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Research Article

Maternal and Fetal Outcomes Among Anemic and Non-Anemic Pregnant Women: A Hospital-Based Comparative Cross-Sectional Study

Gurpreet Kaur[1], Sharish Khan[2]

[1]Assistant Professor, Army College of Nursing, Jalandhar Cantt, Punjab, India
[2]Tutor, Department of Nursing, Syed Mantaqi Memorial College of Nursing & Medical Technology, Islamic University of Science and Technology, IUST, Awantipora, Kashmir, India
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I N F O

Corresponding Author:
Gurpreet Kaur, Army College of Nursing, Jalandhar Cantt, Punjab, India
E-mail Id:
gurpreetkaursaini91@gmail.com
Orcid Id:
https://orcid.org/0009-0001-6716-8401
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A B S T R A C T

Background: Maternal anemia remains a major public health problem in developing countries and is associated with adverse maternal and neonatal outcomes. Evidence from hospital-based studies in North India comparing maternal and fetal outcomes among anemic and non-anemic pregnant women remains limited.

Objective: To compare maternal and fetal outcomes among anemic and non-anemic pregnant women admitted to a government healthcare facility in North India.

Methods: A hospital-based comparative cross-sectional study was conducted among 60 pregnant women, comprising 30 anemic and 30 non-anemic mothers, admitted to the obstetrics department of a tertiary care hospital in North India. Maternal and neonatal outcome data were collected using a structured data collection tool. Data were analyzed using descriptive statistics, the Chi-square test, and Student's *t*-test. A p-value of <0.05 was considered statistically significant.

Results: Anemic mothers had a significantly higher mean pulse rate than non-anemic mothers (88.0 ± 8.22 vs. 81.2 ± 5.90 beats/min; $p < 0.001$), whereas respiratory rate and blood pressure were comparable between the groups. Preterm delivery was more frequent among anemic mothers than non-anemic mothers (53.3% vs. 20.0%). Infants born to anemic mothers more commonly had low birth weight (<2.5 kg; 80.0% vs. 13.3%) and birth asphyxia (43.3% vs. 6.7%) than those born to non-anemic mothers.

Conclusion: Adverse maternal and neonatal outcomes, including preterm delivery, low birth weight, and birth asphyxia, were observed more frequently among anemic mothers than among non-anemic mothers. These findings highlight the importance of routine antenatal screening, early diagnosis, iron–folic acid supplementation, and appropriate management of maternal anemia to improve pregnancy outcomes.

Keywords: Maternal anemia, Pregnancy, Fetal outcomes, Low birth weight, Birth asphyxia, Preterm birth

Introduction

Maternal anemia remains one of the most significant public health challenges worldwide, particularly in low- and middle-income countries.[1,18] The World Health Organization (WHO) defines anemia during pregnancy as a hemoglobin concentration of less than 11.0 g/dL and estimates that approximately 37% of pregnant women globally are affected.[1] Iron deficiency is the predominant cause, accounting for nearly half of all cases, although deficiencies of other micronutrients, chronic infections, inflammatory disorders, parasitic infestations, and hereditary hemoglobinopathies also contribute to its development.[1,2,16] Pregnancy substantially increases maternal iron requirements because of expanded maternal blood volume, fetal growth, placental development, and anticipated blood loss during delivery, making pregnant women especially vulnerable to anemia when nutritional demands are not adequately met.[11,12,19,20]

Maternal anemia is associated with significant adverse consequences for both mothers and newborns. Reduced oxygen-carrying capacity compromises placental perfusion and fetal oxygenation, increasing the risk of preterm labor, intrauterine growth restriction, low birth weight, fetal distress, stillbirth, and neonatal morbidity.[4,6,14,15] For mothers, anemia has been linked with fatigue, reduced physical capacity, postpartum hemorrhage, puerperal infections, prolonged hospitalization, increased need for blood transfusion, and severe maternal morbidity.[4,6,7] The severity of these complications generally increases with decreasing hemoglobin concentration, highlighting the importance of early identification and appropriate management during antenatal care.[1,4,11]

India continues to bear one of the highest burdens of maternal anemia globally despite sustained public health efforts.[3,18] According to the National Family Health Survey-5 (NFHS-5), more than half of women aged 15–49 years are anemic, and anemia among pregnant women remains a major nutritional concern.[3] To address this challenge, the Government of India has implemented several national initiatives, including the Anemia Mukt Bharat strategy, the National Iron Plus Initiative, and POSHAN Abhiyaan, which emphasize routine antenatal screening, iron–folic acid supplementation, dietary counseling, deworming, and improved maternal nutrition.[9,10,22] Nevertheless, the persistently high prevalence of anemia indicates that effective implementation and continuous evaluation of these interventions remain essential.[3,9]

Numerous studies from India and other countries have demonstrated an association between maternal anemia and adverse pregnancy outcomes.[5–8,14,15] Previous investigations have consistently reported increased risks of preterm birth, low birth weight, neonatal intensive care unit admission, postpartum hemorrhage, and cesarean delivery among anemic pregnant women.[5–8] However, the magnitude of these associations has varied across studies because of differences in study populations, severity of anemia, healthcare settings, nutritional status, socioeconomic characteristics, and access to antenatal care.[6,14,15] Such variability underscores the need for region-specific evidence to guide local maternal health policies and clinical practice.

Although several studies have evaluated the prevalence and determinants of maternal anemia in India, comparative evidence examining maternal and fetal outcomes among anemic and non-anemic pregnant women from hospital-based settings in North India remains limited.[5,7,17] Generating local evidence is important because demographic characteristics, nutritional practices, healthcare utilization, and socioeconomic conditions differ considerably across regions and may influence pregnancy outcomes.[3,17,21] Understanding these differences can assist clinicians and policymakers in strengthening antenatal screening strategies and targeted interventions aimed at reducing anemia-related maternal and neonatal complications.[9,21,22]

Therefore, the present study was undertaken to compare maternal and fetal outcomes among anemic and non-anemic pregnant women delivering at a tertiary care hospital in North India. The findings are expected to contribute to the existing body of evidence on maternal anemia and provide information that may support improvements in antenatal care practices and maternal health programs for reducing preventable adverse pregnancy outcomes.

Materials and Methods

Study Design

A hospital-based comparative cross-sectional study was conducted to compare maternal and fetal outcomes among anemic and non-anemic pregnant women admitted for delivery. The study compared pregnancy outcomes between two groups based on maternal hemoglobin status during the third trimester of pregnancy.

Study Setting and Duration

The study was conducted in the Department of Obstetrics and Gynecology, Civil Hospital, Jalandhar, Punjab, India, a government healthcare facility providing comprehensive maternal and neonatal services. Data collection was carried out over a period of six months.

Study Population

The study population comprised pregnant women admitted to the maternity ward of Civil Hospital, Jalandhar, for delivery during the study period.

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Eligibility Criteria

Inclusion Criteria

Pregnant women who:

- were admitted to the maternity ward for delivery during the study period;
- had documented hemoglobin estimation during the third trimester of pregnancy;
- provided written informed consent to participate in the study.

Exclusion Criteria

Pregnant women with:

- known hematological disorders other than iron deficiency anemia;
- chronic medical illnesses such as chronic kidney disease or hemoglobinopathies;
- incomplete clinical records or missing outcome data.

Sample Size and Sampling Technique

A total of 60 pregnant women were included in the study, comprising 30 anemic and 30 non-anemic mothers**.** Participants were selected using a non-probability purposive sampling technique**,** whereby eligible women fulfilling the inclusion criteria were recruited consecutively until the required sample size for each group was achieved. A formal sample size calculation was not performed because the study was conducted as an academic research project. All eligible pregnant women who fulfilled the inclusion criteria during the study period and consented to participate were enrolled until a total sample of 60 participants (30 anemic and 30 non-anemic) was achieved.

Operational Definitions

The following operational definitions were used in the study:

Operational Definitions

- **Maternal anemia**: For the purpose of this study, maternal anemia was defined according to the study protocol as a hemoglobin concentration of <9.9 g/dL, while non-anemic women had hemoglobin levels ≥10 g/dL. Although WHO defines anemia during pregnancy as hemoglobin <11 g/dL, the present study focused on women with moderate-to-severe anemia (hemoglobin <9 g/dL) according to the original study protocol.[1]
- **Preterm birth**: Delivery occurring before 37 completed weeks of gestation, irrespective of birth weight.[23]
- **Low birth weight**: Birth weight of <2.5 kg, measured within the first hour after birth, irrespective of gestational age.[24]
- **Postpartum hemorrhage (PPH)**: Blood loss of ≥500 mL following vaginal delivery or ≥1000 mL following cesarean section within 24 hours after birth, or any blood loss sufficient to cause hemodynamic instability.[25]
- **Birth asphyxia**: Failure of the newborn to initiate and sustain breathing at birth, as documented in the hospital records.[26]
- **Gestational age**: Calculated from the first day of the last menstrual period and/or confirmed by obstetric ultrasonography, and categorized as preterm (<37 weeks) and term (37–40 weeks) for analysis.[23]

Data Collection Procedure

Data were collected using a structured data collection proforma developed after an extensive review of the literature and expert consultation. Sociodemographic information, obstetric characteristics, hemoglobin values, maternal outcomes, and neonatal outcomes were obtained through participant interviews and review of hospital medical records. All participants were enrolled after obtaining written informed consent, and confidentiality of collected information was maintained throughout the study.

Hemoglobin Estimation

Maternal hemoglobin concentration was measured as part of routine antenatal investigations using an automated hematology analyzer in the hospital clinical laboratory. The recorded hemoglobin values documented in the hospital medical records were used for classification of participants into the anemic and non-anemic groups according to the study protocol.

Study Variables

Independent Variable

- Maternal anemia status (anemic/non-anemic)

Dependent Variables

Maternal outcomes

- Gestational age at delivery
- Symphysis-fundal height
- Uterine contraction
- Immediate postpartum complications
- Maternal clinical parameters (pulse, respiratory rate, blood pressure)

Fetal outcomes

- Birth asphyxia
- Birth weight
- Length
- Head circumference
- Chest circumference
- Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of MHR DAV Institute of Nursing, Jalandhar,

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prior to commencement of the study (approval number; BFUHS/2K21/P-TH/4928). Administrative permission was obtained from the Medical Superintendent of Civil Hospital, Jalandhar (7689). Written informed consent was obtained from all participants before enrollment. Confidentiality and anonymity were maintained throughout the study, and participation was entirely voluntary.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics. Comparative analyses between anemic and non-anemic mothers were performed using the independent-samples *t*-test for continuous variables and the Chi-square test for categorical variables, as appropriate. A two-tailed *p*-value <0.05 was considered statistically significant.

Results

Participant Characteristics

A total of 60 pregnant women participated in the study, comprising 30 anemic and 30 non-anemic mothers. The sociodemographic and obstetric characteristics of the participants are presented in Table 1.

The majority of women in both groups were aged 24–29 years (46.7%). Most participants had completed secondary education and were homemakers. Multigravida women constituted a higher proportion of the anemic group (73.3%), whereas primigravida women were more common in the non-anemic group (53.3%). Most anemic mothers (76.7%) had third-trimester hemoglobin levels between 7 and 9.9 g/dL, whereas most non-anemic mothers (66.7%) had hemoglobin levels between 10 and 11 g/dL. The majority of participants in both groups reported no previous abortion (83.3% and 93.3%, respectively). Detailed participant characteristics are presented in Table 1.

Maternal Outcomes

Maternal outcomes are presented in Table 2. Preterm delivery (<37 weeks) occurred more frequently among anemic mothers than among non-anemic mothers (53.3% vs. 20.0%), whereas term delivery (37–40 weeks) was more common in the non-anemic group (80.0% vs. 46.7%).

Regarding symphysis-fundal height, 63.3% of anemic mothers and 80.0% of non-anemic mothers had measurements between 35 and 38 cm, while 30.0% of anemic mothers had a symphysis-fundal height below 35 cm compared with none of the non-anemic mothers.

Poor uterine contraction was observed in 50.0% of anemic mothers compared with 26.7% of non-anemic mothers. Immediate postpartum complications were more frequent among anemic mothers, with postpartum hemorrhage occurring in 43.3% compared with 10.0% of non-anemic mothers. Intrauterine death was reported in 6.7% of anemic mothers and 3.3% of non-anemic mothers, while no immediate complications were observed in 50.0% of anemic mothers and 86.7% of non-anemic mothers.

Maternal Clinical Parameters

The comparison of maternal clinical parameters is presented in Table 3. Anemic mothers had a significantly higher mean pulse rate than non-anemic mothers (88.00 ± 8.22 vs. 81.20 ± 5.90 beats/min; $t = 3.68$, $p < 0.001$). No statistically significant differences were observed between the two groups for respiratory rate (23.26 ± 3.51 vs. 21.66 ± 3.90 breaths/min; $t = 1.67$, $p = 0.10$), systolic blood pressure (116.00 ± 14.04 vs. 112.33 ± 10.65 mmHg; $t = 1.02$, $p = 0.31$), or diastolic blood pressure (73.00 ± 9.44 vs. 74.00 ± 7.84 mmHg; $t = 0.45$, $p = 0.67$).

Neonatal Outcomes

Neonatal outcomes are presented in Table 4. Birth asphyxia occurred more frequently among newborns of anemic mothers than among those born to non-anemic mothers (43.3% vs. 6.7%). Low birth weight (<2.5 kg) was observed in 80.0% of newborns of anemic mothers compared with 13.3% of newborns of non-anemic mothers, whereas birth weights between 2.5 and 3.0 kg were more common among newborns of non-anemic mothers (63.3% vs. 16.7%).

Regarding neonatal anthropometric measurements, 73.3% of newborns of anemic mothers had a length of 45–50 cm compared with 43.3% of newborns of non-anemic mothers. A head circumference of less than 33 cm was observed in 33.3% of newborns of anemic mothers and 6.7% of newborns of non-anemic mothers. Similarly, a chest circumference of less than 30 cm was observed in 26.7% and 6.7% of newborns in the anemic and non-anemic groups, respectively.

Association of Maternal Outcomes with Selected Sociodemographic Variables

The associations between selected sociodemographic variables and maternal outcomes are presented in Table 5. Among anemic mothers, gravidity showed a statistically significant association with maternal outcomes ($\chi^2 = 6.16$, $p = 0.05$). No statistically significant associations were observed for age ($\chi^2 = 10.61$) or hemoglobin category ($\chi^2 = 0.91$). Among non-anemic mothers, no statistically significant associations were observed for age ($\chi^2 = 3.93$,

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$p = 0.686$), gravidity ($\chi^2 = 3.88$, $p = 0.144$), or hemoglobin category ($\chi^2 = 3.62$, $p = 0.164$).

Association of Neonatal Birth Weight with Selected Sociodemographic Variables

The association between selected sociodemographic variables and neonatal birth weight is presented in Table 6. No statistically significant associations were observed between maternal age, gravidity, or hemoglobin category and neonatal birth weight among either anemic or non-anemic mothers. Among non-anemic mothers, the corresponding p-values were 0.489 for age, 0.352 for gravidity, and 0.389 for hemoglobin category.

Table 1.Sociodemographic and obstetric characteristics of anemic and non-anemic pregnant women (N = 60)

Variable	Category	Anemic (n = 30) n (%)	Non-anemic (n = 30) n (%)
Age (years)	18–23	8 (26.7)	10 (33.3)
	24–29	14 (46.7)	14 (46.7)
	30–35	7 (23.3)	6 (20.0)
	>35	1 (3.3)	0 (0.0)
Religion	Hindu	11 (36.7)	16 (53.3)
	Christian	4 (13.3)	3 (10.0)
	Muslim	6 (20.0)	2 (6.7)
	Sikh	9 (30.0)	9 (30.0)
Education	Illiterate	5 (16.7)	5 (16.7)
	Primary	5 (16.7)	5 (16.7)
	Secondary	14 (46.7)	12 (40.0)
	Senior secondary	6 (20.0)	8 (26.7)
Occupation	Homemaker	24 (80.0)	21 (70.0)
	Government employee	1 (3.3)	0 (0.0)
	Private employee	5 (16.7)	6 (20.0)
	Self-employed	0 (0.0)	3 (10.0)
Monthly family income (₹)	<10,000	1 (3.3)	1 (3.3)
	10,001–15,000	6 (20.0)	12 (40.0)
	15,001–20,000	14 (46.7)	11 (36.7)
	>20,000	9 (30.0)	6 (20.0)
Duration of marriage	<1 year	0 (0.0)	2 (6.7)
	1–5 years	19 (63.3)	23 (76.7)
	6–10 years	10 (33.3)	5 (16.7)
	>10 years	1 (3.3)	0 (0.0)
Dietary pattern	Vegetarian	12 (40.0)	14 (46.7)
	Non-vegetarian	18 (60.0)	16 (53.3)
Residence	Slum	02(6.66)	1 (3.3)
	Rural	10 (33.33)	9 (30.0)
	Semi-urban	6(20)	10 (33.3)
	Urban	12 (40)	10 (33.3)
Gravida	Primigravida	8 (26.7)	16 (53.3)
	Multigravida	22 (73.3)	14 (46.7)

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Third-trimester Hb (g/dL)	>12	0 (0.0)	9 (30.0)
	10–11	0 (0.0)	20 (66.7)
	7–9	23 (76.7)	1 (3.3)
	<7	7 (23.3)	0 (0.0)
Previous abortion	Yes	5 (16.7)	2 (6.7)
	No	25 (83.3)	28 (93.3)

Table 2.Comparison of maternal obstetric outcomes between anemic and non-anemic pregnant women (N = 60)

Variable	Category	Anemic (n=30) n (%)	Non-anemic (n=30) n (%)
Gestational age	<37 weeks	16 (53.3)	6 (20.0)
	37–40 weeks	14 (46.7)	24 (80.0)
Symphysis-fundal height	<35 cm	9(30)	0(0)
	35–38 cm	19 (63.3)	24 (80.0)
	>38 cm	2(6.66)	6(20)
Uterine contraction	Well contracted	15 (50.0)	22 (73.3)
	Poorly contracted	15 (50.0)	8 (26.7)
Immediate complications	None	15 (50.0)	26 (86.7)
	PPH	13(43.33)	3(10)
	IUD	2(6.66)	1(3.33)

PPH = Postpartum hemorrhage, IUD = Intrauterine death.

Table 3.Comparison of maternal clinical parameters between anemic and non-anemic pregnant women (N = 60)

Variable	Anemic (Mean ± SD)	Non-anemic (Mean ± SD)	t value	p value
Pulse (beats/min)	88.00 ± 8.22	81.20 ± 5.90	3.68	<0.001
Respiratory rate (breaths/min)	23.26 ± 3.51	21.66 ± 3.90	1.67	0.10
Systolic BP (mmHg)	116.0 ± 14.04	112.33 ± 10.65	1.02	0.31
Diastolic BP (mmHg)	73.0 ± 9.44	74.0 ± 7.84	0.45	0.67

Table 4.Comparison of neonatal outcomes among newborns of anemic and non-anemic pregnant women (N = 60)

Variable	Category	Anemic n (%)	Non-anemic n (%)
Birth asphyxia	Yes	13 (43.3)	2 (6.7)
	No	17 (56.7)	28 (93.3)
Birth weight (kg)	<2.5	24 (80.0)	4 (13.3)
	2.5–3.0	5 (16.7)	19 (63.3)
	>3.0	1 (3.3)	7 (23.3)
Length (cm)	>55	0(0)	0(0)
	45–50	22 (73.3)	13(43.34)
	50–55	8(26.67)	17 (56.7)
Head circumference (cm)	<33	10 (33.3)	2 (6.7)
	33–35	19 (63.3)	24 (80.0)
	>35	1 (3.3)	4 (13.3)

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Chest circumference (cm)	<30	8 (26.7)	2 (6.7)
	30–33	22 (73.3)	27 (90.0)
	>33	0	1 (3.3)

Table 5.Association between selected socio demographic variables and maternal outcome variables among anemic and non-anemic pregnant women

Variable	Anemic χ^2	p value	Non-anemic χ^2	p value
Age	10.61	0.101	3.93	0.686
Gravida	6.16	0.046	3.88	0.144
Hemoglobin	0.91	0.634	3.62	0.164

P value <0.05 was considered statistically significant

Table 6.Association between selected socio demographic variables and neonatal birth weight among anemic and non-anemic pregnant women

Variable	Anemic χ^2	p value	Non-anemic χ^2	p value
Age	5.20	0.518	1.43	0.464
Gravida	0.85	0.654	2.09	0.352
Hemoglobin	1.16	0.560	1.89	0.930

P value <0.05 was considered statistically significant

Discussion

Maternal anemia remains one of the leading nutritional disorders affecting pregnant women worldwide and continues to pose a major challenge in low- and middle-income countries.[1,13,16,18] The present hospital-based comparative cross-sectional study demonstrated that maternal anemia was associated with poorer maternal and neonatal outcomes compared with non-anemic pregnancies. These findings are consistent with growing evidence indicating that anemia during pregnancy adversely affects both maternal health and fetal development through impaired oxygen transport, placental insufficiency, and reduced fetal nutrient availability.[4,6,14,15]

In the present study, most anemic mothers belonged to the 24–29-year age group and were multigravida. A higher proportion of multigravida women in the anemic group may reflect depletion of maternal iron stores due to repeated pregnancies without adequate nutritional replenishment. Similar observations have been reported in studies conducted in South Asian populations, where inadequate birth spacing, poor dietary intake, and limited compliance with iron supplementation contribute substantially to maternal anemia.[3,16,17]

One of the important findings of the present study was the higher proportion of preterm deliveries among anemic mothers compared with non-anemic mothers. Maternal anemia may contribute to placental hypoxia and oxidative stress, thereby increasing the risk of premature uterine activity and early delivery. This finding is supported by the systematic review and meta-analysis by Wang et al.[6] which demonstrated that maternal anemia significantly increased the risk of preterm birth by approximately 51% compared with non-anemic pregnancies. Similarly, Lauer et al.[5] reported that maternal anemia during the third trimester was associated with shorter gestational age and reduced birth weight in a prospective cohort study conducted in Eastern Maharashtra, India.

The present study also demonstrated poorer neonatal outcomes among infants born to anemic mothers, particularly with respect to birth weight. Most newborns of anemic mothers had a birth weight below 2.5 kg, whereas the majority of infants born to non-anemic mothers had normal birth weights. These findings are biologically plausible because maternal iron deficiency reduces placental oxygen and nutrient transfer, thereby impairing fetal growth.[12,19,20] Comparable findings were reported by Parks et al.[7] who observed significantly higher risks of low birth weight, very low birth weight, stillbirth, and neonatal mortality among women with severe maternal anemia in a large multicountry prospective cohort study involving more than 92,000 pregnancies. Likewise, Banavathu et al.[8] demonstrated significantly higher frequencies of low birth weight, neonatal morbidity, and early neonatal death among pregnancies complicated by iron deficiency anemia.

Birth asphyxia was observed more frequently among newborns of anemic mothers than among those born to non-anemic mothers. Chronic fetal hypoxia resulting from maternal anemia may reduce fetal reserve during labor and increase susceptibility to intrapartum distress. Similar associations between maternal anemia and

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neonatal asphyxia have been reported in recent systematic evidence.[6,14,15] further emphasizing the adverse impact of inadequate maternal hemoglobin concentrations on neonatal adaptation after birth.

The maternal clinical assessment in the present study showed significantly higher pulse rates among anemic mothers, whereas blood pressure measurements were broadly comparable between the two groups. These findings are consistent with physiological cardiovascular adaptations in anemia, in which increased cardiac output and compensatory tachycardia maintain tissue oxygen delivery despite reduced hemoglobin concentration.[19,20] Comparable physiological responses have been described in contemporary reviews of maternal anemia and pregnancy outcomes.[4,16]

Although subgroup analyses did not demonstrate statistically significant associations between maternal age, gravidity, hemoglobin category, and several maternal and fetal outcomes, these findings should be interpreted cautiously because of the relatively small sample size. The limited statistical power may have reduced the ability to detect significant associations. Larger prospective multicenter studies are therefore needed to validate these observations.[5,6]

The findings of the present study have important implications for maternal healthcare. Early antenatal registration, routine hemoglobin estimation, timely iron–folic acid supplementation, nutritional counseling, and appropriate management of anemia remain essential strategies for preventing adverse maternal and neonatal outcomes.[9–12,22] Recent evidence further supports strengthening national anemia prevention programs through improved screening, dietary interventions, and close monitoring of high-risk pregnancies to reduce preventable maternal and neonatal morbidity.[1,6,9,22]

Strengths and Limitations

The present study has several strengths. It employed a comparative design to evaluate maternal and fetal outcomes among anemic and non-anemic pregnant women within the same healthcare setting, thereby minimizing variability in clinical management and institutional practices. The study assessed both maternal and neonatal outcomes, providing a comprehensive evaluation of the potential impact of maternal anemia on pregnancy. In addition, standardized clinical assessments and hospital records were used for data collection, enhancing the reliability of the reported findings.

However, the study has certain limitations that should be considered while interpreting the results. First, the study was conducted at a single tertiary care hospital with a relatively small sample size (N = 60), which may limit the generalizability of the findings to other populations and healthcare settings. Second, participants were selected using a non-probability purposive sampling technique, introducing the possibility of selection bias. Third, the cross-sectional design precludes establishing causal relationships between maternal anemia and adverse pregnancy outcomes. Furthermore, the analysis was limited to univariate comparisons because the original dataset was unavailable during manuscript revision, preventing adjustment for potential confounding variables through multivariable analyses. Finally, maternal anemia was classified according to the study protocol used at the time of data collection, which may differ from the current World Health Organization classification, thereby limiting direct comparison with more recent studies.

Despite these limitations, the findings contribute valuable evidence regarding the association between maternal anemia and adverse maternal and fetal outcomes in a hospital-based population and underscore the importance of early detection and effective management of anemia during pregnancy.

Conclusion

The present study demonstrated that adverse maternal and neonatal outcomes were more frequently observed among anemic pregnant women than among non-anemic pregnant women. Anemic mothers had higher frequencies of preterm delivery, poor uterine contraction, postpartum hemorrhage, and intrauterine death. Their newborns more commonly had low birth weight, birth asphyxia, smaller head circumference, and smaller chest circumference than those born to non-anemic mothers. These findings underscore the importance of early identification and appropriate management of maternal anemia during pregnancy to improve maternal and neonatal outcomes.

Routine antenatal screening for anemia, timely hemoglobin assessment, iron–folic acid supplementation, nutritional counseling, and regular antenatal follow-up should remain integral components of maternal healthcare services. Strengthening national initiatives such as the Anemia Mukt Bharat strategy and the National Iron Plus Initiative may further contribute to reducing the burden of maternal anemia and its associated complications. Although the present study was limited by its single-center design and relatively small sample size, it provides hospital-based evidence on the maternal and neonatal outcomes associated with anemia during pregnancy. Further multicenter prospective studies with larger sample sizes are recommended to validate these findings and provide more robust evidence for clinical practice and maternal health policy.

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