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Original Article

FETO/Maternal Complications in Iron Deficiency Anemia during Pregnancy and Labor

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ABSTRACT

Background: Iron deficiency anemia (IDA) is a prevalent nutritional disorder globally, especially in developing countries, impacting both maternal and fetal health. The condition exacerbates the risk of adverse pregnancy outcomes, including increased morbidity and mortality rates.

Objective: This study aimed to examine the prevalence and impact of IDA on feto-maternal health during pregnancy and labor, as well as to evaluate the efficacy of antenatal care programs in managing this condition.

Methods: A six-month cross-sectional study was conducted at Shaikh Zayad Hospital, Larkana, from October 2021 to March 2022. Fifty pregnant women, ranging from primigravida to multigravida, were recruited through emergency and outpatient departments. Comprehensive data collection included demographic information, clinical history, and a full spectrum of laboratory tests for IDA. The severity of anemia and related complications were assessed, and the collected data were analyzed using SPSS version 25.

Results: Of the participants, 74% suffered from moderate anemia, while 12% and 14% had mild and severe anemia, respectively. Serum ferritin levels indicated iron deficiency in 40% of the women, with an elevated total iron-binding capacity (TIBC) in 60% of cases. Maternal complications were prevalent, with 52% encountering unspecified emergency conditions and 16% experiencing postpartum hemorrhage. Fetal complications included intrauterine growth restriction (30%), intrauterine death (18%), and neonatal death (10%).

Conclusion: IDA presents a significant health risk during pregnancy, correlated with a high incidence of maternal and fetal complications. This study emphasizes the importance of proactive management and monitoring of iron levels throughout pregnancy. Establishing comprehensive antenatal care that includes nutritional education and iron supplementation is crucial for preventing IDA and improving pregnancy outcomes.

Keywords: Iron Deficiency Anemia, Feto-Maternal Health, Antenatal Care, Pregnancy Outcomes, Serum Ferritin, Total Iron-Binding Capacity, Cross-Sectional Study, Public Health Nutrition.

INTRODUCTION

Iron is an essential micronutrient, playing a pivotal role in numerous bodily functions, particularly in the synthesis of hemoglobin, which is crucial for the oxygenation of vital organs including the brain, kidney, heart, and adrenal glands. Iron is predominantly obtained from dietary sources such as beans, liver, spinach, meat, and poultry. Insufficiency in iron intake can lead to symptoms such as pallor of skin and eyes, weakness, and diminished concentration. Hemoglobin, present in erythrocytes, is regulated within the body, maintaining levels at approximately 40 mg/kg in women and 50 mg/kg in men (1, 2).

Anemia, a hematological condition characterized by reduced red blood cell volume, low hemoglobin count, and hematocrit, is more prevalent in developing than in developed countries. Iron deficiency anemia, the most common form of nutritional anemia in reproductive-age individuals, affects about a quarter of the global population (3). This condition is especially significant during pregnancy, where it has been linked to various feto-maternal complications if left untreated. Pregnancy induces physiological changes including a plasma volume increase of up to 1,250ml (1.25 L) by term (37-42 weeks), accounting for a 48% rise in total body plasma, indicative of normal fetal growth. The red cell mass also increases by 18% (250 ml) at 38 weeks of gestation, a figure that

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can rise to 30% (400 ml) with iron supplementation. Consequently, inadequate iron levels impede hemoglobin synthesis, with the World Health Organization setting anemia thresholds at hemoglobin levels below 10 g/dl (4, 5).

The impact of anemia on pregnant women is profound, leading to poor pregnancy outcomes. There is a significant correlation between maternal anemia and perinatal as well as neonatal mortality, low birth weight, preterm births, stillbirths, intrauterine growth restriction (IUGR), neonatal deaths, and increased risks of miscarriage and premature births. Furthermore, a hemoglobin level below 6 g/dl is closely associated with birth asphyxia, fetal distress, and potentially fetal death (6). Iron deficiency anemia further escalates maternal morbidity and mortality risks, encompassing general health issues, delayed post-delivery recovery, extended hospital stays, infections, delayed uterine contraction, eclampsia, pre-eclampsia, amniotic fluid embolism, antepartum hemorrhage (APH), post-partum hemorrhage (PPH), deep vein thrombosis (DVT), cardiac failure, and maternal death (7).

To mitigate these risks, pregnant women require an additional 500-800 mg of iron for both fetal development and their own health, with daily iron requirements escalating from 0.8 mg/day to 7.5mg/day as the pregnancy progresses. The average iron necessity during pregnancy is approximately 4.4 mg/day. The heightened demand for iron during pregnancy is detailed in table 1, indicating a gross iron demand of 1240 mg and a net demand of 630 mg after considering factors like cessation of menstruation during pregnancy and the postpartum decrease in red cell mass (8, 9).

Iron stored in the body is primarily in the form of ferritin within the reticuloendothelial system of the liver. Ferritin, a complex protein structure containing 4,500 iron molecules, is crucial for the formation of iron-containing proteins, including hemoglobin and myoglobin. The diagnosis of iron deficiency anemia is facilitated by measuring serum ferritin levels, which are characteristically low in affected individuals, alongside elevated total iron-binding capacity (TIBC) levels (10, 11).

This research aims to scrutinize the array of complications arising from iron deficiency anemia during pregnancy and labor, emphasizing the elevated risk of both maternal and fetal complications. The findings underscore the importance of adequate iron intake during pregnancy to avert adverse outcomes and support the health of both mother and child.

MATERIAL AND METHODS

This study was conducted at Shaikh Zayad Hospital, Larkana, over a period of six months, from October 1, 2021, to March 31, 2022. A total of 50 participants were enrolled in the study, selected through both emergency admissions and outpatient departments during antenatal check-ups or at the time of labor. The study encompassed a wide range of participants, from primigravida to multigravida, and included preterm (<37 weeks) and term pregnancies (37–42 weeks). Prior to inclusion in the study, informed consent was obtained from all participants, in accordance with the Declaration of Helsinki, ensuring ethical standards and participants' rights were maintained throughout the research process.

Participants' demographic and clinical data were meticulously collected, including name, age, residency, income source, booking status, gravidity, parity, presenting complaints, gestational age, medical and surgical history, history of blood transfusions, mode of delivery (normal or cesarean section), dietary habits, and socio-economic status. A comprehensive clinical assessment was performed for each participant, focusing on signs of pallor (in the nails, eyes, and palms) and potential complications affecting both maternal and fetal outcomes, such as preterm delivery, low birth weight, intrauterine growth restriction (IUGR), intrauterine death (IUD), neonatal death (NND), antepartum hemorrhage (APH), postpartum hemorrhage (PPH), disseminated intravascular coagulation (DIC), and cardiac failure.

The laboratory investigations targeted parameters relevant to iron deficiency anemia, including complete blood count, hemoglobin level, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), serum ferritin level, and total iron-binding capacity (TIBC). These tests were crucial for diagnosing iron deficiency anemia and understanding its severity among the pregnant women participating in the study.

Data collected from the study were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. This analysis included both descriptive and inferential statistics, allowing for a comprehensive evaluation of the relationship between iron deficiency anemia and its impact on feto-maternal outcomes. The statistical methods applied aimed to identify significant patterns and associations within the collected data, providing a solid foundation for the study's conclusions.

RESULTS

In this comprehensive study, a significant assortment of clinical presentations was meticulously documented. A substantial portion of participants, precisely 40%, presented with labor pains, as denoted in Figure 1. This figure starkly contrasts with those who attended antenatal checkups, forming 16% of the cohort. Cesarean sections from previous deliveries were a notable historical point for many participants: 16% had undergone one cesarean section, whereas a smaller 8% and 10% had experienced two and three

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cesarean sections, respectively. Instances of labor pains accompanied by per vagina bleeding and labor pains with fits were less common, reported in 8% and 2% of the cases, respectively.

The severity of anemia among the study subjects was delineated in Figure 2, where it was observed that a predominant majority, 74%, suffered from moderate anemia. Mild and severe forms of anemia were less prevalent, at 12% and 14%, respectively, indicating a trend towards the moderate manifestation of the condition in the studied population.

A closer look at the iron stores of the participants revealed in Figure 3 showed that 40% had serum ferritin levels significantly below the normal range (10-50 mg/L), suggesting a high prevalence of iron deficiency. Normal serum ferritin levels (150-300 mg/L) and very low levels (5-10 mg/L) were both reported in 20% of participants, while 10% fell into the intermediary range (50-150 mg/L). This distribution underscores the pressing concern of inadequate iron reserves in expecting mothers.

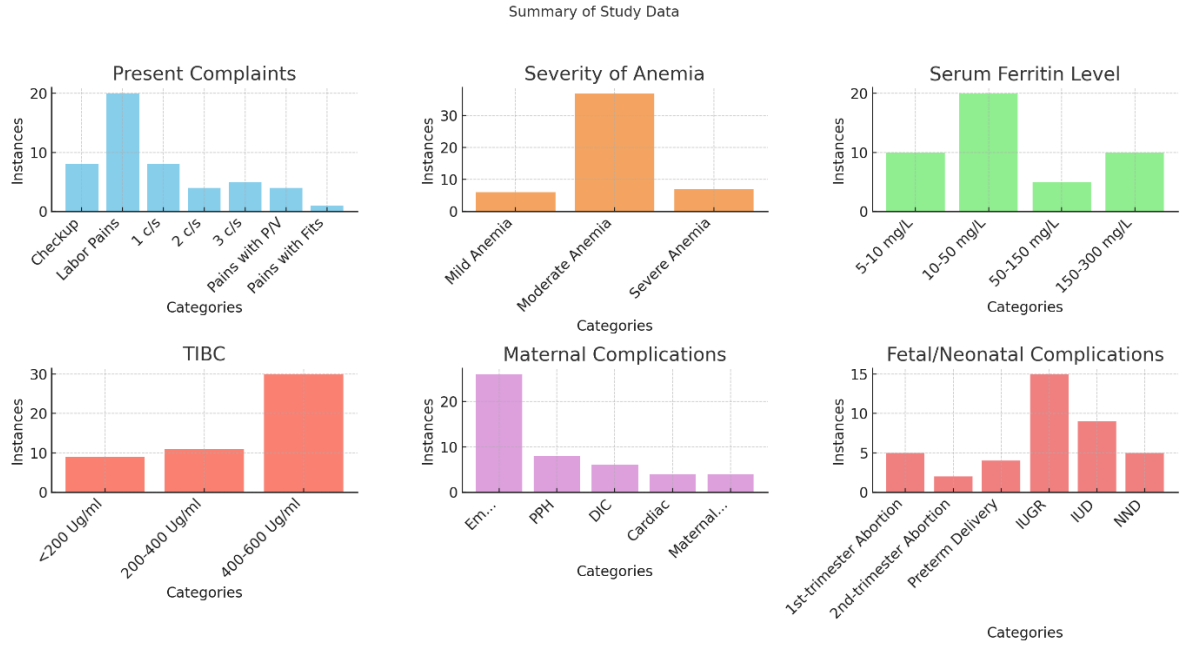

Figure 1 Study Characteristics

The total iron-binding capacity (TIBC), an important biochemical marker for iron deficiency anemia, was explored in Figure 4, where a striking 60% of the participants exhibited elevated levels (400-600 Ug/ml), indicative of the body's increased demand for iron not being met. TIBC in the lower ranges (<200 Ug/ml and 200-400 Ug/ml) was noted in 18% and 22% of the cases, respectively.

Maternal complications, a critical aspect of the study, were summarized in Figure 5. The data showed a significant occurrence of complications, with 52% of the cases presenting with an unspecified condition beginning with "Em...", potentially indicating emergencies related to hypertensive disorders or similar conditions. Other complications such as post-partum hemorrhage, disseminated intravascular coagulation, and cardiac issues were present in 16%, 12%, and 8% of the participants, respectively. An additional 8% faced complications that were categorized under an unspecified "maternal..." condition, possibly encompassing a range of undetailed maternal health issues.

Fetal and neonatal outcomes, as depicted in Figure 6, were also notably impacted by iron deficiency anemia. The most frequent condition observed was intrauterine growth restriction, affecting 30% of the pregnancies. Intrauterine death and neonatal death were observed in 18% and 10% of the cases, respectively, underscoring the severe impact of anemia on the most vulnerable. The study also recorded instances of 1st-trimester and 2nd-trimester abortions, although these were less common, accounting for 10% and 4% of the population, respectively. Preterm delivery was reported in 8% of the cases, further highlighting the range of complications associated with iron deficiency in pregnancy.

DISCUSSION

The findings of this study bring to the forefront the multifarious causes of anemia within developing nations, where a convergence of factors—ranging from poverty, suboptimal iron-rich diets, absence of meat consumption, to low socioeconomic standing—pervades (12). The incidence of anemia was particularly pronounced among pregnant women, with environmental and health-related elements such as contaminated drinking water, worm infestations, and malaria playing contributory roles. The study underscored the impact of insufficient antenatal care and lack of adequate medicinal interventions throughout pregnancy, conditions that were exacerbated by a general lack of awareness and healthcare education (12).

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Reflecting upon the cohort, the adverse effects of iron deficiency were palpable, with a noticeable increase in risks spanning from abortions in both the first and second trimesters, as observed in 9 cases, to preterm labor reported in 4 instances. More severe complications, including premature rupture of membranes, pre-eclampsia, prolonged labor, antepartum hemorrhage, and intrauterine death, were collectively encountered in 19 cases. The consequent escalation in the likelihood of requiring instrumental delivery and operative procedures was documented in 13 cases within the study population. Gravely, the complications tethered to anemia burgeoned into a higher incidence of cesarean sections, genital tract lacerations, postpartum hemorrhage (8 cases), disseminated intravascular coagulation (6 cases), as well as grave outcomes such as postpartum psychosis, depression, infections, pulmonary thromboembolism, cardiac failure, and maternal death (4 cases each), reiterating the gravity of the situation among the 50 pregnant women involved in this study (13).

This research was conducted within a tertiary care setting, illuminating the frequency and risk factors associated with iron deficiency anemia during pregnancy and labor. It highlighted the cyclical nature of the risk, which not only affects current pregnancies but also has implications for future ones. The study's findings were instrumental in advocating for preemptive management strategies to be implemented in follow-up visits, facilitating timely interventions and potentially reducing maternal and neonatal morbidity and mortality (14).

In terms of literacy and awareness, the study subjects were predominantly from low socioeconomic backgrounds, reflecting a broader demographic characteristic that often correlates with limited health facilities and a paucity of health education. The entrenched issue of low iron intake and malabsorption syndrome in the country serves as a critical backdrop against which these findings must be interpreted, further emphasizing the need for improved nutrition and healthcare literacy (12).

This study also illuminated the strengths and limitations inherent in such research. Despite the challenges posed by the participants' socioeconomic status and access to healthcare resources, the research provided valuable insights into the feto-maternal complications arising from iron deficiency. However, it also emphasized the necessity for more comprehensive antenatal programs, which should include free testing of hemoglobin and other relevant investigations. The World Health Organization's recommendation of iron and folic acid supplementation presents a preventative strategy that, if properly implemented, could have a profound impact on reducing adverse outcomes associated with anemia (13).

This investigation underlines iron deficiency anemia as a pivotal health concern, precipitating a spectrum of feto/neonatal and maternal complications. The prophylactic prescription of iron, both preconception and during the perinatal periods, is advocated as a vital step towards mitigating the array of issues engendered by this nutritional deficiency. Establishing and reinforcing nutritional education plans, as well as maintaining robust antenatal programs, emerges as essential for early detection and treatment of anemia, ultimately aiming to alleviate the burden of fetal and maternal morbidity and mortality.

CONCLUSION

The study conclusively demonstrates that iron deficiency anemia remains a significant public health challenge, with far-reaching implications for maternal and neonatal health. Addressing this issue through improved dietary education, enhanced antenatal care, and accessible supplementation programs could substantially reduce the spectrum of associated risks and improve outcomes. The need for a concerted effort to tackle anemia in pregnant women is clear, highlighting the critical role of iron supplementation before, during, and after pregnancy to alleviate the burden of this condition on both mothers and their children.

REFERENCES

1. Freeman HJ. Iron deficiency anemia in celiac disease. World J Gastroenterol. 2015;21(31):9233.
2. Means RT. Iron deficiency and Iron deficiency anemia: implications and impact in pregnancy, fetal development, and early childhood parameters. Nutrients. 2020;12(2):4.
3. Gautam S, M H, K H, J H-S. Determining factors for the prevalence of anemia in women of reproductive age in Nepal: Evidence from recent national survey data. PloS One. 2019;14(6):e0218288.
4. Sifakis S, Pharmakides G. Anemia in pregnancy. Ann N Y Acad Sci. 2000 Apr;900(1):125-36.
5. Georgieff MK. Iron deficiency in pregnancy. Am J Obstet Gynecol. 2020;223(4):516-24.
6. Allen LH. Anemia and Iron deficiency: effects on pregnancy outcome. Am J Clin Nutr. 2000;71(5):1280S-1284S.
7. Di R, Gian C, Filippo S, Irene G, Eleonora B, Graziano C, et al. Iron deficiency anemia in pregnancy. Women's Health. 2015;11(6):891-900.
8. Gillespie S, UNICEF. Major issues in the control of Iron deficiency. Ottawa, ON: IDRC; 1998.
9. Lao TT, Tam KF, Chan LY. Third trimester Iron status and pregnancy outcome in non-anaemic women; pregnancy unfavourably affected by maternal Iron excess. Hum Reprod. 2000 Aug;15(8):1843-8.

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10. Tandon R, Jain A, Malhotra P. Management of Iron deficiency anemia in pregnancy in India. Indian J Hematol Blood Transfus. 2018 Apr;34(2):204-15.
11. Akinajo OR, Babah OA, Banke-Thomas A, Beňová L, Sam-Agudu NA, Balogun MR, et al. Acceptability of IV iron treatment for iron deficiency anaemia in pregnancy in Nigeria: a qualitative study with pregnant women, domestic decision-makers, and health care providers. Reproductive Health. 2024;21(1):1-16.
12. Begum M, Fatema B, Aktar S, Zaman F. Feto-Maternal Outcome of Moderate Anaemia in Term Pregnancy at DMCH. Sch J App Med Sci. 2023;6:1129-36.
13. Dhume P, Rawal R, Vadhera A, Shah A, Dey M, Chawla S, et al. Reassessing Nutritional Supplementation Program: The Impact of Maternal Vitamin B12 Levels on Feto-Maternal Outcomes. Gynecology Obstetrics & Reproductive Medicine. 2023;29(3):152-6.
14. Inya AU, Achara AP, Ikwuka AO, Udeh FC, Chi-kadibia U, Onazi O. Clinical Dynamics of Anemia in Pregnancy: A 16-week Cross-sectional Study of Pregnant Women Who Attended Antenatal Clinic of Federal Medical Center, Keffi, Nasarawa State, Nigeria. American Journal of Clinical Medicine Research. 2023;11(1):1-9.
15. Inya AU, Achara AP, Ikwuka AO, Udeh FC, Chi-kadibia U, Onazi O. Patterns, Peculiarities and Associated Risk Factors of Anemia in Pregnancy: A Case Study of Pregnant Women Attending Antenatal Clinic in North-Central Nigeria. European Journal of Preventive Medicine. 2023;11(2):21-31.
16. Kathuria K. Impact of Maternal Health and Disease on Neonatal Outcome. Clinical Anesthesia for the Newborn and the Neonate: Springer; 2023. p. 11-27.
17. Meena S, Gaikwad HS, Nath B, Gaikwad H. Plasma Homocysteine, Folic Acid and Vitamin B12 in Abruptio Placentae: A Cross-Sectional Study of Their Role and Feto-Maternal Outcome. Cureus. 2023;15(3).
18. Rajauria S, Atreja CB, Mujalda A, Mujalda J, Yadav S, Kundal RK, et al. The effect of sickle cell hemoglobinopathy on pregnancy, labor, puerperium, and fetal outcome: a retrospective cohort study from a single centre. Cureus. 2023;15(1).
19. Sonowal T, Sarmah J, Sarma PK, Deka M. Iodine status, thyroid disorder and feto-maternal outcome among the tribal pregnant women of Eastern Himalayas. Indian Journal of Endocrinology and Metabolism. 2023;27(1):66-72.
20. Vaishnav S, Pandya D, Shrivastava R, Patel N, Phatak AG, Patel A. Early treatment will prevent feto-maternal complications in thyroid disorders during pregnancy: A prospective study. Journal of Family Medicine and Primary Care. 2023;12(12):3393-8.
21. Yousaf S, Sajjad MM, Shabbir M. Impact Of Anemia On Feto-Maternal Outcomes In One Of The Tertiary Care Hospitals In Khyber Pakhtunkhwa. Journal of Rawalpindi Medical College. 2023;27(4).