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Original Research Article

Prevalence of Anemia and Its Associated Factors Among Pregnant Women in a Tertiary Care Hospital of Amritsar

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Abstract:

Background: Pregnancy-related anemia is still a significant public health issue in poorer nations, particularly in India, where nutritional deficiencies and repeated pregnancies contribute significantly to maternal morbidity. Evaluating the frequency of anemia in the local population and its contributing factors helps in planning effective preventive strategies.

Objectives: To ascertain the frequency of anemia and the hematological and biochemical characteristics linked to it in expectant mothers who visit prenatal clinics at a tertiary care hospital in Amritsar.

Methods: From January 2023 to June 2024, The Department of Obstetrics and Gynecology at Government Medical College in Amritsar conducted prospective observational research. A total of 500 pregnant women were enrolled after informed consent. Detailed sociodemographic, clinical, and laboratory data were collected. Hemoglobin estimation and red-cell indices (MCHC, MCV, RBC count, PCV, MCH) were performed using automated analyzers. Serum ferritin, iron, and Vitamin B12 levels were assessed. WHO criteria were used to classify anemia. A p-value of less than 0.05 was considered significant, and SPSS was utilized to analyze the data.

Results: Among 500 pregnant women, 85.2% were anemic. Mild anemia was most common (50%), followed by moderate (27.6%) and severe (7.6%) forms. Hemoglobin levels were 9.11 ± 1.4 g/dL on average. Age and hemoglobin did not significantly correlate ($p = 0.522$). Hematological indices and micronutrient levels (MCV, MCH, MCHC, serum ferritin, iron, and Vit. B12) showed significant differences across anemia severity groups ($p < 0.05$), indicating predominantly iron-deficiency anemia.

Conclusion: In Amritsar, the rate of anemia in expectant mothers is still startlingly high. Routine screening, dietary counseling, and adherence to iron-folic acid supplementation should be strengthened to improve maternal outcomes.

Keywords: Pregnancy, Iron Deficiency, Ferritin, Vit. B12, Anemia.

Introduction

One of the most prevalent avoidable causes of maternal morbidity during pregnancy is anemia. Pregnancy-related anemia is still a principal global public health risk, especially in underdeveloped nations where malnutrition and poor maternal healthcare are still common. A hemoglobin concentration of less than 11 g/dL is considered anemia in pregnancy by the World Health Organization (WHO), which also classifies it as mild to severe based on severity. Anemia is thought to affect over 40% of pregnant women worldwide, affecting almost 32 million women annually. The majority of these cases occur in Asia and Africa, regions where socioeconomic disparities, poor dietary intake, and repeated pregnancies are common. Despite extensive public health initiatives, maternal anemia continues to be a leading source of morbidity and death, contributing significantly to poor obstetric outcomes and impaired child health. Deficiency in iron is the most frequent underlying reason, accountable for about three-quarters of pregnancy-related anemia cases, despite persistent infections, folate, and Vitamin B12 deficits also contribute to its multifactorial etiology.

The impact of anemia in pregnancy extends beyond the physiological fatigue or pallor commonly observed in affected women. It has far-reaching repercussions for the fetus and mother. Intrauterine growth restriction, low birth weight, and preterm

delivery have all been associated with maternal anemia, perinatal mortality, and postpartum hemorrhage. Severe anemia can lead to cardiac failure, reduced physical and cognitive performance, and heightened susceptibility to infections. For the fetus, inadequate maternal hemoglobin and iron stores impair oxygen delivery and lead to long-term developmental delays and weakened immunity during infancy. The persistence of anemia is influenced by several social and biological determinants. Low educational status, poverty, early marriage, multiparity, inadequate birth spacing, and cultural dietary restrictions contribute to inadequate iron intake and absorption. Moreover, the consumption of iron inhibitors such as phytates and tannins, common in traditional Indian diets, further reduces iron bioavailability.

The highest rate of anemia among pregnant women worldwide is found in India. The National Family Health Survey-5 (2019–21) indicates that 52.2% of Indian pregnant women are anemic, reflecting little improvement from previous surveys. The prevalence exceeds 60% in several northern and eastern states, highlighting persistent challenges in prevention and management. The problem is multifactorial—stemming from inadequate dietary iron intake, poor limited access to high-quality prenatal care, recurrent infections, and noncompliance with Supplementing with folic acid and iron. Even with the introduction of government initiatives like the Anemia Mukt Bharat initiative and the Integrated Child Development Services, the decline in anemia prevalence has been marginal. In Punjab, a state that is economically advanced compared to several others, anemia among pregnant women remains a major health issue. Regional surveys have reported prevalence rates ranging from 45% to 70%, depending on study settings and methodologies. Contributing factors include monotonous cereal-based diets with low iron content, misconceptions about iron supplements, and suboptimal monitoring at the primary care level. Urbanization and lifestyle transitions have also altered dietary patterns, further increasing nutritional deficiencies.

Amritsar, being one of the major urban centers in Punjab, caters to a large population from both rural and urban areas through its tertiary care hospitals. Government Medical College, Amritsar, serves as a referral center for complex obstetric cases and thus provides an ideal setting to assess the true burden and determinants of anemia among pregnant women across diverse socioeconomic backgrounds. Regional data on anemia and its associated hematological and biochemical parameters are limited, particularly studies evaluating the relationship between hemoglobin concentration, red cell indices, and micronutrient status. Comprehending these correlations is crucial for creating focused solutions that are adapted to regional requirements. Therefore, the goal of the current study was to ascertain the prevalence of anemia and the factors that are linked to it in pregnant patients at a tertiary care hospital in Amritsar. By correlating hematological indices with biochemical markers such as serum iron, ferritin, and Vit. B12, this research aims to elucidate the predominant patterns and etiologies of anemia in the region. The findings are expected to provide valuable insights for clinicians and policymakers to strengthen antenatal screening programs, enhance nutritional counseling, and improve adherence to supplementation strategies. Ultimately, such evidence will contribute to the overarching goal of reducing the burden of maternal anemia and improving pregnancy outcomes in northern India.

Materials and Methods

Study design and setting: Over the course of one and a half years (January 2023–June 2024), this prospective observational study was carried out at the Department of Obstetrics and Gynecology, Government Medical College, Amritsar.

Study population: A total of 500 antenatal women attending the outpatient department were recruited using convenient sampling after obtaining informed written consent.

Inclusion Criteria: Pregnant women of any gestational age attending antenatal clinic who consented to participate.

Exclusion Criteria: Women with chronic illnesses (renal, hepatic, hematological disorders) or on iron therapy before enrollment.

Data Collection: Demographic details, obstetric history, and clinical examination findings were recorded in a structured proforma. Blood samples were analyzed for hemoglobin, MCHC, MCH, RBC count, MCV, and PCV using an automated hematology analyzer. Serum iron, ferritin, and Vit. B12 were estimated using standard biochemical methods.

Definitions

Anemia was defined per WHO criteria:

- **Normal:** Hb ≥ 11 g/dL
- **Mild:** 10–10.9 g/dL
- **Moderate:** 7–9.9 g/dL
- **Severe:** < 7 g/dL

Statistical Analysis: Data were analyzed using SPSS (version 25). Continuous variables were expressed as mean ± SD. ANOVA and chi-square tests were applied to assess differences between groups. $P < 0.05$ was considered statistically significant.

Results

Sociodemographic Characteristics: A total of 500 pregnant women were enrolled in the study. The majority of participants (49.8%) were between 20–25 years of age, followed by 29.4% in the 26–30 years group, while only 20.8% were above 30 years. Most participants belonged to lower or lower-middle socioeconomic strata, and a large proportion were multigravida, reflecting high parity rates in the study area. No statistically significant difference was observed between maternal age and hemoglobin levels ($p = 0.522$), suggesting that age was not an independent determinant of anemia in this cohort.

Prevalence and Severity of Anemia: Out of 500 pregnant women, 426 (85.2%) were found to be anemic, while only 74 (14.8%) had normal hemoglobin levels. With 50.0% of cases, mild anemia was the most common kind, followed by moderate anemia (27.2%) and severe anemia (7.6%).

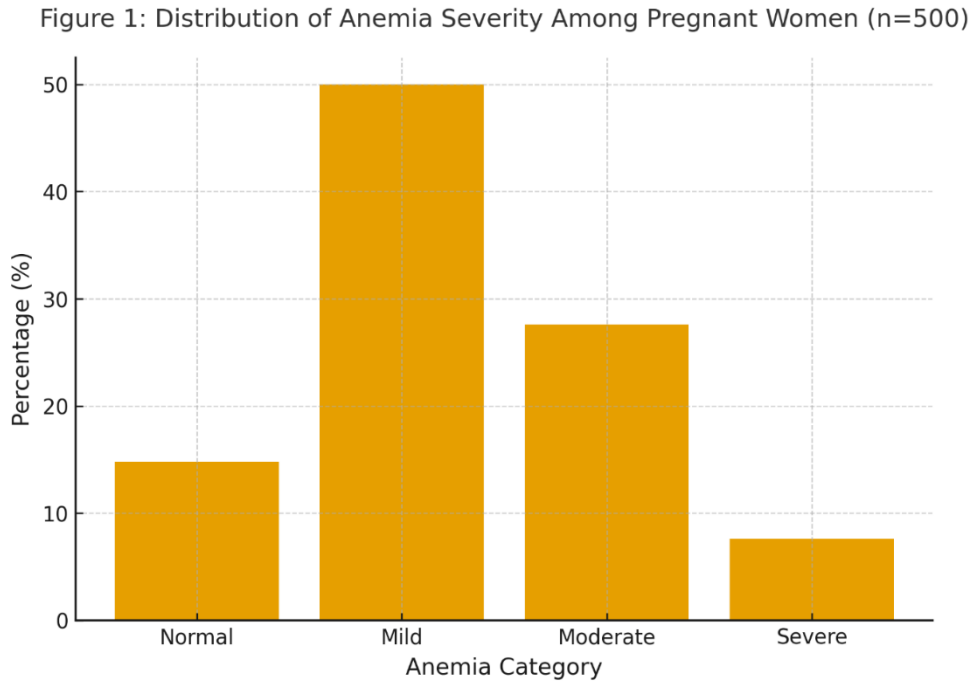


Figure 1: Distribution of anemia severity among pregnant women (n=500)

Table 1: Prevalence and Severity of Anemia Among Study Participants (n=500)

Anemia Category	Hemoglobin (g/dL)	No. of Cases (%)
Normal	≥11.0	74 (14.8%)
Mild	10.0–10.9	250 (50.0%)
Moderate	7.0–9.9	138 (27.6%)
Severe	<7.0	38 (7.6%)
Total	—	500 (100%)

Hematological Parameters: Hematological indices (RBC count, PCV, MCV, MCH, and MCHC) showed a consistent decline with increasing anemia severity. The difference in MCV values among the groups was statistically significant ($p = 0.045$), whereas differences in MCH, MCHC, and PCV were highly significant ($p < 0.001$). This pattern supports the predominance of microcytic, hypochromic anemia, which is characteristic of iron deficiency.

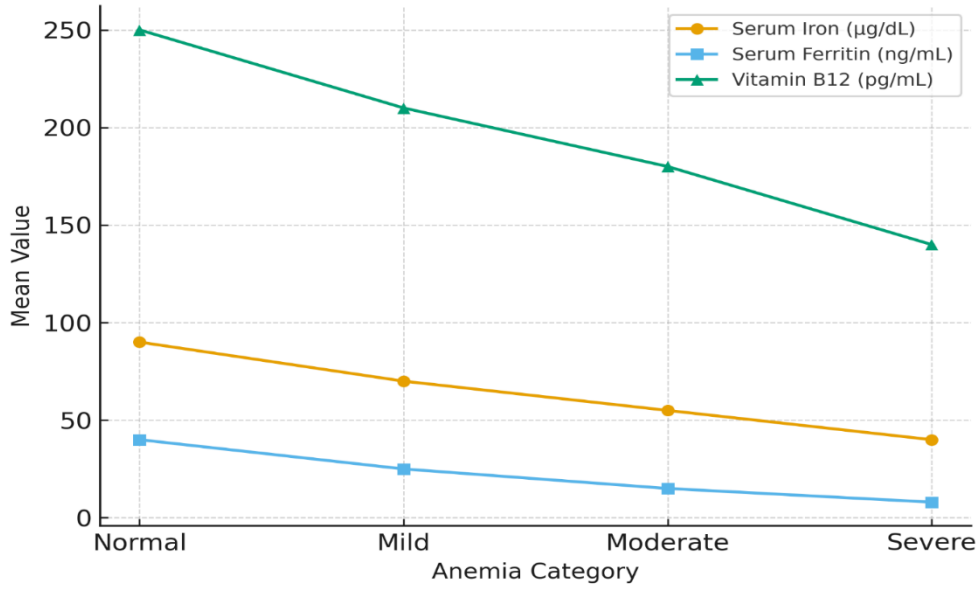
Table 2: Comparison of Hematological Parameters According to Severity of Anemia

Anemia Category	RBC (×10⁶/µL)	PCV (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)
Normal	4.21 ± 0.5	36.5 ± 2.4	87.4 ± 6.1	29.6 ± 2.4	33.8 ± 1.1
Mild	4.11 ± 0.4	34.1 ± 2.2	82.5 ± 5.7	27.1 ± 2.0	32.6 ± 1.2
Moderate	3.87 ± 0.6	31.3 ± 2.8	78.4 ± 6.3	25.5 ± 1.9	31.9 ± 1.0
Severe	3.54 ± 0.5	28.6 ± 2.1	74.9 ± 7.2	23.2 ± 2.3	30.4 ± 1.1
p-value	—	—	0.045	<0.001	<0.001

These results confirm a statistically significant relationship between declining red cell indices and increasing anemia severity, pointing toward a predominantly iron-deficiency etiology.

Biochemical Correlates: Biochemical analysis showed that serum iron, ferritin, and Vit. B12 levels decreased significantly with worsening anemia. Women with severe anemia had markedly depleted ferritin stores and lower B12 levels compared to those with mild or moderate anemia ($p < 0.001$ for all). This biochemical profile reinforces the mixed nutritional deficiency pattern common in Indian populations, where iron and Vit. B12 deficiencies coexist.

Figure 2: Biochemical Trends Across Anemia Severity Categories



Discussion

The findings revealed a strikingly high prevalence of anemia, affecting 85.2% of the study population. This figure is substantially higher than both the national and global averages and underscores the continuing challenge of maternal anemia in northern India. The predominance of mild to moderate anemia suggests that, although the most severe forms are now less common due to improved access to healthcare and supplementation, preventive strategies remain insufficient to address early or subclinical deficiencies. These results emphasize the need for renewed focus on nutritional interventions and antenatal monitoring.

When compared with other Indian studies, the prevalence observed in this research is on the higher end of the reported spectrum. NFHS-5, 2019–21 reported a 52.2% prevalence of anemia among pregnant women, indicating that the condition remains widespread nationally but particularly severe in certain regions such as Punjab. Similar studies by Kaur et al. and Singh et al. in northern India found prevalence rates of 70% and 76%, respectively, which are still lower than the findings in the current study. The differences may reflect local variations in diet, socioeconomic conditions, and healthcare-seeking behavior. Compared to the global prevalence of around 40% estimated by the WHO, the rates observed in this study suggest that India continues to face a disproportionate share of the global anemia burden. The persistence of such high figure's points toward limitations not in

awareness, but in the implementation and compliance of preventive measures.

The distribution of anemia severity in this study—with half of the women having mild anemia and nearly one-third having moderate anemia—aligns with patterns seen in many Indian hospital-based investigations. The predominance of mild cases indicates partial correction due to Supplementing with folic acid and iron but incomplete recovery due to inconsistent intake or inadequate dosing. The mean hemoglobin concentration of 9.11 g/dL found in this study closely parallels results from previous studies in North India, confirming that anemia remains moderately severe in most women. The absence of a significant association between maternal age and hemoglobin levels suggests that anemia is not confined to a particular age group, but rather reflects broader nutritional and environmental factors. High parity, poor dietary quality, and limited access to diverse food sources likely contribute to this pervasive problem.

Hematological findings in this study reinforce the conclusion that iron deficiency is the leading cause of anemia among pregnant women. The progressive decline in MCV, MCHC, and MCH with increasing anemia severity reflects a microcytic hypochromic pattern typical of iron-deficiency anemia. These results are consistent with previous studies that documented similar hematological profiles among antenatal women in India. Decreases in RBC count and PCV across anemia grades suggest a generalized reduction in erythropoiesis and oxygen-carrying capacity. The consistent hematological trends across parameters validate the accuracy of laboratory assessments and confirm that nutritional anemia remains the predominant type, rather than anemia related to chronic illness or genetic disorders.

The biochemical assessment of serum ferritin, serum iron, and Vit. B12 levels provided additional insights into the etiology of anemia in this population. A clear and statistically significant decline in these biochemical markers was observed with increasing anemia severity. The depletion of ferritin reflects exhausted iron stores, while low Vit. B12 levels point to a concurrent deficiency frequently seen in vegetarian populations. This combination suggests that anemia in this region is not caused by a single nutrient deficiency but by overlapping inadequacies. Similar observations have been reported by Pathak and colleagues, who noted that nearly half of anemic pregnant women exhibited combined iron and Vit. B12 deficiencies. These findings emphasize the need to broaden supplementation programs beyond iron and folate to include Vit. B12, especially in areas where vegetarian diets predominate.

Several factors likely contribute to the persistently high prevalence of anemia observed in this study. Poor adherence to iron-folic acid tablets remains one of the primary reasons for inadequate correction, often due to gastrointestinal side effects, forgetfulness, or misconceptions about their use. In addition, late registration of pregnancy delays screening and treatment, limiting opportunities for early intervention. Socioeconomic constraints and cultural food practices also play a significant role, as many women in lower-income groups rely on cereal-based diets with limited bioavailable iron. Moreover, irregular supply of supplements through public health programs and insufficient follow-up mechanisms further diminish the effectiveness of existing initiatives. Addressing these barriers requires not only improved clinical care but also community-level interventions focusing on education, accessibility, and behavioral change.

The implications of these findings extend beyond individual patient management to public health policy. Strengthening antenatal screening through regular hemoglobin and ferritin testing is essential for early detection. Nutritional counseling should be incorporated into every antenatal visit, emphasizing locally available iron- and B12-rich foods. Community health workers can play a critical role in ensuring compliance and monitoring supplement intake. Expanding supplementation programs to include multiple micronutrients and enhancing monitoring of the Anemia Mukt Bharat initiative could yield better results. Although this was a hospital-based study, its large sample size and detailed hematological and biochemical assessments make the findings highly relevant. However, future community-based research should include assessments of dietary habits, infections, and socioeconomic status to provide a more comprehensive understanding of anemia's multifactorial nature.

In conclusion, anemia remains a major health challenge among pregnant women in Amritsar, with an overwhelming prevalence driven primarily by nutritional deficiencies. The findings of this study demonstrate that despite government programs and widespread awareness, gaps persist in implementation, monitoring, and compliance. Early screening, consistent supplementation, and targeted education can substantially reduce this burden. Adopting a holistic approach that combines clinical vigilance, nutrition-focused counseling, and community engagement is vital to improving maternal and perinatal outcomes. Only through sustained, multifaceted strategies can the long-standing issue of maternal anemia be effectively mitigated in northern India.

Conclusion

In this study of 500 pregnant women attending a tertiary care hospital in Amritsar, anemia was found in 85.2% of participants, with mild anemia being the

most common form. The hematological and biochemical profiles indicated that iron deficiency was the predominant cause, frequently accompanied by low ferritin and Vit. B12 levels. The absence of a significant association between age and hemoglobin concentration suggests that anemia affects women across all reproductive age groups. These findings highlight persistent nutritional deficiencies and gaps in antenatal screening and supplementation programs. Strengthening early detection through routine hemoglobin and ferritin assessments, improving compliance with Supplementing with folic acid and iron, and including Vit. B12 in antenatal regimens are essential. Comprehensive strategies emphasizing dietary counseling, education, and community-based interventions are required to reduce the burden of maternal anemia and improve pregnancy outcomes in northern India.

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