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# PREVALENCE AND SEVERITY OF POSTPARTUM ANEMIA AMONG POSTNATAL MOTHERS IN URBAN PUDUCHERRY: A COMMUNITY-BASED CROSS-SECTIONAL STUDY

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## ABSTRACT

**Background:** Postpartum anemia remains an important but often overlooked public health concern affecting women during the early postnatal period. Although antenatal screening and iron supplementation programs have improved maternal health outcomes, anemia frequently persists after delivery due to iron depletion during pregnancy and blood loss during childbirth. Understanding the magnitude and severity of postpartum anemia is essential for strengthening maternal health interventions and ensuring adequate recovery during the postnatal phase. The objective is to estimate the prevalence and severity of postpartum anemia among postnatal mothers residing in an urban area of Puducherry.

**Materials and Methods:** A community-based cross-sectional study was conducted in the urban field practice area of an Urban Health and Training Centre in Puducherry, India. A total of 170 postnatal mothers who delivered at ≥37 weeks of gestation were followed up and assessed at 6–8 weeks postpartum. Sociodemographic and obstetric information was collected using a pre-tested semi-structured questionnaire. Venous blood samples were obtained for hemoglobin estimation using standardized laboratory methods. Postpartum anemia was defined as hemoglobin concentration <12 g/dL according to World Health Organization criteria. Severity of anemia was classified as mild (11.0–11.9 g/dL), moderate (8.0–10.9 g/dL), and severe (<8.0 g/dL). Data were analyzed using descriptive statistics, and results were expressed as frequencies and percentages.

**Results:** Among the 170 postnatal mothers included in the study, 71 women (42.0%) were found to have postpartum anemia. Mild anemia was observed in 46 women (27.0%), while 25 women (15.0%) had moderate anemia. No cases of severe anemia were identified. The majority of participants belonged to the 24–29-year age group (47.7%), and most households consisted of fewer than five members (72.4%). The findings indicate that although severe anemia was absent, mild and moderate anemia remained common during the early postpartum period.

**Conclusion:** Postpartum anemia remains a substantial health concern among postnatal mothers in urban Puducherry, with more than two-fifths of women affected at 6–8 weeks after delivery. The predominance of mild and moderate anemia highlights incomplete hematological recovery during the early postnatal phase. Strengthening postpartum screening, reinforcing continued iron–folic acid supplementation, and improving nutritional counseling during postnatal care visits may help reduce the burden of postpartum anemia and support maternal recovery.

**Keywords:** Postpartum anemia; prevalence; severity; postnatal mothers; maternal health; Puducherry.

## INTRODUCTION

Anemia remains a major global public health problem affecting women of reproductive age, particularly in low- and middle-income countries. The World Health Organization estimates that nearly one-third of women worldwide are affected by anemia, with the highest burden observed in South Asia and Sub-Saharan Africa. Women in the reproductive age group are especially vulnerable because of menstrual blood loss, repeated pregnancies, inadequate dietary intake, and increased physiological iron requirements. Although anemia during pregnancy has received considerable attention through antenatal screening and supplementation programs, anemia occurring during the postpartum period remains comparatively under-recognized in both clinical practice and research.[1]

The postpartum period represents a critical stage of maternal recovery during which physiological changes gradually restore hematological and metabolic equilibrium following childbirth. During pregnancy, maternal blood volume expands substantially, and iron demands increase to support fetal growth and placental development. Delivery is often accompanied by varying degrees of blood loss, which may further compromise maternal hemoglobin levels. When iron stores are depleted during pregnancy and are not adequately replenished after delivery, women may enter the postpartum phase with persistent anemia. Failure to restore hemoglobin concentrations during this period may adversely affect maternal health, leading to fatigue, reduced work capacity, impaired cognition, and increased susceptibility to postpartum depression. These consequences may ultimately influence maternal caregiving ability and infant well-being.[2]

Postpartum anemia is frequently overlooked because maternal health programs primarily emphasize antenatal care and safe delivery services. However, emerging evidence suggests that anemia often persists beyond pregnancy, particularly in settings where dietary iron intake is insufficient and adherence to iron–folic acid supplementation declines after childbirth. Studies conducted in several developing countries have reported postpartum anemia prevalence ranging from 30% to 60%, indicating that a substantial proportion of women remain anemic during the early postnatal period. Such findings highlight the importance of extending anemia surveillance beyond pregnancy and incorporating postpartum screening into routine maternal health services.[3]

In India, anemia among women continues to represent a significant nutritional and public health challenge. National survey data consistently demonstrate a high prevalence of anemia among women aged 15–49 years despite ongoing national initiatives such as the Anemia Mukt Bharat program. While antenatal screening and supplementation have been strengthened in recent years, systematic evaluation of hemoglobin status after delivery is not consistently integrated into postnatal care. Consequently, women who enter the postpartum period with depleted iron reserves may remain undiagnosed and untreated, allowing anemia to persist during a phase when adequate maternal health is essential for infant care and recovery.[4]

Understanding the magnitude and severity of postpartum anemia is crucial for strengthening maternal health programs and improving postnatal care strategies. Data on the distribution of anemia severity can provide insight into the extent of hematological recovery following childbirth and help identify populations that may benefit from targeted interventions. However, evidence describing the burden and severity pattern of postpartum anemia in urban communities of South India remains limited. Generating region-specific data is therefore essential to guide local public health planning and ensure continuity of anemia prevention strategies across the maternal care continuum.[5]

In this context, the present study was undertaken to estimate the prevalence and severity of postpartum anemia among postnatal mothers residing in an urban area of Puducherry. By documenting the magnitude of anemia and its severity distribution during the early postpartum period, this study aims to contribute to the growing evidence base needed to strengthen postpartum screening and maternal nutrition interventions.

## MATERIALS AND METHODS

**Study Design and Setting:** A community-based cross-sectional study was conducted in the urban field practice area attached to an Urban Health and Training Centre (UHTC) of a tertiary care teaching institution located in Puducherry, India. The study area represents a well-defined urban population served by a structured primary healthcare system that provides antenatal registration, maternal health surveillance, and routine postnatal follow-up services.

The broader research framework involved prospective identification of eligible pregnant women during the late antenatal period and their follow-up into the postpartum stage. For the present analysis, hemoglobin assessment performed at 6–8 weeks after delivery was used to estimate the prevalence and severity of postpartum anemia. The study was conducted over a period of 18 months, allowing adequate time for participant recruitment, follow-up, and data collection across different seasons.[6]

**Study Population:** The study population consisted of postnatal mothers residing in the selected urban field practice area who had completed at least 37 weeks of gestation and were available for evaluation during the early postpartum period.

**Inclusion Criteria**

Women were eligible for participation if they:

- Were aged 18–45 years

- Were permanent residents of the selected urban area
- Delivered at ≥37 weeks of gestation
- Provided written informed consent
- Were available for hemoglobin assessment between 6 and 8 weeks postpartum

**Exclusion Criteria**

**Participants were excluded if they:**

- Had previously diagnosed hematological disorders such as hemoglobinopathies
- Had chronic systemic illnesses known to influence hemoglobin levels
- Were temporary residents or were unavailable for follow-up during the postpartum period.[7]

**Sample Size Estimation:** The sample size for the study was calculated using the standard formula for estimating prevalence in cross-sectional studies:

$n = Z^2pq / d^2$

**Where:**

- n = required sample size
- Z = standard normal deviate at 95% confidence level (1.96)
- p = anticipated prevalence of postpartum anemia (47.3%) based on previously published regional evidence
- q = 1 – p
- d = absolute precision (8%)

After substitution of values and adjustment for potential non-response, the minimum sample size required was determined to be 170 participants, which constituted the final study population.[8]

**Sampling Technique:** Eligible pregnant women registered at the Urban Health and Training Centre were identified from antenatal care registers maintained by the health facility. Consecutive sampling was employed, whereby all women fulfilling the eligibility criteria during the recruitment period were invited to participate. Participants were initially enrolled during the late antenatal period and were subsequently followed up for assessment during the postpartum stage.

This approach ensured systematic recruitment while minimizing selection bias within the defined study population.[9]

**Data Collection Procedure**

Data collection was carried out in two phases.

Phase I: Late Antenatal Assessment

During the late antenatal period (≥37 weeks of gestation), baseline information was collected using a pre-tested semi-structured questionnaire. The questionnaire captured demographic characteristics, obstetric history, and relevant maternal health information. Antenatal hemoglobin values were obtained from hospital laboratory records documented during routine antenatal visits.

Phase II: Postnatal Assessment

Participants were visited at their residence between 6 and 8 weeks postpartum. This time interval was selected because maternal hemodynamic changes and plasma volume shifts typically stabilize during this stage, enabling more reliable evaluation of hemoglobin status following childbirth.

During the postnatal visit:

- Sociodemographic characteristics were reconfirmed
- Household and family structure details were documented
- Obstetric and intrapartum events were recorded
- Information on postnatal health events was collected
- Venous blood samples were obtained for hemoglobin estimation.[10]

**Measurement of Hemoglobin:** Venous blood samples were collected under aseptic precautions by trained personnel. Hemoglobin concentration was measured using standardized automated hematology analyzers calibrated according to manufacturer guidelines. Quality control procedures were implemented periodically to ensure reliability and accuracy of laboratory measurements.

For the purpose of this study, postpartum anemia was defined as hemoglobin concentration <12 g/dL at 6–8 weeks postpartum, in accordance with the World Health Organization criteria for anemia among non-pregnant women.

**Severity of anemia was categorized as follows:**

- Mild anemia: 11.0–11.9 g/dL
- Moderate anemia: 8.0–10.9 g/dL
- Severe anemia: <8.0 g/dL

**Study Variables**

**Primary Outcome Variable**

- Postpartum anemia status (anemic / non-anemic)

**Additional Outcome Measures**

- Severity classification of anemia (mild, moderate, severe)

**Independent Variables**

Sociodemographic and maternal characteristics collected included:

- Age
- Educational status
- Socioeconomic status
- Type of family
- Household size
- Parity
- Birth spacing
- Number of antenatal visits
- Mode of delivery
- Intrapartum blood loss

**Data Management and Statistical Analysis**

Collected data were reviewed for completeness and coded prior to entry. Data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA).

Continuous variables were summarized using mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages.

The prevalence of postpartum anemia was calculated as the proportion of women with hemoglobin concentration below 12 g/dL among the total study population. Severity distribution was determined by categorizing anemic participants into mild, moderate, and severe groups based on hemoglobin levels.

Results were presented using appropriate tables and graphical representations to illustrate the distribution of postpartum anemia and its severity pattern within the study population.

**Ethical Considerations:** The study protocol was reviewed and approved by the Institutional Ethics Committee of the affiliated medical institution. Written informed consent was obtained from all participants prior to enrollment.

Confidentiality was maintained by anonymizing participant identifiers during data entry and analysis. Women identified with anemia during the study were counseled and referred for appropriate management according to national maternal health guidelines. The study adhered to the ethical principles outlined in the Declaration of Helsinki for research involving human participants.

## RESULTS

**Participant Characteristics:** A total of 170 postnatal mothers completed follow-up at 6–8 weeks postpartum and were included in the final analysis. The age distribution of the study population showed that the majority of participants belonged to the 24–29-year age group (81; 47.7%), followed by women aged below 24 years (52; 30.6%) and 30 years or older (37; 21.8%).

Regarding household structure, 82 participants (48.2%) resided in nuclear families, while 88 women (51.8%) lived in joint or extended family settings. The majority of households comprised fewer than five members (123; 72.4%), whereas 47 households (27.6%) had five or more members.

Educational attainment indicated that 151 women (88.8%) had education beyond high school, while 19 participants (11.2%) had completed education up to high school level.

These baseline sociodemographic characteristics of the study participants are summarized in [Table 1].

The table indicates that the study population largely consisted of women in the mid-reproductive age group, with a relatively high level of educational attainment and a balanced distribution between nuclear and joint family structures.

**Table 1: Sociodemographic Characteristics of Study Participants (N = 170)**

| Variable | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age (years) | <24 | 52 | 30.6 |
| | 24–29 | 81 | 47.7 |
| | ≥30 | 37 | 21.8 |
| Type of Family | Nuclear | 82 | 48.2 |
| | Joint/Extended | 88 | 51.8 |
| Family Size | <5 members | 123 | 72.4 |
| | ≥5 members | 47 | 27.6 |
| Education | Up to High School | 19 | 11.2 |
| | Above High School | 151 | 88.8 |

### Prevalence of Postpartum Anemia

At 6–8 weeks postpartum, hemoglobin assessment revealed that 71 women (42.0%) had hemoglobin concentrations below 12 g/dL, thereby meeting the diagnostic criteria for postpartum anemia. The remaining 99 participants (58.0%) had normal hemoglobin levels.

This finding indicates that more than two out of five postnatal mothers remained anemic during the early postpartum period, despite having completed pregnancy and delivery.

The overall prevalence of postpartum anemia observed in the study population is presented in [Table 2].

**Table 2: Prevalence of Postpartum Anemia (N = 170)**

| Hemoglobin Status | Frequency (n) | Percentage (%) |
|---|---|---|
| Non-anemic (≥12 g/dL) | 99 | 58.0 |
| Anemic (<12 g/dL) | 71 | 42.0 |

The results demonstrate that postpartum anemia continues to affect a substantial proportion of women during the early postnatal phase.

### Severity Distribution of Postpartum Anemia

Among the 71 women diagnosed with postpartum anemia, the majority were classified as having mild anemia, while a smaller proportion had moderate anemia. No cases of severe anemia were identified in the study population.

Specifically, 46 women (27.0% of the total sample) had mild anemia with hemoglobin levels between 11.0 and 11.9 g/dL, while 25 women (15.0%) had moderate anemia with hemoglobin levels between 8.0 and 10.9 g/dL.

The distribution of anemia severity is summarized in [Table 3].

**Table 3: Severity Distribution of Postpartum Anemia (N = 170)**

| Severity Category | Frequency (n) | Percentage (%) |
|---|---|---|
| Mild anemia (11–11.9 g/dL) | 46 | 27.0 |
| Moderate anemia (8–10.9 g/dL) | 25 | 15.0 |
| Severe anemia (<8 g/dL) | 0 | 0 |

These findings indicate that while severe anemia was not observed in this cohort, a considerable proportion of women continued to experience mild to moderate hemoglobin deficiency during the early postpartum period.

**Distribution of Hemoglobin Status**

To further illustrate the burden of anemia in the study population, the proportion of anemic and non-anemic women was visualized using graphical representation. The distribution of hemoglobin status is shown in Figure 1.

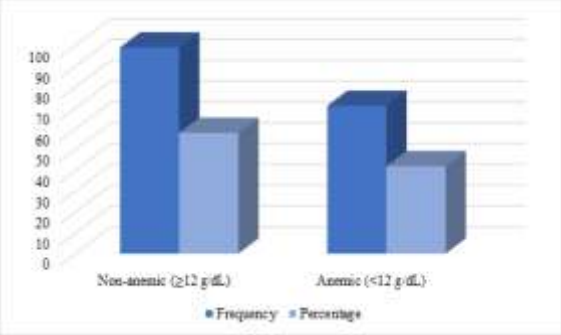


**Figure 1: Distribution of Postpartum Anemia among Study Participants**

The figure demonstrates that a substantial proportion of postnatal mothers remained anemic even several weeks after delivery.

Severity Pattern of Postpartum Anemia

The severity pattern among anemic women was further illustrated using a bar chart to highlight the relative predominance of mild and moderate anemia categories is shown in [Figure 2].

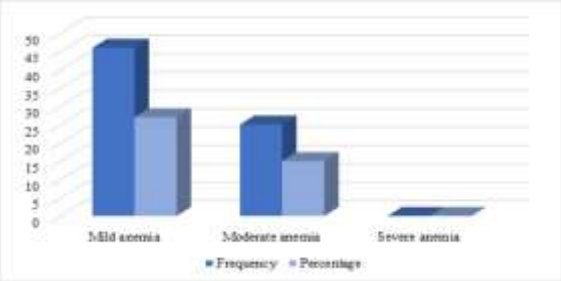


**Figure 2: Severity Pattern of Postpartum Anemia**

The graphical representation indicates that mild anemia constituted the largest proportion of cases, suggesting that although hemoglobin levels had partially recovered after childbirth, complete hematological restoration had not occurred for many women.

**Summary of Key Findings**

The results of this study highlight a substantial burden of postpartum anemia among postnatal mothers in urban Puducherry.

**Key observations include:**

• Overall prevalence of postpartum anemia: 42%
• Mild anemia: 27% of the total study population
• Moderate anemia: 15% of the total study population
• Severe anemia: not observed
• Majority of participants were in the 24–29-year age group and belonged to households with fewer than five members

These findings indicate that although severe anemia was absent, mild and moderate forms remain common during the early postpartum period, emphasizing the importance of continued maternal nutritional monitoring and follow-up after delivery.

## DISCUSSION

The present study assessed the prevalence and severity of postpartum anemia among postnatal mothers residing in an urban area of Puducherry. The findings revealed that 42% of women remained anemic at 6–8 weeks postpartum, indicating that a substantial proportion of mothers continue to experience hematological deficits even after delivery. Although severe anemia was not observed, the predominance of mild and moderate anemia suggests incomplete recovery of hemoglobin levels during the early postnatal period. These results highlight the continued public health importance of postpartum anemia, particularly in settings where maternal health programs primarily emphasize antenatal care while postpartum surveillance remains relatively limited.

The prevalence observed in this study is consistent with reports from several developing countries where postpartum anemia has been documented in 30–60% of postnatal women. Studies from South Asia and Sub-Saharan Africa have similarly demonstrated that anemia frequently persists beyond childbirth despite improvements in antenatal screening and institutional delivery coverage.[11] The persistence of anemia during the postpartum period may reflect the cumulative effect of iron depletion during pregnancy, blood loss during delivery, and insufficient restoration of iron stores following childbirth. In many cases, women enter the postpartum phase with already compromised hemoglobin levels, and recovery may be further hindered by inadequate nutritional intake or suboptimal adherence to iron supplementation.

In the present study, mild anemia constituted the majority of cases, accounting for more than half of the anemic participants. This pattern is consistent with findings reported in other population-based studies of postpartum women, where mild anemia has been observed as the most common severity category during the early postnatal phase.[12] Although mild anemia may appear clinically less severe, it can still have meaningful implications for maternal well-being. Even modest reductions in hemoglobin concentration have been associated with fatigue, reduced physical capacity, diminished concentration, and impaired quality of life among postpartum women. These symptoms may affect a mother's ability to care for her newborn and perform routine

household activities during a period when adequate physical recovery is essential.

The absence of severe anemia in this study population may reflect partial effectiveness of antenatal anemia control initiatives and the widespread availability of institutional delivery services within the study area. Over the past decade, national programs in India have strengthened antenatal screening and iron–folic acid supplementation under initiatives such as Anemia Mukt Bharat, which aim to reduce anemia across the life course.[13] Improved access to antenatal care and early identification of anemia during pregnancy may contribute to preventing extreme hemoglobin deficits during the postpartum period. Nevertheless, the continued presence of mild and moderate anemia indicates that current interventions may not fully address the restoration of maternal iron stores after childbirth.

Another important consideration is the potential decline in iron supplementation adherence after delivery. While antenatal supplementation is widely promoted and monitored during pregnancy, continuation of iron–folic acid tablets during the postpartum period often receives less emphasis in routine maternal care. Previous studies have shown that many women discontinue supplementation soon after childbirth, either due to reduced counseling, perceived recovery after delivery, or competing caregiving responsibilities.[14] Consequently, women who enter the postpartum period with marginal iron reserves may fail to achieve complete hematological recovery.

The findings of this study also underscore the importance of extending maternal health surveillance beyond pregnancy and delivery. Postnatal care visits offer an opportunity to reassess maternal nutritional status, identify persistent anemia, and reinforce counseling on diet and supplementation. However, postpartum follow-up remains underutilized in many settings, particularly in urban communities where early discharge after delivery is common. Strengthening routine postpartum screening could therefore facilitate early detection and management of anemia, thereby improving maternal recovery and overall well-being.

The persistence of postpartum anemia has broader implications for maternal and child health. Maternal anemia during the postnatal period has been associated with increased fatigue, reduced breastfeeding performance, and impaired cognitive functioning. Additionally, anemia may contribute to postpartum depressive symptoms, which can adversely influence mother–infant bonding and early childhood development.[15] Addressing postpartum anemia is therefore essential not only for maternal health but also for optimizing infant care and family well-being.

**Strengths and Limitations:** This study has several strengths. The community-based design and standardized hemoglobin assessment at 6–8 weeks postpartum provide a reliable estimate of anemia prevalence during the early postnatal period. The inclusion of a well-defined urban population and objective laboratory measurements enhances the validity of the findings.

However, certain limitations should be acknowledged. First, dietary intake and adherence to iron supplementation were not quantitatively assessed, which limits interpretation of nutritional influences on hemoglobin recovery. Second, biochemical indicators of iron status such as serum ferritin were not measured. Third, as the study primarily focused on prevalence and severity, causal relationships between risk factors and anemia could not be established.

**Implications for Maternal Health Programs**

The findings of this study emphasize that postpartum anemia remains a significant health concern even in urban settings with high institutional delivery coverage. Maternal health programs should therefore strengthen postnatal follow-up strategies, including routine hemoglobin assessment during the early postpartum period. Counseling on continued iron supplementation, dietary iron intake, and postpartum nutritional support should be integrated into postnatal care services.

Improving postpartum anemia surveillance and management may contribute to enhanced maternal recovery, improved caregiving capacity, and better long-term health outcomes for both mothers and infants.

## CONCLUSION

The present study demonstrates that postpartum anemia remains a considerable public health concern among postnatal mothers residing in urban Puducherry. At 6–8 weeks after delivery, more than two-fifths of women were found to have hemoglobin levels below the recommended threshold, indicating that hematological recovery following childbirth is incomplete for a substantial proportion of mothers. Although severe anemia was not observed in this population, the predominance of mild and moderate anemia highlights the persistence of iron deficiency during the early postpartum period.

These findings suggest that current maternal health interventions, which largely prioritize antenatal screening and treatment, may not sufficiently address the continuation of anemia after delivery. While improvements in institutional delivery and antenatal care coverage may have contributed to preventing severe anemia, the high proportion of women with residual anemia indicates the need for stronger postpartum monitoring and nutritional support.

Routine hemoglobin assessment during the early postnatal period should therefore be integrated into standard maternal health services. Reinforcing adherence to iron–folic acid supplementation after delivery, promoting adequate dietary iron intake, and strengthening postnatal follow-up can play an important role in improving maternal recovery.

Addressing postpartum anemia is essential not only for restoring maternal health but also for enhancing caregiving capacity, maternal well-being, and early infant care.

Future research should explore longitudinal hemoglobin recovery, dietary intake patterns, and biochemical indicators of iron status to better understand the mechanisms underlying persistent postpartum anemia. Strengthening evidence in this area will support the development of comprehensive maternal health strategies that extend beyond pregnancy and ensure continuity of care throughout the postpartum period.

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