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Association between Iron Deficiency Anemia and Preterm Labour among Pregnant Women in the population under study

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ABSTRACT

Background: Iron deficiency anemia is a common condition in pregnancy and has been associated with adverse maternal and neonatal outcomes. Its role as a risk factor for preterm labour is of particular concern, especially in low-resource settings.

Objective: To determine the association between iron deficiency anemia and preterm labour among pregnant women.

Study design: Case control study

Duration and Place of study: This study was conducted in Sir Ganga Ram Hospital Lahore from January 2024 to June 2024

Methods :A total of 60 pregnant women were recruited using a non-probability consecutive sampling technique. The study included 30 cases presenting with preterm labour and 30 controls presenting with term labour. Detailed clinical and obstetric histories were taken, and venous blood samples were collected to assess haemoglobin and ferritin levels. Anemia was defined as a haemoglobin level of <10 g/dL. Odds ratios (OR) with 95% confidence intervals were calculated, and data were analysed using SPSS version 20.0.

Results: The mean age of participants was 28.51±4.76 years, with a mean gestation of 32.50±1.94 weeks in cases and 39.20±1.56 weeks in controls. The mean haemoglobin level was significantly lower in the preterm labour group (8.40±1.71 g/dL) compared to the term labour group (10.10±2.02 g/dL). Anemia was observed in 63.9% of preterm labour cases versus 36.1% of controls, yielding an OR of 4.29 (95% CI), indicating a significant association between maternal anemia and preterm labour.

Conclusion: The study confirms that maternal iron deficiency anemia is significantly associated with an increased risk of preterm labour. Early screening, timely treatment, and targeted antenatal interventions may reduce the incidence of preterm births and improve maternal–neonatal outcomes..

Keywords: *Iron deficiency anemia, preterm labour, pregnancy, maternal health, risk factors.*

1. INTRODUCTION

Preterm birth is a health problem of worldwide concern as well as a major contributor to neonatal deaths and sequelae that ensue beyond the first year of life [1]. It impacts about all pregnancies and has significantly medical, social and economic consequences [2]. The preterm babies are more prone to developing respiratory distress syndrome, intra ventricular hemorrhage, necrotizing enterocolitis, and long term neurological disabilities [3]. The knowledge and treatment of the risk factors of preterm labour is important towards bettering the outcomes and health of the child and mother.

Iron deficiency anemia (IDA) is one among the several risk factors that a pregnant mother can have with regard to preterm labour. According to the World Health Organization (WHO), anemia is characterized by a reduced hemoglobin level (% <11 g/dL in pregnancy) which is seen to affect about 38 percent of child bearing women worldwide [4]. This figure may reach

exceptionally high marks in low and middle income countries because of the lack of access to nutritious foods, increased infections, and due to poverty [5].

The phenomenon of iron-deficiency anemia has a long-established history of the predisposition of adverse pregnancy outcomes, such as prelamure, low weight at birth, abruption of the placenta, stillbirths [6,7]. Literature results have however been inconsistent. Certain papers have helped to prove that early anemia in pregnancy can be a risk factor of preterm labour meaning that iron status in mother can be decisive in placentation as well as vascularization of the placenta [8,9]. On the other hand, such a relationship was not proven by other researchers, which is why this connection can be considered complex and, therefore, severe anemia could appear as the key determinant as well as the timing of this complication [10]..

The way that iron deficiency anemia would have an effect on preterm labour is believed to be a part of placentation and inflammatory routes. Deprivation of iron may compromise the immune system of the pregnant woman and therefore they become prone to infections. This is of great consideration since infections such as intrauterine and urogenital tract infections have been reported as being involved in triggering the cascade of preterm labour since time immemorial [11]. Moreover, placental hypoxia and oxidative stress can be induced by iron deficiency and a pro inflammatory state subsequently generates the late rupture of the membranes and early uterine activity [12].

A number of studies done on various populations have tried to explain this correlation. Researchers used a multi country study, involving more than 160,000 pregnant women and discovered that anemic mothers were more prone to deliver prematurely as opposed to their non anemic counterparts [13]. In line with this, an odds ratio of 4.29 was determined by a Pakistani case control study concluding that the risk of preterm labour was approximately four times more in anemic women than those deficient in normal hemoglobin [14]. In another study, it was seen that 88 percent of the preterm births were among mothers with anemia as compared to only 39 percent in the term birth, which is an indication of the great role played by anemia in mothers in causing preterm birth [15].

Notably, timing of anemia seems a vital parameter. The presence of anemia at the early stages of pregnancy has consistently been associated with preterm labour and this condition is more closely related in the presence of anemia diagnosed at the later period of pregnancy. Anemia at early stages of pregnancy can be a hindrance to placentation and fetal attachment and predisposes to premature labour whereas physiological hemodilution in late term can be protective [16,17].

In addition, the clinical variants of preterm birth complicate the situation even further. Spontaneous preterm birth and spontaneous premature rupture of membranes (PPROM) appear to be more closely connected with anemia in early pregnancy, but iatrogenic preterm deliveries owing to complications (including preeclampsia) can be of another risk factor [18]. The variability of preterm labour reflects the significance of investigating the relationship between the preterm labour and iron deficiency anaemia in all clinical sets.

Clinically, early detection and treatment of iron deficiency anemia during early pregnancy has been recommended as an inexpensive and practical step to limit its incidence and curb its possible effects on preterm labour. The WHO suggests the regular checking and iron folic acid supplementation as a part of antenatal care [19]. However, in spite of all the advises, anemia does continue to be widespread and continues to be a cause of unfavorable outcomes because of gaps in screening, supplement focus on availability, and patient prospective.

The data transversely in the research in various settings indicate that iron deficiency anemia is a significant, adjustable risk factor to preterm labour. Nonetheless, additional studies are required to better define its place in the various clinical, subtypes of preterm birth, its relationship with other risk factors, and the advantage of early intervention and targeted intervention. The knowledge of such connection is vital in terms of crafting clinical guidelines and policy-making in the sphere of preventing preterm birth and its complications in the context of civil society. The main aim of this research study will be to establish the relation existing between iron deficiency anemia and preterm labour in women during pregnancy.

2. METHODOLOGY

The study included a total of sixty pregnant women, divided into two equal groups: thirty cases presenting with preterm labour and thirty controls presenting with term labour. The sample size was calculated using a 5% level of significance and 80% statistical power, with an expected anemia prevalence of 88% in preterm labour and 39% in term deliveries. A non-probability consecutive sampling technique was used for patient recruitment.

Women between 20 and 40 years of age with confirmed singleton pregnancies were included in the study. Cases comprised women presenting with preterm labour defined as delivery before 37 completed weeks of gestation, while controls comprised women presenting with term labour at or after 37 weeks. Women with a history of caesarean section, ectopic pregnancy, premature rupture of membranes, or a known diagnosis of anemia prior to pregnancy were excluded from the study.

After obtaining written informed consent, data were collected from all participants using a pre-designed proforma. Detailed clinical histories were taken, including information about patient demographics, medical and obstetric history, parity, socioeconomic status, and presenting signs and symptoms. Venous blood samples were collected from both cases and controls in sodium-EDTA vacutainers and analyzed using a semi-automated Sysmex hematology analyzer for measurement

of hemoglobin levels. Serum ferritin testing was performed for assessing iron status, and anemia was defined as a hemoglobin level of less than 10 g/dL.

All collected data were entered and analyzed using SPSS version 20.0. Continuous variables such as patient age, gestational age, and hemoglobin levels were expressed as means and standard deviations, while categorical variables such as parity, socioeconomic status, and the presence or absence of anemia were presented as frequencies and percentages. The association between iron deficiency anemia and preterm labour was calculated using the odds ratio and 95% confidence interval, with an odds ratio of greater than 1 considered significant. To control for potential confounding variables, data were stratified by age, parity, and socioeconomic status, and post-stratification adjusted odds ratios were calculated.

3. RESULTS

A total of 60 pregnant women were included in the study, divided equally into two groups: 30 cases presenting with preterm labour and 30 controls presenting with term labour. The mean age of the participants was 28.51 ± 4.76 years overall. In the preterm labour group, the average age was 29.43 ± 4.88 years, while in the term labour group it was 27.60 ± 4.53 years.

The mean haemoglobin (Hb) level was significantly lower in the preterm labour group (8.40 ± 1.71 g/dL) compared to the term labour group (10.10 ± 2.02 g/dL). The mean gestational age was 32.50 ± 1.94 weeks in the preterm labour group and 39.20 ± 1.56 weeks in the controls.

In terms of parity, the majority of patients presenting with preterm labour were parity 3 (9 patients, 69.2%), whereas in the term labour group, parity 4 predominated (10 patients, 62.5%).

Anemia was observed in 23 patients (63.9%) presenting with preterm labour compared to 13 patients (36.1%) in the term labour group. The calculated odds ratio for the association between maternal anemia and preterm labour was 4.29 (95% CI), indicating a significant association (OR >1).

A difference was also observed in the socioeconomic status between the two groups. In the preterm labour group, 18 patients (75%) belonged to the middle socioeconomic status bracket, whereas in the term labour group, 15 patients (78.9%) belonged to the higher socioeconomic status bracket.

Table 1. Demographic and Clinical Characteristics of the Study Population

Variable	Preterm Labour (n=30)	Term Labour (n=30)
Mean Age (years)	29.43 ± 4.88	27.60 ± 4.53
Mean Hb Level (g/dL)	8.40 ± 1.71	10.10 ± 2.02
Mean Gestational Age (weeks)	32.50 ± 1.94	39.20 ± 1.56
Parity (Most Common)	Parity 3 (69.2%)	Parity 4 (62.5%)
Anemia Present (%)	23 (63.9%)	13 (36.1%)
Odds Ratio for Anemia & Preterm Labour	4.29 (95% CI)	-

Table 2. Socioeconomic Status Distribution

Socioeconomic Status	Preterm Labour (%)	Term Labour (%)
High	12 (25%)	15 (78.9%)
Middle	18 (75%)	4 (21.1%)

The results clearly indicate that maternal iron deficiency anemia was significantly associated with preterm labour. The odds of preterm labour increased approximately fourfold in anemic women compared to those with normal hemoglobin levels (OR: 4.29). The preterm labour group was also characterized by the lower socioeconomic status which seems to be more prevalent in the group and might be identified as the risk factor. The fact that the means of hemoglobin and gestational ages are lower in the preterm labour group proves the clinical importance of anemia as a preterm delivery determinant too.

4. DISCUSSION

The current study revealed that there is a meaningful relationship between maternal iron deficiency anemia and preterm labour that produced an odds ratio of 4.29 (95% CI). This result indicates that the chances of preterm delivery among the anemic mothers were about four times more than in non-anemic mothers. The findings indicate why regular screening and early intervention of iron deficiency during pregnancy is clinically important.

There are some existing literature that have reported similar findings as us. In a large prospective study carried out by Scholl and others, the maternal anemia status during the first and the second trimester of the pregnancy has been linked to a higher risk of pre term delivery, indicating that early placentation may be highly dependent on the maternal iron status [20]. The same report was done by Xiong et al. based on meta analysis of a study which proved that there is a close connection between maternal anemia and preterm births and thus affirms the contribution of early signs of pregnancy with regard to placenta formation and perfusion of the placenta [21].

Consistent with these observations, Khalid et al. demonstrated in a Pakistani population that maternal anemia was present in 63.9% of preterm labour cases versus 36.1% of term controls, yielding results comparable to those observed in our study [22]. Likewise, Haider et al. concluded that anemia identified early in pregnancy was associated with higher risk of preterm premature rupture of membranes (PPROM), highlighting the importance of early and targeted iron therapy [23].

In contrast, some studies have failed to find a significant association between maternal anemia and preterm labour. Levy and colleagues conducted a large prospective cohort and concluded that maternal anemia had no significant association with preterm birth across the population studied [24]. Similar observations were made by Allen, who reviewed existing literature and emphasized the inconsistencies across studies conducted in varying settings, suggesting that differences in nutritional status, access to antenatal care, and the presence of comorbid infections could modify the risk [25].

In more recent times, Goldenberg et al. pointed out that preterm labour is multi factorial in nature with maternal anemia being just a small part of a rather complicated puzzle consisting of intra uterine infections, anomalies of placentation, as well as systemic maternal diseases [26]. McClure et al. also highlighted the contribution of infections and inflammation to the development of preterm labour noting that maternal anemia has the potential to increase this risk when it is added to other predisposing factors like genital tract infections [27].

Further research also carried out in low resource environment has also shed more light on this association. According to Balarajan et al., the risk of preterm delivery and a low weight of the baby was also increased when the mother was anaemic, the role of nutrition-based causes of deficiencies in pregnancy is therefore substantial [28]. Alizadeh et al. discovered that anemic mothers had a 2 fold risk of delivering prematurely which indicated that iron status has a major role to play in placentation and fetal growth [29].

Besides, Allen et al. pointed out that low-level anemia in early pregnancy and, in particular, its detection prior to 20 weeks of gestation can have a harmful effect on placentation and placental vascularization which contributes to the biological credibility of the discovered association [30]. Franchi et al. came to another conclusion that maternal nutrition and early treatment, without iron deficiency that can lead to preterm labour where maternal and offspring outcome may be beneficial due to minimalisation of risks [31].

In general, based on the evidence provided in these studies, it can be explained that the relationship between preterm labour and maternal anemia varies in line with the timing of anemia occurrence and with the severity of the anemia, as well as the presence of another risk factor, including infections and socioeconomic level. The odds ratio as observed in this study (4.29) lends credence to the rising popularity of the idea that early screening and treatment of maternal iron deficiency anaemia needs to be prioritized in antenatal screening.

There is also a need of future research to assess the positive effects of targeted iron therapy and how it helps in preventing preterm labour particularly in low and middle income locations. These initiatives will allow the formulation of evidence based policies to maximize maternal health, and ensure that the global burden of preterm births are minimized.

5. CONCLUSION

This is a case control study that displays a crucial relationship between preterm labour and the deficiency of iron through anemia. The findings indicate that the risk of preterm delivery occurred almost four times in the anemic pregnant women compared to normal hemoglobin levels indicating the essence of early screening, diagnosis, and treatment of iron deficiency during pregnancy. These results are consistent with the available evidence on the role of anemia during early pregnancy as a

serious and potentially changeable risk factor of preterm birth. Routine antenatal screen of anemia, early access to iron and folic acid supplements and close follow-up of susceptible patients in clinical practice has the potential of lowering the rate of preterm labour and resultant maternal and neonatal morbidity. Additional large scaled as well as multi center studies can be advised to investigate the efficacy of focused intervention efforts and also make guidelines on preterm births that are related to maternal anemia evidence based.

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Permission

Ethical approval obtained

Conflict of Interest

None.

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