In contrast, educational level showed a distinct relationship with anemia rates: women educated below the 5th standard had the highest prevalence (88%), diminishing progressively to 76% among graduates. This association suggests that higher education enhances knowledge about anemia, its etiology, and preventive strategies—a finding supported by studies from Nepal, Ghana, and Saudi Arabia, which link advanced education to improved women's health literacy (11-13).

Family structure also appeared influential; women residing in joint families exhibited higher anemia rates (87.8%) compared to those in nuclear families (81.9%). This disparity may stem from the economic challenges often faced by larger households, potentially resulting in poorer nutritional intake. Parity had no significant impact on anemia prevalence, with primigravida and multigravida women showing similar rates (82% and 84%, respectively). These results concur with findings from Puducherry, India (14), but differ from other studies suggesting an increased anemia risk with higher parity (15). Other demographic factors such as occupation, family type, and BMI did not show significant associations in our cohort.

The overall anemia prevalence of 84% in our population (Figure 1) considerably exceeds the 52.5% reported by the NFHS-5 survey for India (5). Comparable research by Cheema et al., Singh et al., and Vanamala et al. documented anemia rates between 48% and 65.6% (15, 16), whereas a study by Kefiyalew et al. in Ethiopia reported a much lower prevalence of 27.9% (17). Moderate anemia was the most common grading in our study (52.5%), aligning

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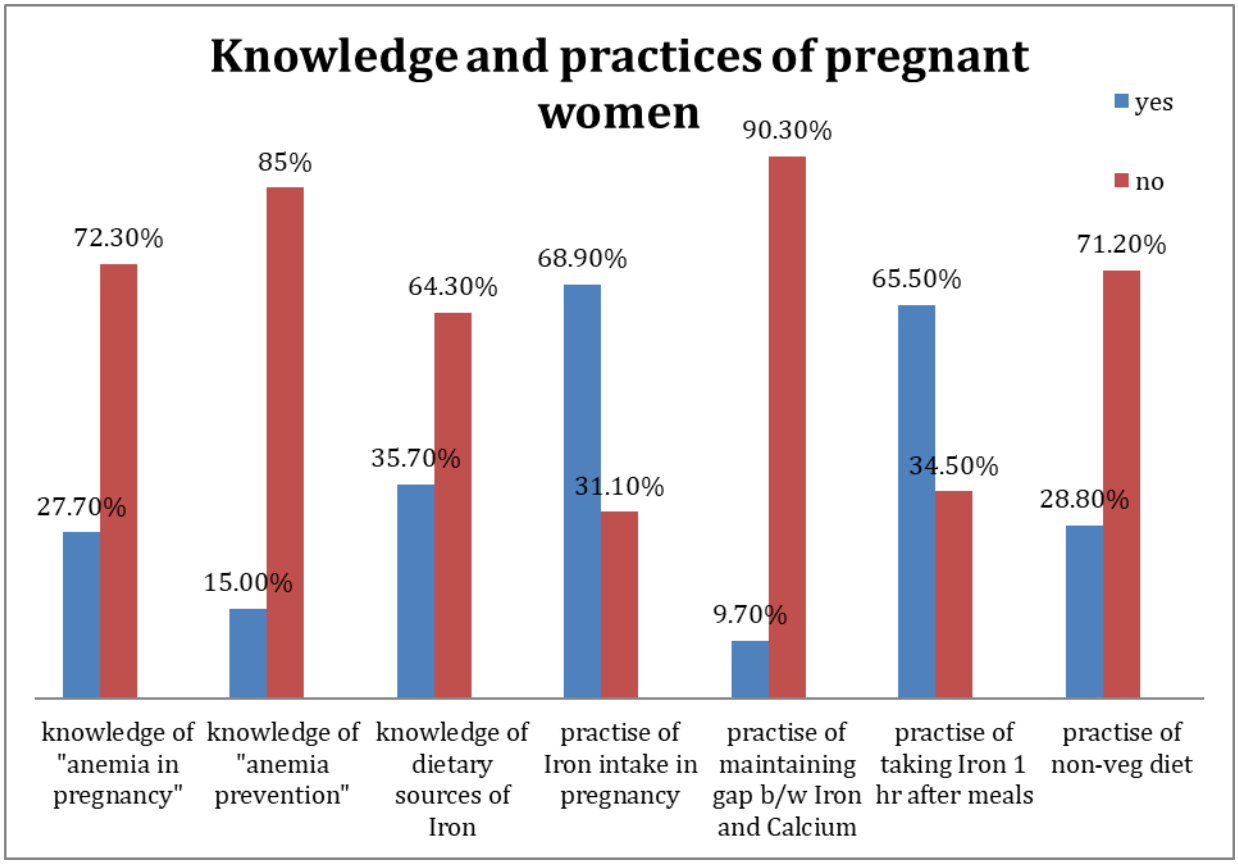

Figure 2 Knowledge and practices of pregnant women

with Nagar et al.'s (10) findings, though some literature notes mild anemia as more prevalent.

Awareness of anemia during pregnancy was limited, with only 27.7% of all participants and 37.9% of non-anemic women demonstrating awareness. These figures are substantially lower than those reported from Puducherry and Tamil Nadu, where awareness ranged from 40% to 76.5%, and much lower than data from a tertiary center in Pune, where over 95% of women exhibited moderate to good knowledge (14, 18). International studies also report higher awareness levels (44.9% and 54.1%) (5, 19), likely reflecting differences in socioeconomic status and education. Our sample predominantly represented lower socioeconomic strata, with nearly half of the participants educated below the 8th grade, which likely contributed to the low awareness observed. Notably, anemia-related knowledge decreased markedly with severity, dropping from approximately 35% among mild cases to just 5% in severe anemia.

Similarly, understanding of anemia prevention was poor, with fewer than 15% aware overall and less than 30% among women with normal hemoglobin levels. This contrasts sharply with other studies reporting 69–75.5% awareness of preventive measures, including iron supplementation (18, 20). Ethiopian studies also showed better prevention knowledge (57.7% and 63.2%) (5, 19). Differences may arise from temporal, cultural, and demographic factors. A strong negative correlation existed between prevention knowledge and anemia severity; only 10% of moderately anemic and none of the severely anemic women were aware of prevention methods.

Awareness of dietary sources rich in iron was low (37.5%) compared to 80–99% reported in other studies (14, 20). This awareness inversely correlated with

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anemia severity, with only 30% of severely anemic women identifying iron-rich foods correctly.

Regarding preventive practices, about 70% of women reported taking iron supplements, consistent with findings from Puducherry and Pune (14, 19, 20) but lower than some other reports. Supplement adherence was strongly linked with anemia severity: 97.7% of non-anemic women followed supplementation regimens, whereas it plummeted to 10.8% among severely anemic women. Proper spacing between iron and calcium intake, crucial for optimizing iron absorption, was maintained by just 9.7% of participants, substantially below the 70% adherence reported elsewhere. Non-anemic women were more likely to observe this interval than severely anemic women, highlighting its clinical importance. Moreover, 65.5% took iron supplements one hour after meals, with significantly greater adherence among non-anemic (90.8%) versus severely anemic (16%) women. Only 28.8% consumed a mixed diet—typical of Indian dietary habits—potentially contributing to anemia prevalence. This contrasts with an Ethiopian study reporting 61.7% weekly meat consumption, emphasizing the role of diet in anemia risk (19).

Strengths and Limitations

The cross-sectional design limits the ability to establish causality between variables. Additionally, data derived from self-reported questionnaires may be subject to recall and reporting biases. Nevertheless, the large sample size of 545 pregnant women and thorough data collection enhance the reliability of our prevalence estimates and assessments of knowledge and practices related to anemia in this population.

Conclusion

This study highlights that anemia remains a significant public health challenge among pregnant women. Despite national programs like Anemia Mukt Bharat, there is still a widespread lack of awareness regarding the condition and its prevention. Moreover, the adoption of preventive practices remains inadequate. These findings underscore the urgent need for targeted interventions, including comprehensive nutrition education and improved access to iron supplements. Early counseling, particularly during the first trimester, is crucial to ensure sustained understanding and adherence throughout pregnancy. Additionally, leveraging technology-based solutions, such as mobile health apps or SMS reminders, could improve awareness and promote healthier practices, ultimately helping to reduce the burden of maternal anemia.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this article.

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