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Anemia in Pregnancy: Prevalence and Associated Factors among Women Receiving Antenatal Care at Nangarhar University Teaching Hospital

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ABSTRACT

Anemia in pregnancy remains a major public health concern worldwide, particularly in low- and middle-income countries where nutritional deficiencies, infectious diseases, and limited access to quality antenatal care are common. This study aimed to determine the prevalence, morphological patterns, severity, and associated obstetric and medical factors of anemia among pregnant women attending antenatal care (ANC) at Nangarhar University Teaching Hospital. A descriptive cross-sectional study was conducted from September 15 to November 15, 2024, among pregnant women attending ANC services at Nangarhar University Teaching Hospital, Jalalabad. A total of 1,130 eligible women were enrolled using a consecutive sampling technique. Data were collected through face-to-face interviews using a structured questionnaire and review of antenatal records. Hemoglobin levels and red blood cell indices were used to diagnose, classify, and assess the severity of anemia according to WHO criteria. Data were analyzed using SPSS version 26, and descriptive statistics were employed. The overall prevalence of anemia was 57% among the study participants. Normocytic normochromic anemia was the most common morphological type (69.9%), followed by microcytic hypochromic anemia (29.3%). Mild anemia accounted for 68.9% of cases, while 23.9% and 7.1% had moderate and severe anemia, respectively. High parity, short interpregnancy intervals, low ANC attendance, malaria, hookworm infection, and low iron supplement use was common among anemic women. In conclusion, Anemia is highly prevalent among pregnant women attending ANC at Nangarhar University Teaching Hospital and represents a severe public health problem. Strengthening antenatal care services and conducting further analytical and interventional researches with emphasis on early screening, nutritional supplementation, infection control, and maternal health education is strongly recommended.

Keywords: Anemia, Antenatal care, Associated factors, Nangarhar, Pregnant women, Prevalence

INTRODUCTION

Anemia in pregnancy, defined by a reduction in maternal hemoglobin concentration below threshold levels recommended by the World Health Organization, remains one of the most persistent global public health challenges, particularly affecting women in low- and middle-income countries where nutritional deficiencies and limited access to comprehensive prenatal care are prevalent (Abdilahi et al., 2024) . According to the World Health Organization, anemia in pregnant women is identified when hemoglobin concentrations fall below 11.0 g/dL during the first and third trimesters, and below 10.5 g/dL during the second trimester (Mbowe et al., 2025). Despite broad recognition of these health consequences, the prevalence of anemia in pregnancy varies widely across settings and is influenced by a constellation of socioeconomic, dietary, and obstetric factors (Balcha et al., 2023).. It is estimated that the global prevalence is 42% among pregnant women, and it is a major cause of maternal mortality (World Health Organization, 2007). Worldwide, the prevalence of anemia among pregnant women differs markedly by region, with the highest proportions observed in South Asia (approximately 52%), followed by Africa (46%), while substantially lower levels are reported in developed regions (around 23%) (DeLoughery, 2024). Anemia

during gestation undermines the physiologic competence of the maternal oxygen-transport system and is associated with increased risks of maternal morbidity, perinatal mortality, and adverse fetal outcomes including preterm birth and low birth weight (Geta et al., 2022). Anemia during pregnancy adversely affects both the mother and the newborn, leading to a wide range of complications such as maternal weakness and breathlessness, diminished resistance to infections, impaired physical and cognitive functioning, and reduced capacity for daily activities, as well as fetal and neonatal outcomes including anemia, restricted intrauterine growth, low birth weight, preterm birth, increased likelihood of postpartum hemorrhage, stillbirth, and elevated perinatal mortality (Balcha et al., 2023; Frayne & Pinchon, 2019). The leading causes of anemia include nutritional inadequacies, most notably deficiencies of iron, folate, vitamin B12, and vitamin A, while non-nutritional conditions such as hemoglobinopathies, malaria, and tuberculosis also contribute substantially to its occurrence (Yousufza et al., 2025). Iron deficiency anemia represents the most widespread nutritional problem globally, affecting approximately two billion individuals(Jain et al., 2022). During pregnancy, the overall iron requirement is estimated at nearly 900 mg, with a reported range of 700–1400 mg; about 500–600 mg of this is utilized by the uterus and developing fetal tissues. An additional 150–200 mg is lost due to bleeding at the time of childbirth, and a comparable quantity is consumed during breastfeeding. Many pregnant women tend to neglect their own health needs because they are occupied with various daily responsibilities. Consequently, recognizing the factors that increase the risk of anemia among expectant mothers is essential for effective prevention and management (Bansal et al., 2020; Jain et al., 2022). Deficits in folate and vitamin B12 have been identified as contributory factors to nutritional anemia since the 1960s and 1990s, respectively. A prominent cause of folate deficit is dietary deficiencies or elevated demand, such as during pregnancy. Between one and fifty percent of pregnant individuals have folate deficiencies. Patients who are economically disadvantaged have a higher prevalence. The vitamin B12 is mostly present in meals derived from animals, and anemia has not been linked to a B12 deficit (Detels, 2015). Anemia in pregnancy arises from multiple contributing factors, including repeated pregnancies, brief interpregnancy intervals, and inadequate nutritional intake, with iron deficiency representing the most common underlying cause (Mohammad et al., 2024). Nutrition-centered strategies that raise iron consumption—such as fortifying staple foods and promoting a more varied diet—represent effective and sustainable methods for reducing iron deficiency anemia at the population level. In environments where anemia arises from multiple etiologies beyond iron lack, iron-focused actions must be integrated with complementary interventions. Comprehensive programs should therefore target additional contributing factors to anemia and be incorporated into primary health care services and ongoing public health initiatives (Kejela et al., 2020). Furthermore, anemia has been implicated in increased likelihood of perinatal complications, which place additional burdens on healthcare systems in resource-limited settings. Collectively, these findings underscore the public health imperative to address anemia in pregnancy through comprehensive antenatal care strategies that encompass early screening, targeted nutritional support, and community education (Qiao et al., 2024).

Despite the documented prevalence and risk factors, gaps remain in localized research, particularly within specific hospital settings where sociocultural, economic, and healthcare access patterns may differ substantially from broader regional or national contexts. Institutional studies, such as those conducted in tertiary care hospitals, provide valuable insights into the prevalence and determinants of anemia among women actively engaged with antenatal care services, yet such evidence is comparatively limited in Afghanistan. Therefore, conducting facility-based research among pregnant women

at Nangarhar University Teaching Hospital represents an essential contribution to understanding the magnitude and correlates of anemia in pregnancy within this unique clinical and demographic environment.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted from September 15 to November 15, 2024, at the University Teaching Hospital in Jalalabad, Nangarhar Province. The aim of the study was to determine the prevalence of anemia and to identify factors associated with it among pregnant women attending antenatal care (ANC). Routine prenatal services at the hospital include health education, immunization, monitoring of high-risk pregnancies, and regular hemoglobin screening for the detection of anemia in expectant mothers. All pregnant women who met the inclusion criteria and attended the antenatal clinic during the study period were enrolled in the study. The participants' ages ranged from 18 to 48 years. Primary data were collected through face-to-face interviews, and demographic, clinical, and socioeconomic information was obtained using a standardized questionnaire. In addition to the interviews, participants' antenatal records were reviewed to extract relevant medical history, including previous pregnancy complications, dietary practices, and laboratory investigation results. The study population comprised pregnant women receiving ANC services at the University Teaching Hospital, which provides care to both urban and rural communities.

Sample size and sampling method

A consecutive sampling technique was employed, whereby all pregnant women who met the inclusion criteria and attended the antenatal clinic at the University Teaching Hospital during the study period (September 15–November 15, 2024) were invited to participate until the end of the data collection period.

Inclusion Criteria:

Pregnant women aged 18–48 years; women who attended the antenatal clinic during the study period (September 15 to November 15, 2024); women who provided informed consent to participate in the study; and participants with documented antenatal records available for review.

Exclusion Criteria:

Women with known chronic illnesses that could independently influence hemoglobin levels (e.g., HIV/AIDS, tuberculosis, chronic kidney disease, or cancer); women with diagnosed hemoglobinopathies (e.g., sickle cell disease or thalassemia); and women who were unwilling or unable to provide informed consent.

Data Collection

Data collection was conducted between September 15 and November 15, 2024. All participants provided verbal informed consent after being clearly briefed on the objectives of the study and its expected outcomes. To ensure participants' comfort and maintain confidentiality, interviews were carried out in a quiet and private setting. Data were collected by trained personnel, including senior medical staff and trainees enrolled in training programs. the questionnaire was reviewed by seniors to ensure clarity and reliability of the collected information.

Sociodemographic characteristics, including age, occupation, educational level, number of children, and interpregnancy interval, were obtained using standardized data collection tools. These data were gathered directly from participants through a structured questionnaire specifically developed for the study. Information related to the current pregnancy—such as gravidity, gestational age, and the use of hematinic supplements—was also recorded. Anthropometric measurements, including height and weight, were taken, and blood pressure was measured. Body mass index (BMI) was calculated using the formula: BMI = weight (kg) / height (m^2)(Khanna et al., 2022). Assessment of anemia was performed using hemoglobin (Hb) and hematocrit values, with cutoff points determined according to gestational age. A woman was classified as anemic if her Hb level

was below 11.0 g/dL, In addition, the proportion of pregnant women with Hb levels below 10.5 g/dL in the second trimester was documented (Eltayeb et al., 2023). Manufacturer reference ranges were used to define normal values for red blood cell indices: mean corpuscular hemoglobin (MCH) 27.0–33.5 pg, mean corpuscular hemoglobin concentration (MCHC) 32.0–36.0 g/dL, mean corpuscular volume (MCV) 80.0–98.0 fL, and red cell distribution width (RDW) 11.9–14.5%. The severity of anemia was categorized as follows: mild anemia was defined as Hb levels between 10.0 and 11.0 g/dL in the first and third trimesters, or between 10.0 and 10.5 g/dL in the second trimester. Moderate anemia was defined as Hb levels between 7.0 and 10.0 g/dL, while severe (extreme) anemia was defined as Hb levels below 7.0 g/dL, regardless of gestational age (Eltayeb et al., 2023).

Statistical Analysis

Data were entered and analyzed using Microsoft Excel and IBM SPSS Statistics version 26. Descriptive statistics, including means and standard deviations, were computed for continuous variables, while frequencies and percentages were used to summarize categorical variables. Univariate analysis was performed to describe the dataset. To ensure confidentiality, the dataset was anonymized by replacing participant names with unique codes and identification numbers.

RESULTS

Sociodemographic information of participants

A total of 1,130 pregnant women participated in the study, all of whom were attending antenatal care (ANC) services at the University Teaching Hospital. The mean age of the participants was 25.70 ± 5.24 years. More than half of the women 614(54.34%) were aged 20–29 years, while 254(22.51%) were younger than 20 years and 274(24.24%) were aged 30 years or older. Regarding nutritional status, 790 (69.87%) of the participants had a normal body mass index (BMI: 18.5–24.9), whereas 340(30.12%) were classified as overweight or obese (BMI > 25). A large proportion of the women were illiterate 937(82.91%), and most resided in rural areas 193(64.28%). In terms of economic status, 44(35.40%) were categorized as poor (household income < 15000 afghani), 476(42.14%) as fair (household income = 15000 – 30000 afghani), and 233(20.65%) as having good economic status (household income >30000). Concerning occupation, nearly three-quarters of the participants 831(73.57%) were housewives, while 298(26.39%) were engaged in paid employment (table 1).

Table 1. sociodemographic information the participants

Variables	Category	Number n	Percentage %
Age (years)	Less than 20	254	22.51
	20 - 29	614	54.34
	>30	274	24.24
Body weight (BMI)	Normal	790	69.87
	Overweight and obese	340	30.12
Educational status	Illiterate	937	82.91
	Literate	193	17.08
Residence	Rural	726	64.28
	Urban	404	35.71
Economic status	Poor	400	35.40
	Fair	476	42.14
	Good	233	20.65
Occupation	No (house wife)	831	73.57
	Yes (Employed)	298	26.39

Prevalence of anemia

Among all 1,130 participants 644 pregnant women had anemia so the prevalence is 57%. The remaining 486 participants had normal hemoglobin level according to WHO guideline (Figure 1).

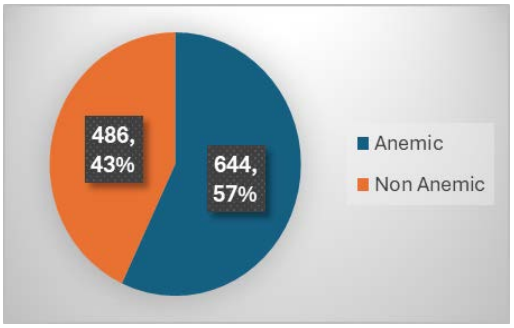

Figure 1 Prevalence of anemia

Morphological distribution of anemia

Among 644 anemic participants, the majority (450; 69.87%) had normocytic normochromic anemia, while 189 (29.34%) had microcytic hypochromic anemia. Only 5 participants (0.44%) exhibited macrocytic anemia (MCV > 100 fL). Based on morphological classification, approximately two-thirds of anemic women had normocytic normochromic anemia, and about one-third had microcytic hypochromic anemia, indicating that normocytic normochromic anemia was the most common type among the study population (table 2).

Table 2. Morphological distribution of anemia

Anemia status	Frequency	Percentage
Normocytic normochromic	450	69.87
Microcytic hypochromic anemia	189	29.34
Macrocytic	5	0.44
Total	644	100

Severity of Anemia Among Pregnant Women

Among the 644 anemic pregnant women, the majority (444; 68.94%) had mild anemia, with hemoglobin levels ranging from 10 to 11.9 g/dL. Moderate anemia, defined as hemoglobin levels between 7 and 9.9 g/dL, was observed in 154 participants (23.91%). Severe anemia, characterized by hemoglobin levels below 7 g/dL, was present in 46 women (7.14%). These findings indicate that while mild anemia was the most common form among the study population, a notable proportion of women also experienced moderate to severe anemia, highlighting the need for targeted interventions and monitoring during pregnancy (table 3).

Table 3. Severity of anemia

Level of Anemia	Hemoglobin Level	Number (n)	Percentage (%)
Mild	10–11.9 g/dL	444	68.94
Moderate	7–9.9 g/dL	154	23.91
Severe	<7 g/dL	46	7.14
Total	-	**644**	**100**

Obstetric and Medical Factors Associated with Anemia

Table 4 presents the distribution of obstetric and medical factors among the anemic pregnant women. Among the participants, 168 women (26.08%) were primigravida, 219 (34.0%) were multigravida, and 257 (39.90%) were grand multipara. Regarding the interpregnancy interval, 271 women (42.08%) had a short interval of less than 18 months between pregnancies, whereas 205 participants (31.83%) had an interval of more than 30 months, and 168 (26.08%) were experiencing their first pregnancy. Concerning antenatal care utilization, 310 women (48.13%) had only one prenatal visit, 199 (30.90%) attended two to three visits, and 134 (20.80%) had four or more visits. In terms of pregnancy trimester, 83 participants (12.88%) were in the first trimester, 173 (26.86%) were in the second trimester, and 388 (60.24%) were in the third trimester. Regarding medical conditions, 167 women (25.93%) reported malaria during the current pregnancy, reflecting the high prevalence of malaria in the eastern region of Afghanistan, while 109 participants (16.92%) had intestinal hookworm infections. Use of iron supplements was reported by 194 women (30.12%), whereas the majority (450; 69.87%) did not use them. These findings highlight key obstetric and medical factors that may contribute to anemia among pregnant women in this population.

Table 4. distribution of various obstetric and medical factors associated factors contributing to anemia

Associated factors		Number (n=)	Percentage (%)
Gravidity	Primigravida	168	26.08
	Multigravida	219	34.00
	Grand multipara	257	39.90
Interpregnancy interval	First pregnancy	168	26.08
	Short interval < 18 months	271	42.08
	Long interval > 30 months	205	31.83
Number of	One visit	310	48.13

Antenatal visits	2–3 visits	199	30.90
	≥4 visits	134	20.80
Malaria in current pregnancy	Yes	167	25.93
	No	477	74.06
Hookworm infection	Yes	109	16.92
	No	535	83.07
Use of iron supplements	Yes	194	30.12
	No	450	69.87
Trimester of pregnancy	First (0–12 weeks)	83	12.88
	Second (13–24 weeks)	173	26.86
	Third (25–40 weeks)	388	60.24

DISCUSSION

This study assessed the prevalence, morphological patterns, severity, and associated factors of anemia among pregnant women attending antenatal care at Nangarhar University Teaching Hospital. The findings demonstrate that anemia remains a major public health problem in this population, with more than half of pregnant women affected.

The overall prevalence of anemia in the present study was 57%, indicating a severe public health burden according to World Health Organization (WHO) classification. This finding is comparable with findings of a study by Bably Sabina Azhar in Bangladesh and by Eunice Justin Lema in Tanzania where the prevalence was 62.5% and 57.2% respectively (Azhar et al., 2021; Lema & Seif, 2023). This prevalence is higher than that reported in many recent studies from low- and middle-income countries, a study by Gemechu Kejela from western Ethiopia shows 17.8% , 34.1% in a study by MAHA AWADH ALRESHIDI maha awdah alreshidi in Saudia arabia and from a study by Assefa Philipos Kare in southern Ethiopia shows 24.1%, This difference may be due to different environmental, cultural, nutritional and behavioral factors (Alreshidi & Haridi, 2021; Kare & Gujo, 2021; Kejela et al., 2020). The higher prevalence observed in Nangarhar may be explained by persistent food insecurity, poor dietary diversity, high burden of infectious diseases, and limited access to quality antenatal care services. The morphological distribution of anemia revealed that normocytic normochromic anemia (69.9%) was the predominant type, followed by microcytic hypochromic anemia (29.3%), while macrocytic anemia was rare. This pattern suggests that anemia in this population is likely multifactorial. Normocytic normochromic anemia is commonly associated with anemia of chronic disease, acute or chronic infections, malaria, and inflammation, all of which are prevalent in eastern Afghanistan. Similar morphological distributions have been reported in recent African studies. A 2019 Ethiopian study found normocytic normochromic anemia to be the most common type (75.5%) among pregnant women (Berhe et al., 2019). an institutional study in Arba Minch, South Ethiopia (2019) found 75.5% normocytic normochromic types, 23.3% microcytic hypochromic, and 1% macrocytic anemia, which is broadly similar in pattern though with a slightly higher normocytic proportion (Waye et al., 2020). The relatively lower proportion of microcytic hypochromic anemia in this study does not negate iron deficiency as a major contributor; rather, it suggests that infection-related anemia and repeated pregnancies may play a substantial role. This is supported by the high prevalence of malaria and hookworm infection observed among anemic women. Analysis of severity of anemia showed that mild anemia was most common (68.9%), followed by moderate (23.9%) and severe anemia (7.1%). This distribution is consistent with literature, where mild anemia predominates among ANC attendees, in a study by Eunice Justin Lema in in Tanzania shows 63.8% of mild anemia (Lema & Seif, 2023). Despite mild anemia being most prevalent, the presence of moderate and severe anemia in nearly one-third of affected women in this study is concerning and underscores the need for early detection and management. The obstetric characteristics of anemic women revealed that grand multiparity was common (39.9%), and a large proportion had short interpregnancy intervals (<18 months). Similar findings have been consistently reported in recent studies. Several obstetric and medical factors identified in this study as common among anemic women—such as high parity,

short interpregnancy interval, low antenatal care attendance, malaria, hookworm infection, and low iron supplement use—have analogs in the published literature. For example, the Chinese multicenter cohort found that rural residence, low education, and higher gravidity were associated risk factors for anemia across pregnancy (Qiao et al., 2024). The refugee study in Uganda also identified higher odds of anemia with increased parity and lower education, suggesting overlap with our findings regarding sociodemographic determinants (Bongomin et al., 2025). The Arba Minch study found malaria infection and blood loss to be independently associated with anemia, consistent with our malaria prevalence of 25.9% and high proportion of women without iron supplementation (Waye et al., 2020). Taken together, these comparisons suggest that reproductive history, infectious disease exposure, and nutrition/inadequate supplementation consistently influence anemia risk among pregnant women in low-resource settings. The relatively high anemia prevalence in your study implies a significant public health concern. It suggests that routine ANC services should emphasize early detection and comprehensive management of anemia, including targeted screening for nutritional deficiencies (especially iron), infectious disease prevention and treatment (malaria and parasitic infections), and strengthening education on iron supplement adherence. Your findings are particularly important in the context of rural and low-literacy populations where health education and access to preventive care may be limited.

This study has several limitations that should be acknowledged. As a cross-sectional descriptive study, it cannot establish causal relationships between anemia and associated factors. The study was conducted at a single tertiary hospital, which may limit generalizability to pregnant women who do not attend ANC or reside in remote areas. Biochemical markers such as serum ferritin, vitamin B12, and folate levels were not assessed, limiting precise etiological classification of anemia. Additionally, some variables relied on self-reported information, which may be subject to recall bias. Despite these limitations, the study provides valuable baseline data on anemia in pregnancy in eastern Afghanistan and highlights critical areas for intervention.

CONCLUSION

This study demonstrates that anemia is a significant public health problem among pregnant women attending antenatal care at Nangarhar University Teaching Hospital, indicating a severe burden. Most affected women were young, illiterate, rural residents and housewives, highlighting underlying socioeconomic vulnerabilities. Normocytic normochromic anemia was the predominant morphological type, suggesting a multifactorial etiology related to chronic infections, repeated pregnancies, and poor maternal reserves, while iron deficiency remains an important contributor. Mild anemia was most common; however, a substantial proportion of women had moderate to severe anemia, posing increased risks for adverse maternal and fetal outcomes. High parity, short interpregnancy intervals, limited antenatal care attendance, malaria, hookworm infection, and low iron supplement use were frequently observed among anemic women. These findings emphasize the need to strengthen antenatal care services through early screening, improved iron supplementation, effective infection prevention and treatment strategies.

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CONFLICT OF INTEREST:

All authors declare that there are no financial, professional, or personal conflicts of interest that could have influenced, or be perceived to have

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AUTHORS CONTRIBUTIONS:

All authors contributed well in making this article for publishing. Wahida Ahmady and Mohammad Haroon Rahemi led conceptualization, methodology and supervision. Suhaila Rahimi contributed to data collection, investigation, and original draft preparation. Hafiza Sahak performed data analysis, visualization, and drafting. Ourzala Saidal contributed to review, editing, methodology refinement, and funding acquisition. All authors read and approved the final manuscript.

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