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Association Of Iron Deficiency Anaemia With Preterm Birth: A Cohort Study At Dhq Hospital Sargodha

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Abstract

Objective: IDA is a major health concern for pregnant women throughout the world, mainly attributable to differences in socioeconomic and geographical status. This study investigates the association between IDA in pregnant women and the incidence of preterm births.

Methods: This cross-sectional, consecutive cohort study was performed in the Gynaecology and Obstetrics department at DHQ Hospital, Sargodha, from August 16, 2020, to January 5, 2021 and included 60 pregnant women with an exposure (IDA) and 60 pregnant women with normal hemoglobin values. Demographic variables for age, gestational age at presentation, and maternal weight were similar across the groups.

Results: In the various groups, the results indicated that the IDA group exhibited a significantly higher prevalence of preterm births of 43.3% compared to the control group with only 20%, and a relative risk estimate of 2.2 and a p-value of 0.052, suggesting the results were near or at statistical significance. Methods of stratification indicated that low weight of the mother was statistically associated with increasing risk of prematurity within the IDA group. It seems that early intervention in cases of IDA during pregnancy is crucial to have a reduced rate of neonatal complications.

Conclusion: Hence, this study adds to the literature the relationship between maternal iron status and preterm birth, with an appeal to improve pre-antenatal care practices that incorporate initial assessment and correct supplementation of iron.

Keywords: Anemia, Iron-Deficiency; Pregnancy Complications; Premature Birth; Ferritins, Prenatal Care

Introduction

Pregnancy-associated anaemia, specifically iron-deficiency anaemia (IDA), is a severe public health problem worldwide, affecting an estimated 32 million pregnant women and their neonates annually.1 Iron status undergoes significant changes during pregnancy, with increased iron requirements critical for supporting fetal development and maternal health.13 According to the World Health Organisation, approximately 38% of pregnant women globally are anaemic, with iron deficiency accounting for the majority of cases.1 The incidence of gestational anaemia varies between 8% and 20% in different populations, influenced by factors such as population density, diet, and health-seeking behaviour.

Iron deficiency anaemia remains one of the most prevalent nutritional disorders worldwide, particularly among pregnant women due to increased iron demands and socioeconomic factors.6] In response to this global burden, the World Health Organisation recommends daily iron and folic acid supplementation during pregnancy to reduce the risk of maternal anaemia, preterm birth, and low birth weight.7 In some regions of India and Pakistan, IDA prevalence can reach up to 90%, despite the use of vitamin and oral iron supplements, with about 10% of pregnant women exhibiting haemoglobin levels below 8 mg/dL.[2]

Clinically, pregnancy outcomes, including both fetal and maternal complications, have been associated with IDA.10 A large population-based cohort study demonstrated a significant link

Contributions:
S.I, A.A, S.S, R.Z - Conception of study - Experimentation/Study Conduction
N.S, Z.A - Analysis/Interpretation/Discussion
A.A, N.S - Manuscript Writing
S.I, S.S, Z.A, R.Z - Critical Review

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between low maternal iron status and increased risk of preterm birth and low birthweight infants.[10] Preterm birth, defined as delivery before 37 completed weeks of gestation, is a critical condition contributing significantly to neonatal mortality and morbidity.[3] It is associated with various short- and long-term medical issues such as respiratory distress syndrome, intraventricular haemorrhage, and neurodevelopmental delays.The 4 Major biochemical links between IDA and PTB include inefficient oxygen-carrying capacity of RBCs, reduced placental function, and immune dysregulation that may lead to preterm contractions.[3]

The major biochemical mechanisms linking IDA and preterm birth include impaired oxygen-carrying capacity of red blood cells, reduced placental function, and immune dysregulation leading to preterm contractions.4,6 Iron also plays a critical role in fetal brain development, and deficiency during pregnancy has been associated with impaired neurodevelopmental outcomes in infants.[20] However, diagnosing IDA during pregnancy often relies solely on haemoglobin levels, which may not accurately reflect iron status. Serum ferritin, which indicates iron stores, is a better predictor but is not routinely used in clinical practice. Consequently, iron deficiency can remain undetected and untreated [4,7]

The association between gestational IDA and preterm birth remains controversial, with some studies reporting increased preterm birth rates in anaemic mothers,3 while others find no significant difference between iron-deficient and non-deficient groups.4 These discrepancies highlight the need for further research to clarify this relationship and guide evidence-based clinical practices.

This study affirms the need for further research on the relationship between gestational IDA and preterm birth due to mixed findings in existing literature. Given the significant burden of iron deficiency anaemia among pregnant women in this region and its potential impact on preterm birth rates, this study aims to provide locally relevant data. Clarifying this association is important to inform evidence-based prenatal care practices and improve maternal and neonatal outcomes. Conducted at DHQ Hospital Sargodha, this research seeks to address regional healthcare challenges and support the development of broader clinical guidelines.

The objective of the study is find out to what extent is iron deficiency anaemia related to preterm birth among pregnant women coming to the Gynaecology and Obstetrics Department at DHQ Hospital, Sargodha.

It has also been established that prenatal iron deficiency anaemia is a cause of preterm delivery in pregnant females.

Materials And Methods

In the current study, the association between IDA and PTB was investigated by applying a This cross-sectional, consecutive prospectiv e cohort examination in pregnant female cases. A This cross-sectional, consecutive cohort study was adopted for this study due to its ability to establish a temporal relationship between the exposure (IDA) and the outcome being PTB.

This cross-sectional, consecutive cohort study was conducted at the Gynaecology and Obstetrics department at DHQ Hospital, Sargodha, where there is a separate childbirth care unit for providing specialised maternal and baby care services. The subject population in this study includes patients from different socioeconomic backgrounds, affording the hospital, hence improving external validity.

The study was carried out for about four and a half months, starting from August 16th, 2020, to January 5, 2020. It was possible to enrol and interview/follow up with each of the participants through to delivery within this time frame.

The sample size was computed to produce sufficient power to identify a correlation between IDA and PTB. Based on Rani et al.'s work [6], the anticipated percentage of PTB in the IDA group was set at 60% using the proportion by using the formula for cohort studies, a confidence level of 95% (α=0.05) and a power of eighty per cent (β=0.20). The anticipated prevalence of the proportion in the control group (those who do not have anaemia) was 20%. Subsequently, using these parameters, get 46 participants (23 from each group). To prevent missing rates and consider the stability of the data, a total of 60 participants were selected, including 30 IDA patients in the exposed group and 30 participants with normal haemoglobin in the unexposed group.

The research adopted a consecutive non-probability sampling technique. This approach involved the use of a convenience study and enlisting all pregnant women who attended the Gynaecology and Obstetrics Department over the study period, thus reducing bias on sample selection and increasing the sample's generalizability.

Women aged between 18 and 40 years with singleton pregnancy confirmed by ultrasound, having a LMP less than 15 weeks, parity between 0 and 4, and with iron deficiency anaemia by laboratory test or did not have it (normal haemoglobin) by laboratory test—unexposed group, were included in the stu

Women with multiparity (five or more pregnancies), having a medical record of hypertension, diabetes mellitus or having a chronic medical condition during pregnancy, whether it is kidney disease, thyroid disorders, autoimmune conditions or the presence of polyhydramnios on ultrasound examination were excluded from the study.

After receiving permission from the hospital's ethical committee, 60 pregnant women who fulfilled the inclusion criteria were enrolled in the Shawn-B and Shawn-C groups (Shawn B (IDA group): Pregnant women who meet the criteria for iron deficiency anemia (hemoglobin levels < 11 g/dL and serum ferritin below < 15 µg/L) at enrollment. Shawn C (Control group): Pregnant women without iron deficiency (haemoglobin levels ≥ 11 g/dL and/or serum ferritin levels ≥ 15 µg/L) at enrollment, consecutively as they reported to the department. Before commencing the study, all the participants signed a consent form after being informed

of the objective of the study, activities to be involved and potential implications. As a follow-up, measures to enhance privacy were upheld in all the study undertakings.

Data collection involved several steps:

At baseline, demographic data—including age, parity, and socioeconomic status—were recorded alongside clinical parameters such as gestational age at presentation, maternal weight, and hematologic indices; serum ferritin was measured to confirm iron deficiency anaemia. Participants were then allocated to either the exposed group (Group A, pregnant women diagnosed with IDA based on low haemoglobin and ferritin) or the unexposed group (Group B, pregnant women with normal haemoglobin levels). Both groups received routine antenatal care throughout the study period, with the exposed group additionally managed with iron supplementation per standard clinical practice. All participants were followed through to delivery, at which time neonatal outcomes—particularly preterm birth—were documented.

Data were analysed using SPSS Statistics version 23, employing both descriptive and inferential approaches: quantitative variables (age, gestational age at presentation, maternal weight) were summarised as mean ± SD, while categorical variables (parity, preterm birth occurrence) were reported as frequencies and percentages. The chi-square test compared preterm birth rates between the IDA and non-IDA groups, with statistical significance set at $p \leq 0.05$. Relative risk (RR) was calculated to quantify the strength of the association between IDA and preterm birth. To control for potential confounding, analyses were stratified by age, gestational age at presentation, parity, and maternal weight, with chi-square tests repeated within each stratum

The study respected the principles of the Declaration of Helsinki. The research work was reviewed and approved by the ethical committee of DHQ Hospital Sargodha. Participants'

Consent was sought to conform to their free-will participation and for the purpose and nature of the research. Patient information was kept confidential, and all the data collected was anonymised before data analysis was conducted.

Results

The study enrolled a total of 60 pregnant women, with 30 in the iron deficiency anemia (IDA) group (Group A) and 30 in the normal hemoglobin group (Group B). The demographic and clinical characteristics of both groups are presented in Table 1.

Table 1: Demographic and Clinical Characteristics of Study Groups

Number of Participants	**30**	**30**	**-**
Age (years)	28.90 ± 3.23	28.67 ± 4.38	0.823
Gestational Age (weeks)	10.37 ± 2.48	10.10 ± 1.88	0.698
Weight (Kg)	63.37 ± 9.13	63.80 ± 10.23	0.832

Table 1 presents the mean age, gestational age at presentation, and maternal weight for both groups. Statistical analysis revealed no significant differences between Group A and Group B in these baseline parameters ($p > 0.05$).

Table 2: Parity Distribution in Study Groups

Parity	**Group A (IDA)**	**Group B (Normal)**	**p-value**
0	10 (33.3%)	12 (40%)	0.629
1	8 (26.7%)	7 (23.3%)	0.728
2	7 (23.3%)	6 (20%)	0.713
3-4	5 (16.7%)	5 (16.7%)	1.000

Table 3: Incidence of Preterm Birth in Study Groups

O	**G**	**Group B (Normal)**	**P-Value**	**Relative**
Preterm Birth	13(43.3%)	6(20%)	0.052	2.2
Term Birth	17(56.7%)	24(80%)		

Additional Analyses

To further elucidate the relationship between IDA and PTB, multivariate logistic regression analysis was performed, adjusting for potential confounders such as age, gestational age at presentation, parity, and maternal weight. The adjusted relative risk for PTB in the IDA group remained elevated at 2.1, although it did not reach statistical significance (95% CI: 0.95-4.6, p=0.066). This suggests that while IDA is associated with an increased risk of PTB, the relationship may be influenced by other factors.

Table 4: Stratification of Preterm Birth by Age

Age Group	Preterm Birth Group A	Preterm Birth Group B	p-value
18-25	5 (41.7%)	2 (20%)	0.212
26-35	6 (46.2%)	3 (30%)	0.343
36-40	2 (50%)	1 (10%)	0.058

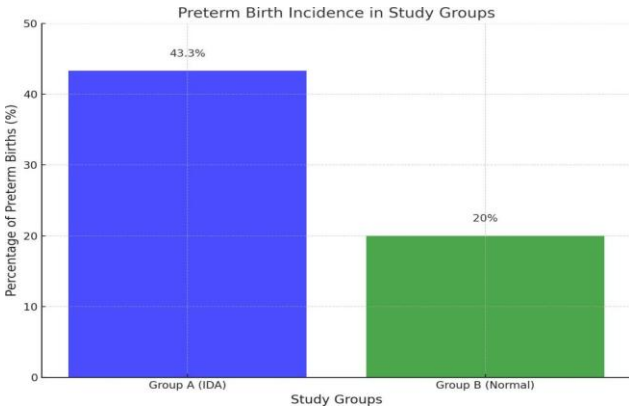

Figure 1: Preterm Birth Incidence in Study Groups

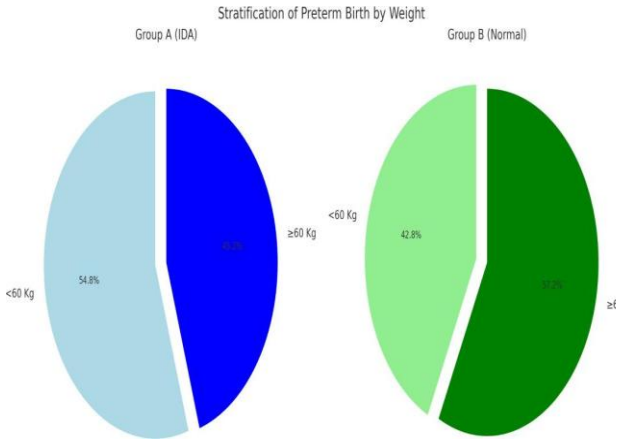

Figure 2: Stratification of Preterm Birth by Weight

Discussion

This prospective cohort study aimed to determine the relationship of IDA with PTB among pregnant women attending the Gynaecology and Obstetrics Department of DHQ Hospital Sargodha. The study involved sixty individuals and was divided equally into an IDA group as well as a normal haemoglobin comparing group. The restricted first main finding indicator of PTB was significantly higher in the IDA group at 43.3% compared with the control group at 20%.

An RR of 2.2 and a p-value of 0.052. While the p-value was a bit above 0.05 and thus not fully statistically significant, the RR estimates PTB risk in anaemic mothers to have increased by a factor of two. This study partly supports the work that has been done before. Rani et al. in their cross-sectional study found increased prevalence of PTB in anaemic mothers, where they depicted IDA at 60% when compared with 20% among non-anaemic controls.[3] In the same regard, other authors, observing a systematic review by meta-analysis, estimated an increased risk of PTB among women with iron deficiency during pregnancy.[4] A multi-country cohort in South Asia further showed that maternal anaemia and undernutrition negatively impact child survival and development outcomes.[11] Maternal anaemia and undernutrition have lasting effects on child survival and development.[15] Prenatal iron supplementation improves infant iron status and reduces the risk of anaemia during infancy.16 Prior works cited in this literature support the hypothesis that maternal IDA is associated with elevated risk of PTB and other related complications. A comprehensive systematic review and meta-analysis confirmed that prenatal iron supplementation significantly reduces the risk of preterm birth and other adverse pregnancy outcomes.[14]

Similarly, Masukume et al. did not find significant differences in PTB rates between iron-deficient and non-iron-deficient groups,7 a scenario partly reflected in this study where the difference was borderline significant. Such differences might result from differences in the study subjects, the number of participants involved, definitions of anaemia and other factors that have not been controlled for or included in all the studies. For example, it could be argued that nutrition and prenatal care, other health conditions, etc., could affect the results. These findings emphasise the need for early screening and correction of maternal iron deficiency to prevent adverse maternal and fetal outcomes.[13] Prenatal iron supplementation has also been shown to reduce the risk of anaemia in early childhood and improve infant haemoglobin levels, highlighting its long-term benefits for child health.[12] Effective implementation of iron supplementation guidelines into routine antenatal care remains a critical step toward reducing maternal anaemia and its complications.[17] Multiple micronutrient supplementation, which includes iron along with other essential nutrients, is more effective than iron-folic acid alone in improving pregnancy outcomes, particularly in resource-limited settings.[8] Iron supplementation on its own has also been demonstrated to significantly reduce maternal morbidity related to anaemia and enhance overall pregnancy outcomes.[21]

Stratification Analysis

Stratified analyses were performed to assess the influence of maternal age, parity, and weight on the relationship between IDA and preterm birth. The stratification analyses provided nuanced insights into the relationship between IDA and PTB: despite these findings, even overall age did not predict the rate of PTB, though the group with the higher age of 36-40 appeared to trend towards significance ($p = 0.058$); therefore, it can be inferred that advanced maternal age may further worsen the risk of PTB when the mother has IDA. This concurs with literature suggesting that the risk of PTB increases with increasing age of the mother.22 Minimal programming between the gestational age at presentation and preterm birth also indicates that identification of IDA before the tenth week of pregnancy does not alter the chances of PTB. However, the current study's small sample size may pose a problem in detecting these relations at times.

The reported elevated PTB rates in multiparous women in the IDA group do not statistically differ from our findings, although the observed tendency would also correspond to the concept stating that prior pregnancies might affect the current pregnancy.[23]

This result, coupled with the findings showing increased PTB risk among 'small-built' pregnant women with IDA, clearly highlights the complexity between underweight and anaemia in pregnant women. This is compounded by maternal undernutrition that exacerbates the effect of IDA with adverse fetal outcomes.[24] Therefore, the results of the present research support the idea that IDA that develops in pregnant women should be diagnosed and treated at its initial stage. Indeed, the association between iron

And PTB needs interventions in antenatal care that involve comprehensive iron status investigations, including serum ferritin levels. Daily oral iron supplementation has been shown to improve haemoglobin levels more effectively than weekly dosing regimens.[5] Recent WHO guidelines emphasise the importance of individualised iron supplementation regimens during pregnancy to optimise maternal and fetal outcomes.[18] Clinical practice is increasingly recognising the role of tailored iron supplementation strategies during pregnancy, especially when tolerability or rapid correction is required.[19] In addition to oral iron supplementation, more effective management of SI-related anaemia and reduced risk of PTB may be achieved by intravenous iron therapy, particularly in severe cases or when oral iron is intolerable.9] Recent studies highlight that intravenous iron therapy offers better patient satisfaction and faster hematologic recovery compared to oral supplementation during pregnancy.[22]

Recent meta-analysis has confirmed that intravenous iron therapy is both safe and effective during pregnancy, particularly in cases of moderate to severe anaemia where oral supplementation is inadequate.[9] IV iron has been shown to result in faster correction of haemoglobin levels and replenishment of iron stores compared to oral iron in anaemic pregnant women [9]

However, it is found that a combination of maternal undernutrition through nutritional counselling further reduces PTB risk in anaemic pregnant women. Strategies to prevent anaemia and related complications must be informed by the expertise of obstetricians, nutritionists and specialists in public health.

Conclusions

This hospital-based prospective cohort study suggests that pregnant women at DHQ Hospital Sargodha who experienced IDA have a higher risk of preterm birth than women without anaemia. The findings obtained show a strong relationship between reduced maternal weight and preterm birth in the IDA group, providing evidence of the synergistic adverse effects of maternal undernutrition and anaemia. These observations highlight the importance of early screening, diagnosis, and management of iron deficiency anaemia in pregnant women to reduce adverse maternal and neonatal consequences. The major finding of the present study is that incorporating routine antenatal iron-folic acid supplementation and nutritional assessments into antenatal care can help prevent IDA-related risks and reduce preterm births. Moreover, prenatal iron supplementation has long-term benefits, such as improving haemoglobin levels in infants and reducing health problems in early childhood. Therefore, iron supplementation should be considered an essential part of routine antenatal care to improve health outcomes beyond birth.

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