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PREVALENCE OF ANEMIA AND ITS ASSOCIATION WITH AGE AND BLOOD GROUP AMONG PREGNANT WOMEN IN BAHAWALPUR, PUNJAB, PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

Pregnancy anemia is becoming a major issue of health, especially in low- and middle-income nations, increasing the potential risk of complications among mothers and their children. Although iron deficiency is the most common cause, all the other nutritional and genetic factors might also play a role. This study aimed to detemine the prevalence of anemia among pregnant women of the Bahawalpur region of Pakistan along with its correlation with age and blood group of the mother.

Methods:

A cross-sectional study was conducted from January to April 2025 at Al-Falah General & Eye Hospital, Bahawalpur. Using convenience sampling, 100 pregnant women aged 16 to 48 years and at gestational ages between 8 and 40 weeks were enrolled. Women with hypertension, bleeding disorders, systemic illnesses, or acute infections were excluded. Venous blood samples were collected and analyzed using the Sysmex KN-21 N Hematology Analyzer to measure hemoglobin levels. Anemia was classified based on WHO criteria. Data analysis was performed using descriptive statistics and cross-tabulation in SPSS version 16.0 to evaluate relationships between anemia, age groups, and blood types.

Results:

Anemia was detected in 51% of participants, with 44% having mild anemia, 6% moderate, and 1% severe. The mean hemoglobin concentration was 11.08 ± 1.59 g/dL. Women under 25 years had the highest anemia prevalence (75%), which declined with advancing age. B-positive blood group was most prevalent (42%) and accounted for the highest proportion of anemic cases (61.9%). Notably, no anemia was observed among individuals with O-negative blood group.

Conclusion:
Anemia remains a substantial issue among pregnant women in Bahawalpur, particularly in younger women and those with B-positive blood type. Early screening, nutritional interventions, and targeted public health measures are essential to mitigate this burden and improve maternal and neonatal outcomes.

INTRODUCTION

Anemia is the most common hematological problem in pregnancy, followed by thrombocytopenia. Leukocytosis is almost always associated with pregnancy. [1] Anemia is defined as a condition in which there is less than the normal hemoglobin (Hb) level in the body, which decreases oxygen-carrying capacity of red blood cells to tissues. Anemia is a global public health problem affecting both developed and developing countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle. [2, 3]

A major worldwide health problem, anemia, is defined as a decrease in the hemoglobin (Hb) concentration below normal levels. Anemia remains a global health challenge despite decades of interventions, indicating a persistent gap in prevention, early detection and treatment across vulnerable populations [25]. Pregnancy significantly increases iron and micronutrients demands, making women more susceptible to anemia even when baseline national stores are marginal [27,28].

Women of reproductive age and younger children are more likely to be affected by this disorder; however, it affects people of all ages and genders [3]. In addition to being a major cause of maternal morbidity and death, anemia also has a significant effect on poor pregnancy outcomes, such as low birth weight, human health, social welfare, and economic development [4]. If left untreated, anemia during pregnancy can compromise maternal physiological reserves, impair fetal growth, and increase the risk of obstetric complications [29,30]. Approximately 56 million pregnant women are among the approximately 1.62 billion people worldwide who suffer from anemia [3]. This amounts approximately a quarter of the global population. Approximately 591,000 perinatal fatalities and 115,000 maternal deaths occur every year as a result. Anemia during pregnancy is categorized by severity: mild (Hb 10.0–10.9 g/dL), moderate (Hb 7.0–9.9 g/dL), and severe (Hb <7.0 g/dL) (4). Anemia is the most prevalent hematological disorder during pregnancy, with thrombocytopenia being the second most common. Additionally, physiological leukocytosis is often noted in pregnant women [5].

Despite being a worldwide problem, anemia is more prevalent in low- and middle-income nations, where it disproportionately affects women of reproductive age, with a global prevalence of approximately 30.2% [3]. The World Health Organization (WHO), for example, reported that the frequency among Saudi Arabian women of reproductive age who are not pregnant is 32.3% [3]. Estimates of the frequency of anemia among ever-married women in Pakistan ranging from 1544 years old have shown substantial variation; in rural regions, the number of anemia cases has risen to 47% [6]. The prevalence among pregnant women in urban areas varies from 29% [7] to 50% [8, 9]. Pakistan continues to face a disproportionately high burden of maternal anemia despite ongoing nutritional programs, reflecting socio economic disparities, limited antenatal screening, and inadequate dietary awareness. Overall, the prevalence in low- and middle-income nations may reach 56%, with significant regional differences: South America has a prevalence of 24.1%, Southeast Asia has a prevalence of 48%, and sub-Saharan Africa has a prevalence of 57% [10, 11].

Anemia during pregnancy in developing countries arises from various factors that are frequently specific to particular regions. Iron deficiency continues to be the predominant global health issue, largely because of insufficient dietary consumption, menstrual losses, and heightened physiological requirements during pregnancy, such as fetal development and increased maternal blood volume [12, 13]. Other contributors include deficiencies in folate, vitamins A and B12; chronic infections such as tuberculosis and HIV; parasitic infestations; and genetic conditions [14, 15]. Dietary patterns significantly affect anemia risk; specific foods such as tea, coffee, bran, and egg yolk hinder iron absorption, whereas meat, dairy products, and foods rich in vitamin C promote it [16, 17].

Although anemia poses a significant burden among pregnant women, numerous studies in Pakistan have focused primarily on hospital-based populations, potentially failing to capture the prevalence and determinants of anemia within the wider community. However, data from private health care settings in Pakistan remain scarce [32], even though many pregnant women seek antenatal care in these facilities. Reliable local epidemiological data are crucial for guiding public health strategies to mitigate anemia-related maternal and perinatal morbidity and mortality. Assessing anemia within private hospitals essential for generating more representative local evidence that can guide targeted maternal health interventions [33]. Understanding modifiable risk factors is crucial for designing community-based interventions suitable for resource-limited settings.

In this study the authors of the research paper wanted to find out the incidences of anemia among pregnant women attending antenatal care visits in Bahawalpur Pakistan and to determine the level of severity of anemia in the population. Therefore, identifying the prevalence and associated risk factors of anemia in the population can support policymakers and clinicians in developing more effective prevention and management strategies [34]. The proposed study is expected to give insights that can

be used to plan strategies that would help improve the situation of maternal health in the southern province of Punjab, specifically Bahawalpur.

Materials and Methods

Study population

This cross-sectional study was done during a period of half a year (January 2025—June 2025) Al- Falah General & Eye Hospital, Bahawalpur, Punjab Province. The hospital was selected based on convenience and accessibility and noticing the patient flow. All the pregnant women between the ages of 16 years and 48 years during weeks 8 to 40 of pregnancy were included after taking the written consent. Women with normal blood pressure (<140/90 mm/Hg) and meeting the inclusion criteria were recruited using non probability consecutive sampling. Women were excluded if they had disorders of bleeding, splenomegaly, connective tissue diseases such as systems lupus erythematosus, hypertension, HIV, hepatitis B infection, and the nonsteroidal anti-inflammatory drugs (such as aspirin).

Sample collection

Each of the participants was recruited to donate blood samples (without a significant degree of stasis) of 4.5 mL drawn venous through the antecubital vein via sterile and disposable syringes and needles. The blood was collected in anticoagulant ethylenediaminetetraacetic acid (EDTA) and the samples were labeled with the age and identification number of the participant. The samples of EDTA were placed at room temperature and processed within four hours of collection.

Procedures

Samples were gently mixed, and a sample of approximately 20 µL was aspirated by the sampling probe of the analyzer. They analysis was initiated by pressing the start button, and the results were shown after approximately 30 seconds. A thermal print out of the results was produced automatically by the analyzer.

Laboratory analysis

Complete blood counts were carried out by using a KN-21 N Hematology Analyzer (Kehua Biotech, China). The analyzer measured the 19 hematological parameters including: hemoglobin (Hb) concentration, packed cell volume (PCV), red blood cell (RBC) concentration, mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), white blood cell (WBC) count, platelet (PLT) count, and so on. Upon calibration, the instrument was used in accordance with the instructions given by the manufacturer with regard to the samples processing.

Statistical analysis

Data analysis was conducted via SPSS version 16. The descriptive statistics were presented as the mean values + standard deviations (SDs) for continuous variables and percentages for categorical variables, Anemia was defined according to the WHO cutoff for pregnant women (HB < 11g/dl). Associations between anemia and risk factors were assed using chi - square test for categorical variables and independent T test for continuous variables. Logistic regression was used to identify predictors of anemia.

Results

Figure 1 displays the distribution of hemoglobin levels among pregnant women, classified by anemia severity.

The average hemoglobin level for all participants was 11.08 ± 1.59 g/dL. Non anemic women had an average hemoglobin concentration of 12.38 ± 0.83 g/dL. In contrast, women with mild anemia (hemoglobin between 9.0 and 10.9 g/dL) had a mean Hb level of 9.88 ± 0.89 g/dL. Those with moderate anemia (hemoglobin between 7.0 and 8.9 g/dL) had a mean hemoglobin level of 8.33 ± 1.17 g/dL. Only one case of severe anemia (hemoglobin less than 7.0 g/dL) was reported, with a mean hemoglobin level of 6.0 g/dL.

Figure 1 Prevalence of anemia in 100 pregnant women

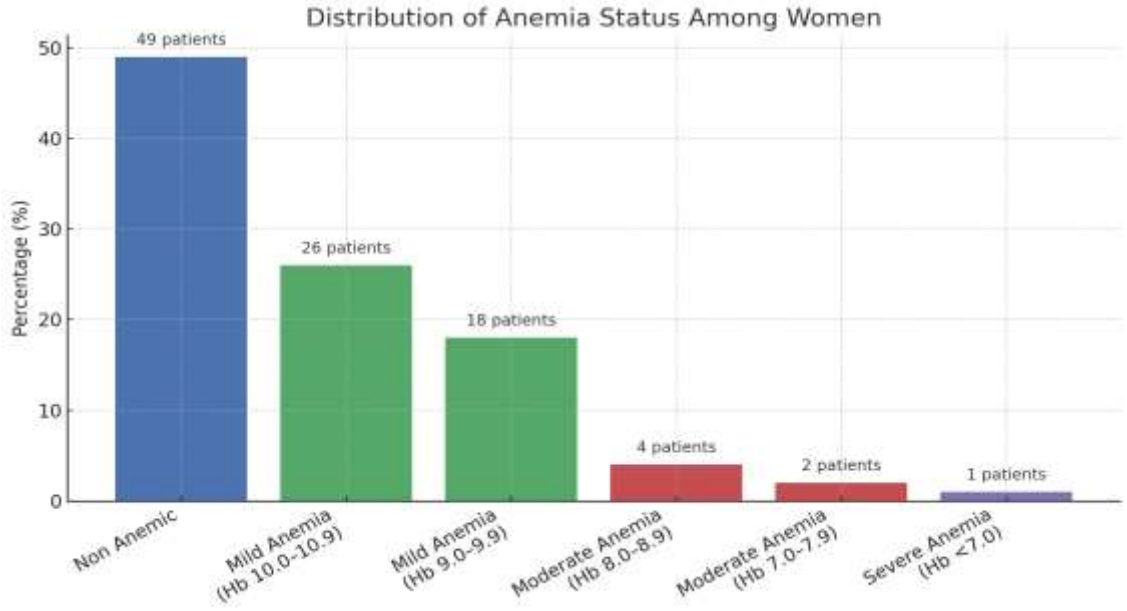

Table 1 shows the blood groups of the study participants. The most common blood group was B positive, with 42% of people being positive. O positivity was the next most common at 24%, followed by a positivity at 19% and AB positivity at 6%. No participants had the O negative blood type.

Figure 2 shows the ages of the study participants. Most participants were between 25 years old and 34 years old, making up 40% of the group.

Blood Group	Frequency	Percentage
A Positive	19	19.0
B Positive	42	42.0
AB Positive	6	6.0
O Positive	24	24.0
A Negative	1	1.0
B Negative	6	6.0
AB Negative	2	2.0
O Negative	0	0.0
Total	100	100.0

Fig 2. Frequencies by age group

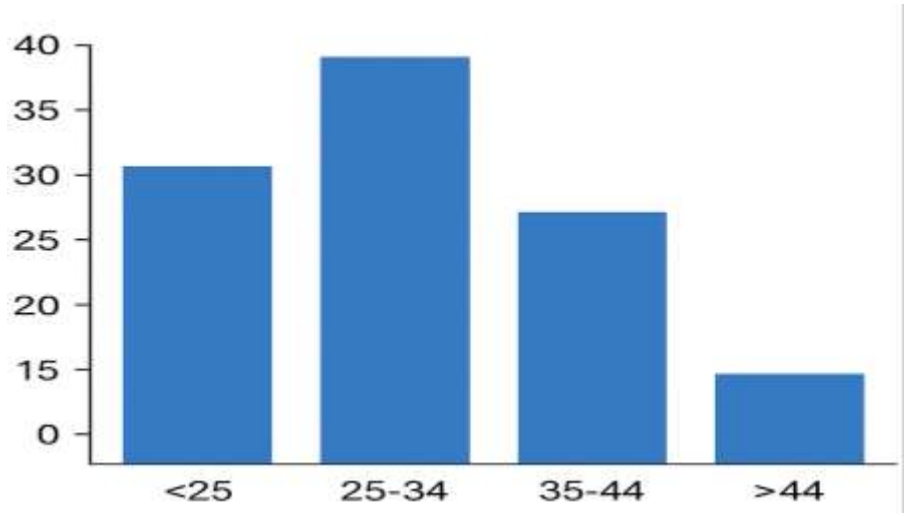

Table 2 shows how anemia spreads across different age groups. Most anemia was found in people under 25 years of age, with 75% having anemia. In the 25–34 years age group, 50% had anemia, whereas 75% of people aged 35–44 years did not have anemia. For those over 44 years of age, half had anemia. Among the 100 participants, 51 had anemia, and 49 did not.

Table 2 Distribution of anemia in pregnant women according to age (n = 100)

Age (years)	Anemia n (%)				Normal n (%)	Total
	Mild (%)	Moderate	Severe	Total		
<25	17 (60.7)	3 (10.7)	1 (3.5)	21 (75)	7 (25)	28
25-34	18 (45)	2 (5)	0	20 (50)	20 (50)	40
35-44	6 (25)	0	0	6 (25)	18 (75)	24
>44	3 (37.5)	1 (12.5)	0	4 (50)	4 (50)	8
Total	44 (44)	6 (6)	1 (1)	51 (51)	49 (49)	100

Table 3 shows anemia by blood type. The B positive blood group had the most anemic people, with 26 out of 42. The A positive group included 12 out of 19 patients with anemia. Only one person who was AB positive had anemia, and 9 out of 24 individuals in the O positive group had anemia. Overall, 51 people had anemia, and 49 did not.

Table 3 Distribution of anemia in pregnant women according to blood group (n = 100)

Blood Group	Anemia n (%)			Total	Normal n (%)	Total
	Mild	Moderate	Severe			
A Positive	11	1	0	12	7	19
B Positive	21	4	1	26	16	42
AB Positive	1	0	0	1	5	6
O Positive	8	1	0	9	15	24
A Negative	1	0	0	1	0	1
B Negative	2	0	0	2	4	6
AB Negative	0	0	0	0	2	2
O Negative	0	0	0	0	0	0
Total	44	6	1	51	49	100

Discussion

The prevalence of anemia among pregnant women in our study was 51%, which, although substantial, is significantly lower than the 90.5% reported in a similar study conducted in Pakistan. This discrepancy may be explained by differences in the timing of hemoglobin assessment. In our study, hemoglobin levels were measured at various gestational stages, whereas the comparison study primarily evaluated women in the late second trimester—a period characterized by physiological hemodilution due to disproportionate increases in plasma volume relative to red cell mass. Despite this variation, both studies reported that most anemia cases were classified as mild, reinforcing the hypothesis that much pregnancy-related anemia is preventable and manageable with timely intervention.

In our cohort of 100 pregnant women, 49% were anemic, whereas 44% presented mild anemia, 6% moderate anemia, and 1% severe anemia. This distribution aligns with trends observed in both regional and international literature, where mild anemia constitutes the majority of cases [9, 18]. The mean hemoglobin concentration among all participants was 11.08 ± 1.59 g/dL, and among non-women, it reached 12.38 ± 0.83 g/dL a relatively better hemoglobin profile than that reported in earlier national studies.

Consistent with large-scale regional findings—such as an Indian study reporting 98% anemia prevalence among pregnant women [18]—our results highlight the continued burden of anemia across South Asia. However, the lower proportion of severe anemia (1%) in our study, compared with the 2–7% range reported in other developing countries [9], may suggest improved antenatal care, greater nutritional awareness, or enhanced access to healthcare services in our study setting.

In terms of age distribution, the highest proportion of participants fell within the 25–34-year age group (40%), followed by those under 25 years (28%). This pattern is clinically relevant, as younger women and those with multiple pregnancies are at increased risk for iron deficiency due to cumulative physiological demands. Hence, targeted educational and nutritional interventions for this population may be particularly beneficial.

Our findings also included blood group distribution, with B positivity being the most prevalent (42%), followed by O positivity (24%) and a positivity (19%). While ABO blood group does not directly influence anemia risk, understanding its distribution is useful for transfusion preparedness in antenatal and obstetric care, especially in high-risk pregnancies.

Socioeconomic and dietary factors remain central in understanding the anemia burden. Consistent with other studies, women from lower socioeconomic backgrounds and those with limited educational attainment are more likely to experience anemia [8]. Limited financial resources can restrict access to iron-rich foods and supplements. Additionally, traditional Pakistani diets—often based on whole wheat—contain high levels of phytates, which inhibit iron absorption, potentially exacerbating iron deficiency [19, 20].

Although this study did not directly assess dietary intake, previous research has shown that women who consume meat and fruits more than twice a week tend

to have higher hemoglobin levels owing to the bioavailability of heme iron in meat and the iron-absorption-enhancing properties of vitamin C in fruits [21]. The lack of detailed dietary data in our study limits the ability to draw definitive conclusions between dietary patterns and anemia status.

Despite widespread awareness campaigns, adherence to iron supplementation during pregnancy remains a challenge in many developing countries [22, 23]. Furthermore, iron supplementation alone may not suffice for women who become pregnant with pre-existing iron depletion. This underscores the importance of routine pregnancy screening and early antenatal care. The WHO recommends daily iron supplementation for women of reproductive age, particularly in high-risk regions, to improve iron stores before conception and reduce anemia-related complications during pregnancy [24].

In conclusion, while our study revealed a lower prevalence of anemia than did several previous reports from Pakistan, the 51% rate remains a significant public health concern. The predominance of mild anemia underscores the potential for successful intervention through early antenatal screening, nutrition education, and iron supplementation. Community-based programs focusing on diet quality, awareness of iron absorption inhibitors (e.g., tea consumption), and the consequences of pica and poor dietary diversity could substantially mitigate the burden of anemia during pregnancy and improve maternal and neonatal health outcomes.

This study has several limitations that should be considered when interpreting the findings. As a single-center investigation with a relatively small sample size (n = 100), its results may not be fully representative of the broader population. Moreover, the cross-sectional design limits the ability to establish causal relationships between the identified risk factors and anemia. Important variables such as dietary intake, socioeconomic status, iron supplementation history, obstetric profile, and underlying medical conditions were not assessed, which could have provided a more comprehensive understanding of anemia determinants. Hemoglobin concentration was the sole hematological parameter measured, without additional biomarkers like serum ferritin, transferrin saturation, folate, vitamin B12, or reticulocyte indices that could help differentiate anemia types and underlying etiologies. Future studies should address these gaps by employing larger multicenter cohorts to enhance generalizability and explore regional differences, incorporating detailed dietary and socioeconomic assessments, and adopting longitudinal designs to better evaluate cause–effect relationships and the impact of targeted interventions. Additionally, expanding laboratory evaluations and developing public health strategies focused on awareness, early screening, and treatment adherence among women of reproductive age could contribute to more effective anemia prevention and management.

Conclusion

This study highlights a high prevalence of anemia (51%) among pregnant women in Bahawalpur, Pakistan, with the majority suffering from mild anemia (44%), followed by moderate anemia (6%) and severe anemia (1%). The average hemoglobin level among the participants was 11.08 ± 1.59 g/dL. The highest prevalence of anemia was observed in women under 25 years of age, indicating a need for early nutritional and antenatal interventions in younger age groups. B Positive blood group individuals were most strongly associated with anemia, followed by positive and O-positive individuals. These findings underscore the importance of routine screening and targeted nutritional programs for pregnant women, especially in resource-limited settings.

Declaration

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Ethics approval and consent to participate

Written informed consent was taken from all patients. This study was approved by the hospital ethics committee.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Availability of data and materials
The datasets generated during and/or analyzed during the current study are not publicly available due to hospital ethical policy in order to protect participant confidentiality

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Authors' contributions
M.A.M. conceived and designed the study. E.E. developed the study protocol, collected and analyzed the data, interpreted the results, and drafted the manuscript. M.A.M. and E.E supervised the study and critically reviewed the manuscript. K.I. and S.S. contributed to clinical interpretation and participant recruitment. W.K. and U.H. conducted literature review and supported data entry. G.M and R.A. performed laboratory investigations and contributed to statistical analysis. All authors read and approved the final manuscript.

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