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# PREVALENCE OF IRON DEFICIENCY ANEMIA IN PREGNANT WOMEN (3RD TRIMESTER) IN AN URBAN POPULATION OF PAKISTAN

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ABSTRACT

**Background:** Iron deficiency anemia (IDA) is the most common nutritional disorder in pregnancy, with the third trimester being the period of highest physiological demand for iron. **Objective:** To determine the prevalence of iron deficiency anemia among third-trimester pregnant women in an urban population and to assess its association with demographic and clinical variables. **Methods:** This cross-sectional descriptive study was conducted at the Department of Obstetrics and Gynecology, Unit-II, Ghulam Muhammad Mahar Medical College (GMC), Sukkur, from October 2024 to March 2025. A total of 111 third-trimester pregnant women meeting inclusion criteria were enrolled through non-probability consecutive sampling. Demographic, obstetric, and clinical data were collected using a structured proforma. Venous blood samples were analyzed for hemoglobin using an automated hematology analyzer and serum ferritin using an ELISA assay. IDA was defined as hemoglobin <11.0 g/dL and serum ferritin <30 ng/mL. **Results:** The mean age of participants was 28.4 ± 4.6 years, and the mean gestational age was 36.5 ± 1.8 weeks. The prevalence of anemia (Hb <11.0 g/dL) was 54.1%, iron deficiency was 47.7%, and IDA was 42.3%. Mild anemia accounted for 50.0% of cases, moderate anemia for 25.0%, and severe anemia for 3.3%. IDA prevalence was significantly higher in women from lower socioeconomic backgrounds (p=0.021), while associations with age, parity, and BMI were not statistically significant. **Conclusion:** IDA remains highly prevalent among third-trimester pregnant women in urban populations, particularly in socioeconomically disadvantaged groups. Routine screening using hemoglobin and ferritin, targeted dietary counseling, and timely supplementation are essential to mitigate maternal and neonatal risks.

## Introduction

Iron deficiency anemia (IDA) represents a significant global health concern, particularly among pregnant women, where it can have profound implications for both maternal and fetal well-being [1]. The most frequent micronutrient deficiency during pregnancy is Iron Deficiency Anemia (IDA) and yes, it continues to fly under the radar in busy antenatal clinics. The strain is during the third trimester: maximum enlargement of plasma volume, intensification of fetal iron accretion, and iron requirements of the maternal organism surpass the average dietary intake [2]. Toward the end of pregnancy, iron demands aggregate to ~1,000 mg (fetal-plug perinatal growth, maternal erythropoiesis and expected losses during childbirth), whereas the amount of absorbed daily iron rises several times over the level of requirement. World Health Organization (WHO) stated that approximately 528.7 (29.4) of women of reproductive age are affected with anemia globally and 20.2 million of them are severely anemic [3]. Moreover, close to two-thirds of developing countries pregnant women develop anemia [4]. Precisely, South-East Asia exhibits the largest burden of anemia in women in the reproductive age range (41.9%), followed by African and Eastern Mediterranean regions.3 Anemia in female reproductive age group (51%) is more than half of the population in Pakistan. Anemia is not a knife with a very high burden among the non-pregnant female population when compared to pregnant women [5]. In a recently conducted National Nutritional Survey-2018 in Pakistan, it is estimated that approximately 41.7 percent of the women of reproductive age are anemic with a modest higher prevalence in the rural (44.3%) than in urban (40.2%) [6]. Pakistan is a country in South Asia; characterized by the complex interaction of socio-demographic factors, iron deficiency anemia in pregnant women during the third trimester is one of the burning problems of the population health [7]. With high rates of urbanization, dietary and health changes, and varying healthcare availability, urban populations present an interesting perspective through which to investigate the effect and rates of IDA amongst this at-risk population [8]. Learning the epidemiology of iron deficiency anemia in the urban environment of Pakistan is crucial to the creation of relevant interventions, enhanced maternal care journey, and well-being of the upcoming generation [9]. The study will serve to illuminate upon iron deficiency anemia of pregnancy among women in their third trimester of pregnancy belonging to an urban community in Pakistan, thus, adding a voice to the existing debate about maternal health and inequity in health care in the region [10]. Proportions of non-pregnant women aged 15 -49 years and pregnant women alive on the day of the survey that had anemia in the year 2011 were 29 percent (496 million) and 38 percent (32.4 million), respectively. Even though IDA is most prevalent in low-income countries, recent statistics indicate that 40-50 percent of European non-pregnant women possess low levels of iron body stores [11]. National figures are essential when gauging the peculiarities of the healthcare situation in Pakistan as well as its specifics. The local studies are undertaken in the urbanity parts of the country itself which give information on the contextual factors that are specific to a particular country like eating habits, socioeconomic factors and healthcare infrastructure (7). Research carried out by Tuba Mahmood, Pakistan established a prevalence rate of 37.8 percent in iron deficiency anemia (IDA) among pregnant women [12].

## Objective

To determine the frequency of iron deficiency anemia (IDA) in pregnant women of 3rd trimester in an urban population of Pakistan.

**Methodology**

This was a cross-sectional study (Descriptive study) conducted at Department of Obstetrics & Gynecology Unit-II, Ghulam Muhammad Mahar Medical College (GMC) Sukkur from October 2024 to March 2025. For the objective of the study, sample size has been calculated by using WHO sample size calculator with Confidence level (1-α) is taken as 95%, with desired precision (d) of 9% and approximate population estimation (frequency of iron deficiency anemia in 3rd trimester of pregnancy) of 37.8 % taken from the parent study (8). By putting all the values, the sample size calculated was 111. Data were collected through Non-probability consecutive sampling.

**Inclusion Criteria**

Pregnant women aged 18–40 years (booked cases) admitted for delivery in their third trimester.

Women belonging to the urban population, as per operational definition.

**Exclusion Criteria**

Women with pre-existing medical conditions or complications that could independently affect iron levels.

Multiple pregnancies (e.g., twins or triplets).

History of prior iron supplementation or treatment for anemia during the index pregnancy.

History of blood disorders during pregnancy (e.g., idiopathic thrombocytopenic purpura) or inherited hematologic disorders such as thalassemia trait or hereditary spherocytosis.

History of autoimmune disorders causing anemia (e.g., systemic lupus erythematosus).

**Data collection**

After approval from the College of Physicians and Surgeons Pakistan (CPSP) and the institutional ethical review committee, all eligible patients admitted in the third trimester were screened. Written informed consent was obtained from each participant. A structured proforma was used to record demographic data (age, height, weight, body mass index), obstetric history (gravida, parity, abortions, gestational age), medical history (previous illnesses such as jaundice, malaria, tuberculosis, hemorrhoids), dietary habits, and supplement use. Vital signs were measured at admission, and symptoms such as pallor, palpitations, or vaginal bleeding were documented. At admission, 5 mL of venous blood was collected aseptically. Three milliliters were placed into EDTA vacutainers for complete blood count analysis, including hemoglobin estimation, using the BC-3200 Plus Auto Hematology Analyzer (Mindray) at the institutional pathology and hematology laboratory. The remaining 2 mL was allowed to clot, centrifuged at 3000 rpm for 15 minutes to obtain serum, and stored under recommended conditions for ferritin estimation using the Fortress ELISA assay kit. Laboratory staff followed standard operating procedures for sample handling and testing, and quality control checks were performed before analysis. Women diagnosed with anemia were managed according to departmental protocols, including initiation of iron supplementation or arrangement of blood transfusion if clinically indicated.

**Data Analysis**

Data were entered and analyzed using SPSS version 26.0. Quantitative variables (age, BMI, hemoglobin levels) were expressed as mean ± standard deviation. Qualitative variables (BMI categories, parity groups, educational status, socioeconomic status, anemia/iron deficiency anemia) were presented as frequencies and percentages. Associations between categorical

variables were assessed using chi-square test. Stratification was done for age, weight, BMI, educational status, and socioeconomic status to control for effect modifiers. Post-stratification chi-square test was applied. A p-value <0.05 was considered statistically significant.

**Results**

Data were collected from 111 patients. The mean age was 28.4 ± 4.6 years, and the mean gestational age was 36.5 ± 1.8 weeks. Most women were overweight (45.9%), followed by those with normal BMI (34.2%) and obesity (19.8%). The majority were multigravida (63.1%), and a large proportion had secondary/matriculation education (39.6%). Nearly half belonged to the middle socioeconomic class (44.1%), with fewer participants in the upper class (18.0%).

**Table 1. Demographic and Clinical Characteristics of Study Participants (N = 111)**

| **Characteristic** | **n (%)** |
|---|---|
| Age (years) | 28.4 ± 4.6 |
| Gestational age (weeks) | 36.5 ± 1.8 |
| BMI (kg/m²) | 25.8 ± 3.4 |
| **BMI category** | |
| – Normal weight | 38 (34.2) |
| – Overweight | 51 (45.9) |
| – Obese | 22 (19.8) |
| **Parity** | |
| – Primigravida | 41 (36.9) |
| – Multigravida | 70 (63.1) |
| **Educational status** | |
| – Primary | 32 (28.8) |
| – Secondary/matriculation | 44 (39.6) |
| – Higher | 35 (31.5) |
| **Socioeconomic status** | |
| – Lower | 42 (37.8) |
| – Middle | 49 (44.1) |
| – Upper | 20 (18.0) |

Anemia (Hb <11 g/dL) was found in 54.1% of women, while 47.7% had iron deficiency (ferritin <30 ng/mL). The prevalence of iron deficiency anemia was 42.3%. Mild anemia was most common (27.0%), followed by moderate anemia (13.5%), with severe anemia being rare (1.8%).

**Table 2. Prevalence and Severity of Anemia and Iron Deficiency**

| **Parameter** | **n (%)** |
|---|---|
| Anemia (Hb <11.0 g/dL) | 60 (54.1) |
| Iron deficiency (ferritin <30 ng/mL) | 53 (47.7) |
| Iron deficiency anemia (Hb <11.0 + ferritin <30 ng/mL) | 47 (42.3) |

| | |
|---|---|
| **Severity of anemia** | |
| – Mild (Hb 10–10.9 g/dL) | 30 (27.0) |
| – Moderate (Hb 7–9.9 g/dL) | 15 (13.5) |
| – Severe (Hb <7 g/dL) | 2 (1.8) |

No significant association was found with age group, BMI category, or parity. However, IDA prevalence was significantly higher in women from the lower socioeconomic class (61.9%) compared to the middle (38.8%) and upper (25.0%) classes (p=0.021).

**Table 3. Association of Iron Deficiency Anemia with Demographic Variables**

| Variable | IDA Present n (%) | IDA Absent n (%) | p-value |
|---|---|---|---|
| **Age group (years)** | | | |
| 18–25 | 15 (39.5) | 23 (60.5) | 0.642 |
| 26–35 | 25 (43.1) | 33 (56.9) | |
| 36–40 | 7 (46.7) | 8 (53.3) | |
| **BMI category** | | | |
| Normal | 12 (31.6) | 26 (68.4) | 0.083 |
| Overweight | 24 (47.1) | 27 (52.9) | |
| Obese | 11 (50.0) | 11 (50.0) | |
| **Parity** | | | |
| Primigravida | 16 (39.0) | 25 (61.0) | 0.529 |
| Multigravida | 31 (44.3) | 39 (55.7) | |
| **Socioeconomic status** | | | |
| Lower | 26 (61.9) | 16 (38.1) | 0.021* |
| Middle | 19 (38.8) | 30 (61.2) | |
| Upper | 5 (25.0) | 15 (75.0) | |

*Significant at $p < 0.05$

The mean hemoglobin was 10.8 ± 1.4 g/dL, and mean serum ferritin was 32.6 ± 14.8 ng/mL. Red cell indices indicated a microcytic, hypochromic pattern, with MCV averaging 78.2 ± 6.5 fL and MCH at 25.1 ± 3.2 pg. The RDW was elevated at 15.8 ± 2.1%, suggesting anisocytosis.

**Table 4. Hematological Indices of Study Participants (N = 111)**

| Parameter | Mean ± SD | Minimum | Maximum |
|---|---|---|---|
| Hemoglobin (g/dL) | 10.8 ± 1.4 | 6.5 | 13.4 |
| Serum ferritin (ng/mL) | 32.6 ± 14.8 | 8.0 | 75.0 |
| Mean corpuscular volume (MCV, fL) | 78.2 ± 6.5 | 64.0 | 92.0 |
| Mean corpuscular hemoglobin (MCH, pg) | 25.1 ± 3.2 | 18.0 | 30.0 |
| Red cell distribution width (RDW, %) | 15.8 ± 2.1 | 12.0 | 20.5 |


DOI: Availability

The highest proportion of mild (33.3%), moderate (21.4%), and severe anemia (7.1%) occurred in the lower socioeconomic group. The middle class had fewer moderate (10.2%) and severe (4.1%) cases, while no severe anemia was reported in the upper class. Overall, anemia burden was disproportionately higher among lower-income women.

**Table 5. Distribution of Anemia Severity by Socioeconomic Status**

| Socioeconomic Status | Mild Anemia n (%) | Moderate Anemia n (%) | Severe Anemia n (%) | Total n (%) |
|---|---|---|---|---|
| Lower | 14 (33.3) | 9 (21.4) | 3 (7.1) | 26 (61.9) |
| Middle | 12 (24.5) | 5 (10.2) | 2 (4.1) | 19 (38.8) |
| Upper | 4 (20.0) | 1 (5.0) | 0 (0.0) | 5 (25.0) |
| **Total** | 30 (27.0) | 15 (13.5) | 5 (4.5) | 50 (45.0) |

**Discussion**

This study investigated the prevalence of iron deficiency anemia (IDA) among third-trimester pregnant women residing in an urban population and assessed its association with key demographic and clinical variables. Interestingly, despite a higher prevalence of IDA in overweight and obese women than in women with normal BMI, the difference was not statistically significant. This could reflect the complex interplay between obesity, chronic low-grade inflammation, and iron metabolism, as inflammation can impair iron absorption and utilization despite adequate or excess dietary intake [18].

This study found no significant correlation between maternal age and parity and IDA, which contrasts with other studies that have found a higher prevalence in multiparous women due to cumulative iron depletion across pregnancies. This discrepancy may be due to differences in study population characteristics, supplementation coverage, or inter-pregnancy intervals. From a public health perspective, the persistence of high IDA prevalence in an urban setting underscores the need for strategies beyond simply providing supplements [19]. Counseling on correct supplement intake, addressing gastrointestinal side effects, and educating about dietary enhancers (e.g., vitamin C) and inhibitors (e.g., tea, coffee, calcium) of iron absorption are essential. The strengths of this study include the use of both hemoglobin and ferritin for defining IDA, ensuring a more accurate prevalence estimate than hemoglobin-based screening alone. In addition, focusing specifically on third-trimester women provides a clear picture of IDA burden at the stage when maternal and fetal iron demands peak [20]. However, the study is not without limitations. The use of non-probability consecutive sampling limits generalizability beyond the study population, and the cross-sectional design prevents causal inference. Self-reported dietary intake and supplement use may be subject to recall bias. Furthermore, inflammatory markers such as C-reactive protein were not measured, which could have helped adjust ferritin interpretation in the presence of inflammation. Routine ferritin testing in late pregnancy should be considered in urban antenatal clinics due to the high prevalence, particularly for low-income women. Obstetric and neonatal complications can be reduced by identifying and treating iron deficiency before it progresses to moderate or severe anemia. In situations where oral iron is ineffective or poorly tolerated, intravenous iron therapy should be started immediately to replenish iron stores prior to delivery.

**Conclusion**

It is concluded that iron deficiency anemia remains a highly prevalent condition among third-trimester pregnant women in urban populations, despite the theoretical advantages of better healthcare access and supplementation programs. In this study, over two-fifths of participants met diagnostic criteria for IDA, with the burden being highest among women from lower socioeconomic backgrounds. Although most cases were mild, a substantial proportion had moderate anemia, which poses significant risks for adverse maternal and neonatal outcomes.

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