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Community-level Prevalence of Anemia and Serum Ferritin Levels among Pregnant Women

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Abstract

Background: 'Pregnancy anaemia continues to be a major public health concern, particularly in the developing world'. Knowing the prevalence of anemia, serum ferritin concentrations, and their relationships helps design better public health strategies. The current study aimed to assess the community level prevalence of anemia and serum ferritin levels alongside some demographic variables among pregnant women attending Khyber Teaching Hospital Peshawar.

Methods: A cross-sectional study starting from January 2023 to January 2024 included 89 pregnant women. Along with blood samples, demographic data was collected through structured interviews. Analyzes were performed on hemoglobin and serum ferritin levels. Using SPSS, data evaluation was done through descriptive statistics and chi-square tests.

Results: The overall anemia prevalence was 62.0%, with mild anemia being most common (30.3%), followed by moderate (21.3%) and severe anemia (5.6%). Ferritin depletion (<15 µg/L) was noted in 53.9% of women. Significant associations were observed between anemia and rural residence (p=0.01), lower educational attainment (p=0.02), and low monthly income (p=0.02). Low serum ferritin strongly correlated with increased anemia severity (p<0.001).

Conclusion: The study highlights substantial anemia prevalence linked to socioeconomic factors and ferritin deficiency among pregnant women. Enhanced nutritional education, targeted antenatal care, and consistent iron supplementation programs should be prioritized to mitigate anemia in this vulnerable population.

Keywords: Anemia, Pregnancy, Serum Ferritin, Iron deficiency, Socioeconomic factors, Maternal health, Peshawar.

INTRODUCTION

Anemia continues to be a prevalent form of nutritional deficiency among pregnant women across the globe, especially in the developing regions. The World Health Organization estimates that iron-deficiency anemia affects almost 40% of pregnant women universally. In the case of Pakistan, where maternal health services are inadequate, it represents an extraordinarily serious public health concern which adversely affects maternal and fetal health outcomes [1-3].

The presence of anemia in expectant mothers exacerbates their already elevated maternal morbidity and mortality risks while also increasing the likelihood of preterm delivery, low weight at birth, and stunted mental growth in the child. In many of the under-resourced regions, maternal anemia is mainly caused due to a lack of iron, which is indicated by low serum ferritin levels. The causes of anemia include insufficient dietary iron intake, lack of healthcare access, poverty, and an absence of adequate maternal education regarding nutrition during pregnancy [4-6] .

While numerous public health efforts have tried to reduce maternal anemia, the condition persists at an unacceptably high rate among rural and economically disadvantaged populations. There is an urgent need to conduct in-depth studies that look at the prevalence of anemia alongside details of its contributing components, especially serum ferritin levels. The identification of such factors is crucial in designing effective strategies aimed at optimizing public health intervention [7-9].

This study aimed to determine the community-level prevalence of anemia and assess serum ferritin levels among pregnant women attending antenatal clinics at Khyber Teaching Hospital in Peshawar. By exploring demographic and socioeconomic associations, our findings will provide critical insights for policymakers and healthcare providers to improve maternal health outcomes in this region.

METHODOLOGY

The cross-sectional study was performed at Khyber Teaching Hospital, Peshawar, from January 2023 to January 2024. Approving the institutional ethical review committee secures enabling consent and assures participants of clear explanations regarding study objectives. Further, consent collection commences only after ethical approval is granted.

Through a consecutive sampling technique, 89 pregnant women attending antenatal clinics at Khyber Teaching Hospital were enrolled. Pregnant women belonging to any age group and of any gestational age were included in the study as long as they provided voluntary informed consent, which was the only prerequisite. Women who were diagnosed with any hemoglobinopathies, any active bleeding disorders, chronic systemic illnesses like renal failure, liver disease, any known malignancies, or those who had received blood transfusions within three months prior, were excluded.

Data collection was performed using a structured questionnaire to record demographic details, including age, education, residence, income status, and parity. Clinical information such as gestational age and dietary history was also documented through face-to-face interviews by trained research assistants.

Blood samples were drawn aseptically using standard phlebotomy protocols. Hemoglobin (Hb) concentration was determined immediately by automated hematology analyzer. Serum ferritin levels were measured through enzyme-linked immunosorbent assay (ELISA) in the hospital's pathology laboratory. 'Anemia was classified following World Health Organization guidelines as normal (Hb ≥11 g/dL), mild anemia (10–10.9 g/dL), moderate anemia (7–9.9 g/dL), and severe anemia (<7 g/dL). Ferritin levels less than 15 μg/L indicated depleted iron stores'.

Data was entered and analyzed using SPSS version 25. Descriptive statistics such as frequencies and percentages were calculated. Chi-square tests were employed to evaluate the relationship between anemia status and demographic factors as well as serum ferritin levels, with a significance level set at a p-value of <0.05. All analyses were double-checked for accuracy, ensuring the robustness of the findings.

RESULTS

The demographic characteristics of the study participants indicated a young population of pregnant women, with the majority (34.8%) between the ages of 20 and 24 years. A significant proportion (59.6%) resided in rural areas, highlighting the rural predominance of the study group. Educational background varied, with the highest frequency (42.7%) attaining secondary or higher education, whereas a notable 24.7% had no formal education at all. Additionally, more than half of the women (51.7%) reported low monthly family income, emphasizing the economic vulnerability of this community. Multiparity was

common (60.7%), reflecting a substantial number of participants who had experienced previous pregnancies.

Table 1: Demographic Characteristics of Pregnant Women (n = 89)

Demographic Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	<20	18	20.2
	20-24	31	34.8
	25-29	25	28.1
	≥30	15	16.9
Residence	Urban	36	40.4
	Rural	53	59.6
Education	None	22	24.7
	Primary	29	32.6
	Secondary or higher	38	42.7
Monthly Family Income	Low	46	51.7
	Middle/High	43	48.3
Parity	Primiparous	35	39.3
	Multiparous	54	60.7

Clinically, the highest number of participants (41.6%) were in their third trimester of pregnancy, followed by those in their second trimester (37.1%). Anemia prevalence was notably high, with only 42.7% of women having normal hemoglobin levels (≥11 g/dL). Mild anemia was the most common form (30.3%), followed by moderate anemia (21.3%), whereas severe anemia was relatively rare (5.6%). More than half (53.9%) of the participants demonstrated depleted serum ferritin levels (<15 µg/L), indicating significant iron deficiency within this group.

Table 2: Clinical Characteristics and Prevalence of Anemia (n = 89)

Clinical Variables	Categories	Frequency (n)	Percentage (%)
Gestational Age	1st Trimester	19	21.3
	2nd Trimester	33	37.1
	3rd Trimester	37	41.6
Anemia (Hb level)	Normal (≥11 g/dL)	38	42.7
	Mild (10–10.9 g/dL)	27	30.3
	Moderate (7–9.9 g/dL)	19	21.3
	Severe (<7 g/dL)	5	5.6
Serum Ferritin Levels	Normal (>15 µg/L)	41	46.1
	Depleted (<15 µg/L)	48	53.9

Upon assessing the relationship between demographic variables and anemia prevalence, significant associations were noted with residence, education, and monthly income. Rural women showed a significantly higher anemia prevalence (64.2%) compared to urban women (47.2%), with a p-value of 0.01. Women with primary or no education (66.7%) had significantly higher anemia rates compared to those with secondary or higher education (44.7%; p = 0.02). Likewise, lower monthly family income was significantly linked to anemia, with 67.4% prevalence among low-income participants compared to 46.5% among those with middle/high incomes (p = 0.02). Age, however, did not show a statistically significant association with anemia prevalence (p = 0.14).

Table 3: Association Between Demographic Factors and Anemia (n = 89)

Variables	Categories	Anemia Present (n=51)	Anemia Absent (n=38)	p-value*
Age (years)	<25	32 (65.3%)	17 (34.7%)	0.14
	≥25	19 (47.5%)	21 (52.5%)	
Residence	Urban	17 (47.2%)	19 (52.8%)	0.01
	Rural	34 (64.2%)	19 (35.8%)	
Education	≤ Primary	34 (66.7%)	17 (33.3%)	0.02
	≥ Secondary	17 (44.7%)	21 (55.3%)	

Income	Low	31 (67.4%)	15 (32.6%)	0.02
	Middle/High	20 (46.5%)	23 (53.5%)	

***Chi-square test, significant at p-value <0.05.**

Evaluating the serum ferritin levels concerning anemia severity revealed a highly significant association ($p < 0.001$). Participants with normal hemoglobin mostly maintained normal ferritin levels (71.1%), while those with varying degrees of anemia predominantly exhibited depleted ferritin levels. Specifically, all women with severe anemia had severely depleted ferritin levels, and the majority of women with moderate anemia (78.9%) and mild anemia (63.0%) also showed depleted iron stores. This clearly indicates that lower ferritin levels strongly correlate with greater anemia severity in this pregnant population.

Table 4: Relationship Between Serum Ferritin Levels and Severity of Anemia (n = 89)

Ferritin Level	Normal Hb (n=38)	Mild Anemia (n=27)	Moderate Anemia (n=19)	Severe Anemia (n=5)	p-value*
Normal (>15 µg/L)	27 (71.1%)	10 (37.0%)	4 (21.1%)	0 (0.0%)	<0.001
Depleted (<15 µg/L)	11 (28.9%)	17 (63.0%)	15 (78.9%)	5 (100%)	

***Chi-square test, significant at p-value <0.05.**

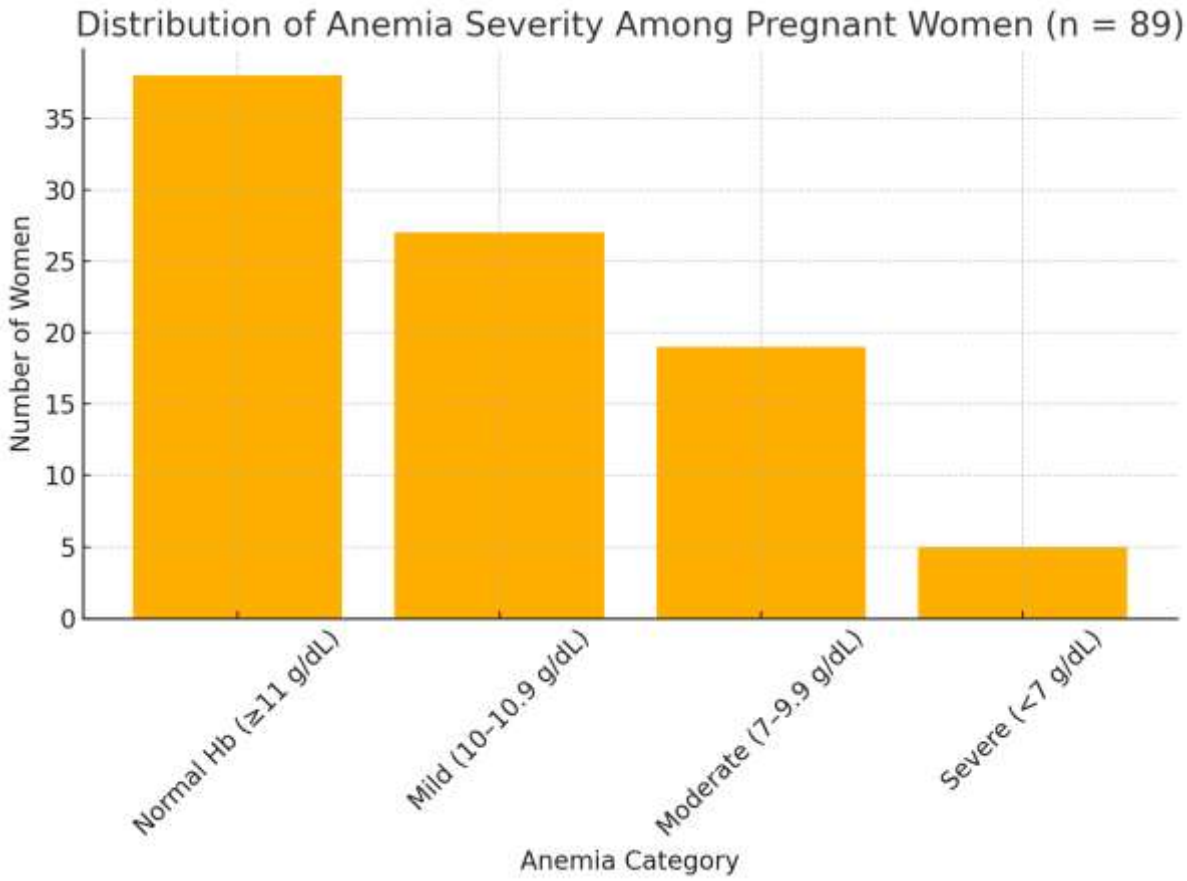

Figure 1: Bar graph showing the distribution of anemia severity among pregnant women in your study. It visually presents how many women fall into each hemoglobin category (normal, mild, moderate, and severe anemia).

DISCUSSION

This study found a significant 'prevalence of anemia and depleted iron stores among pregnant women attending Khyber Teaching Hospital, Peshawar'. The prevalence of anemia in our study was 62.0%, highlighting a major public health concern in the local community. Similar findings were reported which showed anemia prevalence as high as 60%, emphasizing the ongoing burden of maternal anemia in the region [10-12].

Our analysis revealed rural residence, lower educational status, and low monthly income as significant demographic determinants of anemia. This aligns closely with studies identified rural locality and socioeconomic disadvantage as key factors influencing anemia in pregnant women. Education appeared to influence anemia status notably; women with limited or no formal education demonstrated significantly higher anemia rates. This underscores the importance of educational interventions and awareness campaigns targeting anemia prevention, especially in rural or economically disadvantaged areas [13-15].

A striking observation in this research was the marked association between serum ferritin levels and anemia severity. The majority of women exhibiting moderate to severe anemia also had depleted ferritin stores. These results correspond to findings from studies observed that pregnant women with severe anemia typically presented with significantly low ferritin levels, indicating chronic iron deficiency. The WHO also 'highlights iron deficiency as the most prevalent cause of anemia among pregnant women globally, reinforcing the significance of our findings' [16-18].

Moreover, dietary habits and insufficient iron supplementation during pregnancy likely contributed significantly to the high rates of iron deficiency anemia observed in this community, though our study did not explore dietary patterns extensively. Previous regional studies) have emphasized inadequate dietary intake and insufficient antenatal care as critical contributors to maternal anemia. This suggests an urgent need for policy measures aimed at promoting antenatal nutrition education and routine iron supplementation programs at the community level [19, 20].

Despite the strengths of this study, including its clear inclusion criteria and detailed clinical evaluations, it does possess certain limitations. 'The cross-sectional nature of the study restricts the determination of causality'. Additionally, dietary practices and adherence to iron supplementation were not assessed in detail, potentially limiting insight into modifiable risk factors. Future studies employing prospective designs, along with detailed nutritional assessments, could help address these limitations and better inform interventions.

CONCLUSION

Our study demonstrates a significantly high prevalence of anemia and depleted iron stores among pregnant women in the local community. Rural residence, lower socioeconomic status, and educational levels significantly influence anemia prevalence, highlighting the need for targeted community-level interventions. Ensuring adequate dietary education and improving antenatal iron supplementation programs must become a public health priority to effectively reduce anemia prevalence and improve maternal and neonatal outcomes.

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