Section: Community Medicine

Original Research Article

ANEMIA IN PREGNANCY: A CROSS-SECTIONAL STUDY OF NUTRITIONAL, DEMOGRAPHIC, AND REPRODUCTIVE FACTORS IN RURAL BAREILLY

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ABSTRACT

Background: Anemia during pregnancy is a major public health issue in India, contributing to adverse maternal and perinatal outcomes. This study aimed to determine the prevalence of anemia and its associated demographic, reproductive, and nutritional factors among pregnant women in rural Bareilly.

Materials and Methods: A cross-sectional study was conducted among 385 pregnant women attending their first antenatal visit at a secondary care center. Hemoglobin estimation was done using the WHO color scale. Data were collected via a semi-structured questionnaire and analyzed using SPSS version 26. The chi-square test was applied to examine associations.

Results: Anemia was observed in 66.75% of participants, with moderate anemia being most common. Higher prevalence was noted among rural women (71.53%) and those in three-generation families (75.65%). Anemia increased with gestational age. Meal frequency showed a strong association ($p < 0.00001$), with the highest prevalence among women consuming one meal daily. No significant associations were found with IFA supplementation or abortion history.

Conclusion: Anemia in pregnancy is influenced by nutritional and demographic factors, highlighting the need for improved dietary practices and antenatal education.

Keywords: Anemia in pregnancy, Pregnant women, Nutritional factors, Iron supplementation, Maternal health, Antenatal care.

INTRODUCTION

Pregnant women are frequently affected by anemia, and it is a serious public health concern worldwide.[1] Most common cause of anemia is Iron deficiency and other contributory factor is folic acid, vitamin B12, helminthic infection, malaria and chronic diseases.[2,3] Anemia is a significant contributor to maternal and fetal morbidity and mortality, and it appears to be responsible for several adverse effects on the fetus, including intrauterine growth restriction, fetal death in utero, infection, preterm delivery, low birth weight, fetal cognitive and permanent Neurological development damage.[4]

Anemia in pregnancy is defines as a Hemoglobin (Hb) value is less then 11 gm/dL and classified in to mild, moderate and severe, 10 to 10.9 gm/dL, 7 to 9.9 gm/dL and less then 7 gm/dL respectively.[5] In India the prevalence of anemia is 52.2% as per NFHS V.[6] Research has indicated that the prevalence of anemia is caused by several factors, including low socioeconomic status, illiteracy, high parity, short birth interval, and nutritional inadequacies. The issue is further made worse by inadequate prenatal care use and a delayed start to iron and folic acid treatment.[7] To reduce anemia in pregnant women, the government had launched various program in India. Despite of it, anemia remain prevalent in pregnant females. Hence, the purpose of the study is to gather information for prevalence of anemia and the factor associated with it.

Aim and Objectives: The study aimed to estimate the prevalence of anemia among pregnant women and examine its association with demographic, reproductive, and nutritional factors including age, residence, family type, gestational age, abortion history, meal frequency, and IFA supplementation.

MATERIALS AND METHODS

This study employed a cross-sectional design conducted over a period of one year to assess the prevalence and determinants of anemia among pregnant women in a rural region of Bareilly.

Sampling Technique and Sample Size

Participants were selected through simple random sampling. The sample size was calculated based on the prevalence of anemia in pregnancy reported in NFHS V (52.2%), using the formula for a single population proportion:

$$n = \frac{Z^2 \times p\,(1-p)}{e^2}$$

where Z = 1.96 (for 95% confidence), p = 0.52, and e = 0.05. The estimated sample size was 384, which was rounded to 385 to account for potential non-response.

Study Population and Eligibility

The study included pregnant women aged 18–45 years attending their first antenatal visit at Community Health Center (CHC), Bareilly. Participants were enrolled after obtaining informed consent. Women with previous ANC visits or those unwilling to participate were excluded.

Data Collection

A semi-structured, interviewer-administered questionnaire was used to collect information on demographic, nutritional, and reproductive factors. Medical records and antenatal registration cards were reviewed to ensure data accuracy.

Hemoglobin Estimation

Hemoglobin levels were measured using the WHO Hemoglobin Color Scale, which is practical and suitable for field-level assessments in resource-limited settings.

Data Analysis

Collected data were entered and analyzed using IBM SPSS Statistics Version 26. Descriptive statistics were used to summarize the findings, and inferential statistics (Chi-square test) were applied to assess associations between anemia and independent variables. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 385 pregnant women participated in the study, out of which 66.75% were found to be anemic (Figure 1). Classification of anemia based on WHO criteria revealed that 20.77% of the women had mild anemia, 45.45% had moderate anemia, and 2.00% were diagnosed with severe anemia (Figure 2), indicating that moderate anemia was the most frequently observed category.

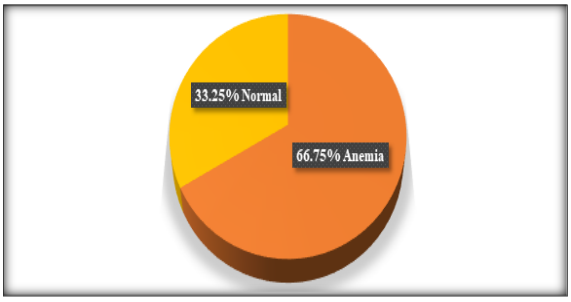

Figure 1: Prevalence of Anemia

Age-wise distribution showed that out of 301 women aged 18 to 27 years, 195 (64.78%) were anemic, whereas in the 28 years and above group, 62 out of 84 women (73.80%) were found to be anemic (Figure 3). This indicates a higher proportion of anemia in the older age group.

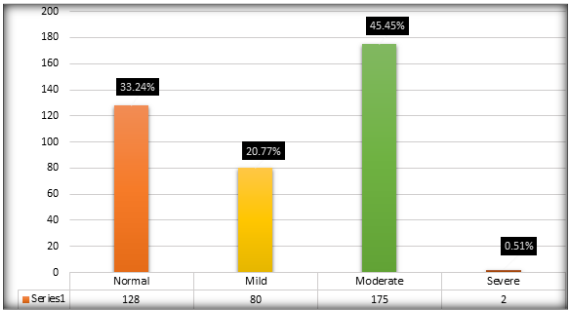

Figure 2: Anemia Status as Per WHO Classification

In terms of residence, 186 out of 260 women (71.53%) residing in rural areas were anemic. Among those from semi urban areas, 64 out of 109 women (58.71%) were anemic, and in urban areas, 7 out of 16 women (43.75%) were found to be anemic. The data highlights a greater burden of anemia in rural regions compared to semi urban and urban localities (Figure 3).

Analysis of family type revealed that among 172 women living in joint families, 113 (65.69%) were anemic. In nuclear families, 57 out of 98 women (58.16%) were anemic. The highest anemia prevalence was observed in women from three-generation households, where 87 out of 115 (75.65%) were anemic. These findings suggest a notable variation in anemia prevalence based on household structure (Figure 3).

Gestational age distribution demonstrated that in the first trimester, 57 out of 98 women (58.16%) were anemic. In the second trimester, 131 out of 192 women (68.22%) were anemic, and in the third trimester, 69 out of 95 women (72.63%) were affected. This trend reflects a progressive increase in anemia prevalence with advancing stages of pregnancy (Figure 3).

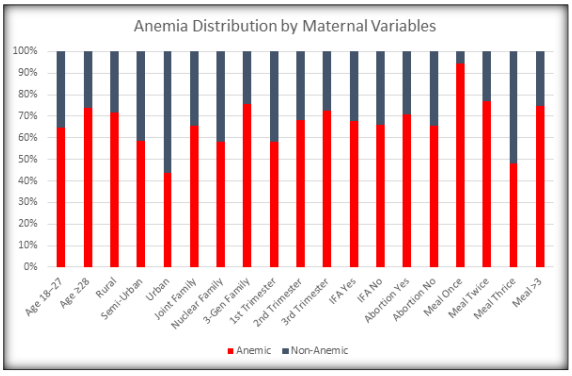

Figure 3: Anemia Status by Demographic, Nutritional, and Reproductive Variables

Regarding Iron-Folic Acid supplementation, 111 out of 164 women (67.68%) who reported taking supplements were anemic. Among those not taking IFA supplements, 146 out of 221 women (66.06%) were anemic. The similar levels of anemia in both groups indicate that supplementation alone may not be sufficient to address the issue comprehensively (Figure 3).

Among women with a history of abortion (n = 72), 51 (70.83%) were anemic. In comparison, among those with no history of abortion (n = 313), 206 (65.81%) were found to be anemic. The distribution suggests a slightly higher anemia burden in those with previous pregnancy losses (Figure 3).

Meal frequency demonstrated a clear gradient in anemia prevalence. Of the 18 women who consumed one meal per day, 17 (94.44%) were anemic. Among 216 women who ate twice a day, 166 (76.85%) were anemic. In the group consuming three meals daily (n = 147), 71 (48.29%) were anemic. Among the 4 women who ate more than three times daily, 3 (75.00%) were anemic. The data suggests a direct relationship between lower meal frequency and higher prevalence of anemia (Figure 3).

These findings collectively show that anemia is widespread among pregnant women, with higher rates observed in rural areas, older age groups, women living in extended households, and those in later stages of pregnancy. Inadequate dietary intake, despite supplementation, appears to be a critical contributing factor, pointing toward the need for broader nutritional and community-based interventions during pregnancy.

Table 1: Distribution of Anemia Among Pregnant Women According to Demographic, Nutritional, and Reproductive Variables (n = 385)

Variables	Groups	Anemia	No Anemia	Total	p Value
Age	18 to 27	195 (64.78%)	106 (35.21%)	301	0.155
	28 or above	62 (73.80%)	22 (26.19%)	84	
Residence	Rural	186 (71.53%)	74 (28.46%)	260	**0.007**
	Semi Urban	64 (58.71%)	45 (41.28%)	109	
	Urban	7 (43.75%)	9 (56.25%)	16	
Type of Family	Joint Family	113 (65.69%)	59 (34.30%)	172	**0.024**
	Nuclear Family	57 (58.16%)	41 (41.83%)	98	
	Three Generation Family	87 (75.65%)	28 (24.34%)	115	
Trimester	First Trimester	57 (58.16%)	41 (41.83%)	98	0.085
	Second Trimester	131 (68.22%)	61 (31.77%)	192	
	Third Trimester	69 (72.63%)	26 (27.36%)	95	
Meals per day	3 Times a day	71 (48.29)	76 (51.70%)	147	**0.00001**
	>3 times a day	3 (75%)	1 (25%)	4	
	Once Daily	17 (94.44%)	1 (5.55%)	18	
	Twice Daily	166 (76.85%)	50 (23.14%)	216	
IFA Supplement	No	146 (66.06%)	75 (33.93%)	221	0.822
	Yes	111 (67.68%)	53 (32.31%)	164	
History of Abortion	No	206 (65.81%)	107 (34.18%)	313	0.498
	Yes	51 (70.83%)	21 (29.16%)	72	

Chi-square analysis (Table 1) revealed statistically significant associations between anemia prevalence and demographic and lifestyle characteristics among pregnant women. A clear and statistically significant association was observed with the place of residence (p = 0.007), where the prevalence of anemia was highest among women residing in rural areas (186 out of 260; 71.53%), followed by those in semi-urban settings (64 out of 109; 58.71%), and was lowest among urban residents (7 out of 16; 43.75%). Likewise, family type also showed a significant relationship with anemia prevalence (p = 0.024). The highest burden was seen among women from three-generation families (87 out of 115; 75.65%), followed by those from joint families (113 out of 172; 65.69%) and nuclear families (57 out of 98; 58.16%).

On the other hand, maternal age did not exhibit a statistically significant association with anemia status (p = 0.155). However, the data showed a higher prevalence of anemia in women aged 28 years and above (62 out of 84; 73.80%) compared to those aged 18–27 years (195 out of 301; 64.78%), indicating a potential trend that did not reach statistical significance. Similarly, while there was an increasing trend in anemia prevalence with advancing gestational trimester, this was not statistically significant (p = 0.085). The prevalence increased from the first trimester (57 out of 98; 58.16%) to the second trimester (131 out of 192;

68.22%) and peaked in the third trimester (69 out of 95; 72.63%), suggesting that physiological demands of pregnancy may contribute to the increasing anemia burden.

A highly significant association was found between meal frequency and anemia prevalence ($p = < 0.00001$), replacing the previously incorrect value. The highest prevalence was observed among women consuming only one meal per day, with 17 out of 18 (94.44%) affected. Among those consuming two meals daily, 166 out of 216 (76.85%) were anemic. In contrast, those who reported eating three times a day had a significantly lower prevalence (71 out of 147; 48.29%). Even among the small group eating more than three meals per day, 3 out of 4 (75.00%) were found to be anemic. These findings highlight a strong correlation between lower meal frequency and increased anemia prevalence during pregnancy.

No statistically significant association was found between anemia status and iron-folic acid (IFA) supplementation ($p = 0.822$). Among those who reported taking IFA, 111 out of 164 (67.68%) were anemic, while among those who did not, 146 out of 221 (66.06%) were anemic indicating minimal difference between the two groups. Likewise, history of abortion did not show a significant association with anemia ($p = 0.498$), although prevalence was slightly higher in women with such a history (51 out of 72; 70.83%) compared to those without (206 out of 313; 65.81%).

The analysis emphasizes the significant role of residence, family type, and particularly meal frequency in determining anemia status during pregnancy. Other factors, including maternal age, gestational stage, IFA intake, and abortion history, showed observable trends but did not reach statistical significance within the scope of this study.

DISCUSSION

The present study identified a high prevalence of anemia among pregnant women, with 66.75% of participants affected. This figure surpasses the national average of 52.2%, the Uttar Pradesh state estimate of 45.9%, and the regional data for Rohilkhand, which stands at 50.9% as reported by NFHS-V6. Furthermore, our findings indicate a rise in anemia prevalence when compared to earlier research conducted in Bareilly, such as the study by Singh P et al,[8] which documented a prevalence of 58.3% in 2014. This suggests that despite ongoing maternal health initiatives, anemia continues to pose a significant public health challenge in the region.

When stratified by age, our data demonstrated that women aged 28 years and above experienced a higher rate of anemia (73.80%) in comparison to those aged 18–27 years (64.78%). These findings contrast with those of Mallika S et al,[9] and Sarala V et al,[10] who reported that younger age groups, particularly women below 25 years, exhibited greater susceptibility to anemia. In their observations, anemia prevalence declined steadily with increasing age. The divergent trend in our study may be attributed to local dietary habits, lifestyle factors, delayed antenatal registration in older women, or variation in health service utilization.

With respect to residence, our results corroborate findings from Rama A et al,[11] and Natarajan MP et al,[12] both of whom highlighted rural residency as a contributing factor to anemia during pregnancy. In the present study, 71.53% of rural participants were anemic, compared to 58.71% in semi-urban and 43.75% in urban areas. This pattern underscores the ongoing urban–rural divide in nutritional health, possibly influenced by differences in access to antenatal care, health literacy, and socioeconomic status.

Family structure also emerged as a significant determinant. Anemia prevalence was highest among women living in three-generation households (75.65%), followed by those in joint families (65.69%) and nuclear families (58.16%). This aligns with observations by Tayade S et al,[13] who identified family type as a significant factor in anemia risk. Although their study reported higher mild anemia in nuclear families, our findings suggest that the burden may be greater in extended households, potentially due to increased caregiving responsibilities, unequal food distribution, or lower autonomy in health-related decision-making.

An increasing trend in anemia prevalence across trimesters was also observed. From 58.16% in the first trimester, rates rose to 68.22% in the second and 72.63% in the third trimester. These results are consistent with those of Dwivedi R et al,[14] who reported a similar progression in anemia with advancing pregnancy, although without statistical significance. This pattern may reflect the rising physiological iron demands during gestation, which are often unmet, particularly in nutritionally vulnerable populations.

In examining obstetric history, we found that women with a history of abortion had a higher anemia prevalence (70.83%) compared to those without such a history (65.81%). Although the association was not statistically significant, the direction of the trend mirrors the findings of Getaneh et al,[15] who documented a significantly higher anemia prevalence in women with prior abortions. This suggests that such women may require closer monitoring and targeted nutritional interventions in subsequent pregnancies.

Iron-folic acid (IFA) supplementation remains a cornerstone of anemia prevention strategies during pregnancy. In our study, anemia prevalence was similar among those who reported taking IFA (67.68%) and those who did not (66.06%). However, a more detailed examination revealed that irregular consumption was associated with higher anemia rates. These findings align with Abiselvi A et al,[16] who found that inconsistent IFA intake significantly increased anemia risk (86.5%)

compared to regular consumption (30.7%, p = 0.001). This underscores the importance not only of supplementation availability but also of adherence and early initiation.

Nutritional intake, particularly meal frequency, showed a strong and statistically significant association with anemia. In our study, anemia was most prevalent among women who consumed only one meal per day (94.44%), followed by those consuming two meals (76.85%), with significantly lower rates in those eating three times daily (48.29%). These findings agree with studies by Abay A et al,[17] and Abriha A et al,[18] both of which reported higher anemia prevalence among women consuming fewer than two meals per day. These results emphasize the role of overall dietary adequacy and frequency in maintaining maternal hemoglobin levels during pregnancy.

CONCLUSION

The present cross-sectional study, conducted among 385 pregnant women in rural Bareilly, highlights a substantial burden of anemia during pregnancy, with a prevalence of 66.75%. The most of cases were classified as moderate anemia according to WHO criteria, underlining the clinical and public health significance of this condition in the antenatal population.

The findings reveal that anemia is not uniformly distributed across all groups but is significantly influenced by certain demographic and nutritional factors. A notably higher prevalence was observed among women residing in rural areas and those living in three-generation families. These associations may reflect disparities in access to health services, nutritional resources, and intra-household food distribution, especially in extended family settings.

A progressive increase in anemia was observed with advancing gestational age, suggesting that physiological demands during pregnancy may not be met adequately, particularly in the later trimesters. Although this trend did not reach statistical significance, it signals the need for early nutritional intervention.

One of the most striking findings of this study is the strong association between meal frequency and anemia prevalence. Women consuming fewer meals per day had a significantly higher risk of anemia, indicating that dietary inadequacy remains a major determinant. While iron-folic acid supplementation is widely promoted, the findings suggest that supplementation alone may not be sufficient, particularly if not complemented by overall dietary improvement.

Other variables, such as maternal age and history of abortion, demonstrated observable patterns but lacked statistical significance. Nevertheless, these factors may still hold relevance at the individual level and warrant further exploration in larger or longitudinal studies.

In conclusion, the study underscores the multifactorial etiology of anemia in pregnancy, influenced by demographic, nutritional, and household factors. Interventions aimed at improving dietary intake, enhancing nutritional education, and addressing contextual barriers in rural and extended family settings are essential. Early identification and comprehensive antenatal care strategies should be strengthened to effectively reduce the burden of anemia among pregnant women in similar low-resource settings.

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