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The Effect of Maternal Anaemia on Infant Birth Weight: A Comprehensive Study

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Abstract

The objective of the present study was to understand about the maternal anaemia on the low birth weight of the neonates and also how it effects the maternal health. This study was conducted at the postnatal ward of the Saveetha Medical College, Chennai, during the period of December 2022 and July 2023. A total of 237 deliveries were analysed for this study. Maternal anaemia is divided in four categories based on the haemoglobin levels: no anaemia (>10 gm%), mild (8-10 gm%), moderate (7-8 gm%), severe (<7 gm%). Neonates were assessed for the birth weight and other perinatal factors. Statistical analysis for this study is done by using the chi-square and correlation coefficients. C Among the 236 antenatal women included, 49.2% were found to be anaemic. The average haemoglobin level was 10.05 ± 2.27 g/dL, and the average birth weight was 3055.81 ± 540.63 g. Of the infants, 8.1% were classified as LBW. A significant correlation was found between maternal anaemia and LBW: 37.9% of LBW infants were born to mothers with severe anaemia ($p < 0.001$). A statistically significant weak correlation ($r = 0.305$, $p < 0.001$) was observed between haemoglobin levels and neonatal weight.

Keywords: *Infant Birth Weight, Iron Deficiency, Low Birth Weight, Prenatal Anaemia, Prenatal Care, Rural Health.*

Introduction

Anemia poses a significant public health challenge during pregnancy in developing countries, with iron deficiency being the predominant cause, mainly due to recurrent menstrual losses and insufficient dietary iron intake. Maternal anemia in pregnancy is widespread and carries detrimental effects on both maternal and fetal health. It is a crucial risk determinant for low birth weight (LBW) and preterm infants. There is limited information available concerning the adverse impacts of anemia during pregnancy, particularly in rural populations [1]. Pregnancy-related anemia is frequently observed due to the heightened need for iron which is necessary for the developing fetus and placenta, alongside an elevated red blood cell count. This condition is further exacerbated by factors including early childbearing, frequent pregnancies, short intervals between pregnancies, and limited

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access to prenatal care and supplementation, which contribute to iron deficiency anemia during pregnancy. This condition increases the risks of premature birth, low birth weight, and perinatal death or stillbirths [2]. Diminished hemoglobin levels induce changes in placental angiogenesis, resulting in decreased oxygen availability to the fetus, restricted intrauterine growth, and reduced birth weight. Approximately 18 million infants are born with a low birth weight (LBW <2500 grams) yearly. While LBW infants comprise only 14% of all live births, they account for an estimated 60–80% of neonatal deaths. The high death rate of these babies stressed the need for effective interventions and prevention. Multiple maternal risk factors interact, resulting in a continuum that increases the probability that an infant will be born LBW. Prematurity, maternal young age, multiple gestations, and history of previous LBW infants are a few factors that have significantly contributed to the increase in the number of patients affected with LBW. Also, malnutrition, heart problems or high blood pressure, untreated celiac disease drugs, and alcoholism in pregnancy will also increase the risk. Social factors influence as well, like smoking or lead exposure, supported by public policy and legal intervention.

Materials and Methods

The analysis was conducted at the postnatal ward of Saveetha Medical College, Thandalam, Chennai, India—a tertiary care hospital —from December 2022 to July 2023, encompassing 237 deliveries.

Sample size calculation: 236

Inclusion Criteria: All newborns with a gestational age exceeding 37 weeks and born to women aged 18 to 35 years were considered for inclusion.

Exclusion Standards: Infants delivered to women with pregnancy-induced diabetes, gestational hypertension, fever with a rash, dwarfism, birth defects, premature births, and sick neonates (including those with respiratory distress syndrome, meconium aspiration syndrome, transient tachypnoea of the newborn, sepsis, hypoglycemia, and seizures) were excluded.

All mothers and infants meeting the inclusion standards were enrolled in the analysis. Pertinent data regarding maternal variables and details of neonatal resuscitation were systematically combined using a predefined proforma. Anemic mothers were categorized into four collectives—no anemia, mild, moderate, and severe—based on hemoglobin levels (no anemia: >10 gm%; mild anemia: 8-10 gm%; moderate anemia: 8-7 gm%; severe anemia: <7 gm%) [4].

All infants were evaluated for gestational age, sex, and perinatal complications by conducting a comprehensive overall assessment and the recorded newborn weight. Information collected was recorded in Microsoft Excel, and statistical analysis was carried out using Statistics 16.0 software, employing appropriate significance tests.

Results

The study reveals a maternal anemia prevalence of 49.2 % in the Thandalam, India, population.

An overall of 236 antenatal women took part in this study. The average hemoglobin level among the study participants was 10.05 ± 2.27 grams, with a range of 6.1-12.8 gms. The average birthweight among the study participants was 3055.81 ± 540.63 grams with a range of 2100-4300 grams.

The Haemoglobin values were categorized as normal, mild, moderate, and severe using WHO criteria. Of the participants, 50.8% (120) had normal hemoglobin levels. Another 17.4% (41) had mild anemia, 24.6% (58) had moderate anemia, and another 7.2% (17) had severe

anemia (Table 1). 8.1% were low birth weight. 49.2% of the study population had a birth weight of 2501 to 3000 grams. Another 24.2% had birthweight to 3000 grams to 3500 grams. 18.6% had a birth weight of more than 3500 grams (Table 2). The relationship between birth weight and hemoglobin status was evaluated by using a chi-square test. Notably, 37.9 % of low-birth-weight babies were delivered by mothers with severe maternal anemia, and this correlation was statistically relevant with a p-value of lesser than 0.001. Babies with LBW also had mothers with mild (26.4 %) and moderate (44.4 %) anemia, albeit at lower percentages. It was observed that as the hemoglobin level decreases, Birthweight also Decreases, and the results are statistically significant (Table 3). There is a statistically significant weak correlation between Anaemia and Neonatal weight ($r = 0.305$, $P < 0.001$) (figure 1), underscoring the direct impact of prenatal anemia on infant birth weight.

Table 1. Distribution of Study Population Based on Haemoglobin Status

Anaemia Classification	**F**	**%**
Normal	120	50.8
Mild	41	17.4
Moderate	58	24.6
Severe	17	7.2

Table 2. Distribution of Study population according to Birth Weight

Birth Weight Classification	**F**	**%**
2000-2500 gms	19	8.1
2501 - 3000 gms	116	49.2
3001 - 3500 gms	57	24.2
3501 - 4000 gms	18	7.6
4001 - 4500 gms	26	11.0

Table 3. Correlation between Anaemia and Birth Weight

	Normal		**Mild**		**Moderate**		**Severe**			**P**
Birth Weight	N	%	N	%	N	%	N	%	CSV	**value**
2000-2500	0	0	1	2.4	1	1.7	17	100		
2501-3000	63	52.5	28	68.3	25	43.1	0	0		
3001-3500	24	20	9	22	24	41.4	0	0		
3501-4000	11	9.2	3	7.3	4	6.9	0	0		
4001-4500	22	18.3	0	0	4	6.9	0	0	231.79	<0.001

Discussion

The systematic review's key findings revealed that anemia during pregnancy poses a risk determinant for reduced birth weight, substantiated by subgroup analyses considering the existence of anemia and its severity. The frequency of maternal anemia in a rural population, as indicated by the current analysis, is estimated to be around 53.3%. In the year of 2008, Milman N reported that equatorial countries witness the occurrence of anemia during pregnancy is generally ranging from 40% to 80% [5]. Notably, a significant relationship between the severe maternal anaemia and the birth of the neonates with low birth weight (LBW) was observed, with a p-value lesser than 0.001, signifying the statistical significance. Singla PN et al. demonstrated that very severely anemic mothers experienced a notably decreased birth weight, establishing a direct relationship with maternal hemoglobin levels [6]. Another study by Singla PN et al., focusing on fetal growth in maternal anemia, determined that various measures of fetal growth exhibit a direct correlation with maternal hemoglobin. The impact of pregnancy-related anemia was more pronounced on fetal birth weight and mid-arm circumference compared to other newborn body size indicators [7]. Rusia US et al. identified a significant correlation between maternal hemoglobin concentration and neonatal weight ($p < 0.01$), Apgar score ($p < 0.001$), and incidence of perinatal asphyxia [7, 8, 9]. Nair M et al.'s research indicated that mothers with anemia during any point of the pregnancy face at least a 4.3 times higher risk of delivering low neonatal weight babies compared to non-anemic mothers during the gestation or pregnancy [8, 10, 11].

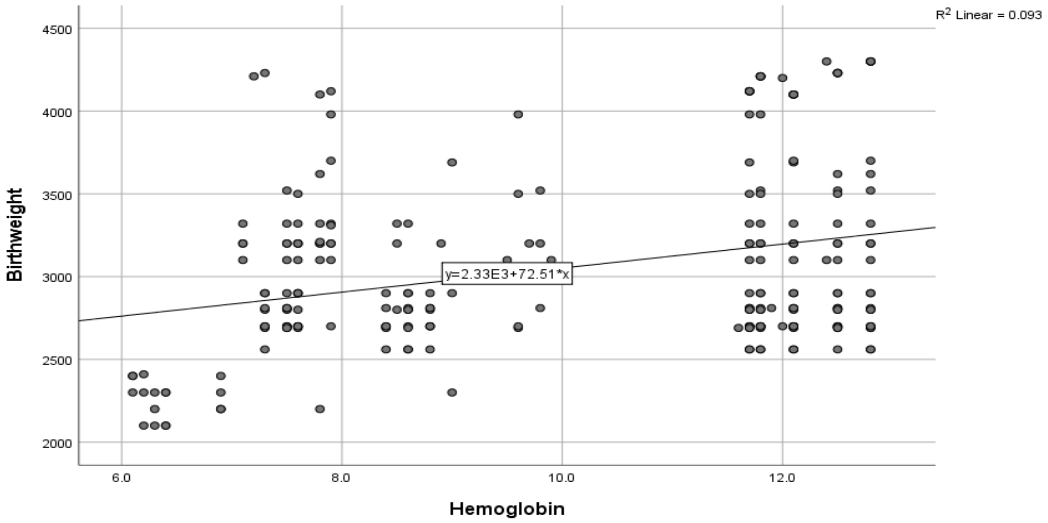

Figure 1. Correlation between Anaemia and Birth Weight

Conclusion

Maternal anemia is strongly related to impaired fetal growth, making it a critical factor in determining low neonatal weight. Addressing maternal anemia proactively is crucial to reducing the rates of low birth weight (LBW) and minimizing the associated risks of mortality and morbidity for both infants and mothers. Effective prevention of maternal anemia is essential for improving neonatal outcomes. By identifying and managing anemia early in pregnancy, the incidence of LBW infants can be significantly reduced. This approach benefits the immediate health of the newborn and contributes to better long-term health outcomes. Despite various government initiatives aimed at controlling and preventing

maternal anemia, its prevalence continues to be high, particularly in rural areas. This ongoing issue highlights that current programs have not fully reached or effectively addressed the needs of these populations. The high prevalence of maternal anemia in rural regions suggests that the impact of government programs is insufficient in these areas. There is a clear need to evaluate and enhance the delivery and effectiveness of these initiatives to ensure they are reaching and benefiting those who need them most. Improving the effectiveness of government programs could involve a range of strategies, including increasing access to prenatal care, providing better education on nutritional needs, and ensuring a more consistent distribution of iron supplements. Tailoring interventions to meet the specific needs of rural communities could make a substantial difference. In a nutshell, it is necessary to enhance and optimize the existing preventive and control measures for maternal anemia. This may be possible by closing the gaps in the running programs so that the population is comprehensively covered to achieve a reduction in the prevalence of cases of maternal anemia and, consequently, improvement in birth weight in infants.

Conflict of Interest

Authors declare no conflict of interest to this work.

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