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Clinical Study of Determinants of Maternal Hemoglobin Levels in Relation to Low Birth Weight in Teritiary Care Centre

Dr. M Harika Reddy[1]*, Dr. Ananda Kumar[2], Dr. Milind Ram[1], Dr. G. V. Kumar[3]

[1]Post Graduate Student, Sri Siddhartha Medical College, 83W5+296 Ssmc, Tumakuru, Karnataka 572107, India
[2]Professor & Unit Head, Department of Pediatrics, Sri Siddhartha Medical College, 83W5+296 Ssmc, Tumakuru, Karnataka 572107, India
[3]Professor & HOD, Department of Pediatrics, Sri Siddhartha Medical College, 83W5+296 Ssmc, Tumakuru, Karnataka 572107, India

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***Corresponding Author**
Dr. M Harika Reddy

Post Graduate Student, Sri Siddhartha Medical College, 83W5+296 Ssmc, Tumakuru, Karnataka 572107, India

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A B S T R A C T

In 2020, the incidence of low birth weight (LBW) was 27.6%. The high rates of neonatal morbidity and mortality in our country are largely attributed to factors such as poor nutrition, inadequate healthcare, and limited education for female children, early teenage marriages, frequent pregnancies, maternal malnutrition, fewer antenatal visits, and a history of adverse obstetric outcomes. These factors significantly contribute to the increased prevalence of LBW. The aim of this study was to explore the relationship between maternal haemoglobin levels and LBW.A hospital-based cross-sectional study was conducted on a total of 420 babies born at Sri Siddhartha Medical College and Hospital Research Centre in Tumkur over a period of 24 months. The study found that haemoglobin levels, and iron and folic acid supplementation were all positively associated with low birth weight (LBW) babies. The occurrence of low birth weight (LBW) is influenced by multiple maternal factors, highlighting the complexity of its causes. To reduce LBW rates, it is essential to address these factors through health education, socioeconomic development, and improving maternal nutrition during pregnancy.

Keywords: Low birth weight, Anemia during pregnancy, iron and folic acid intake during pregnancy.

INTRODUCTION

The World Health Organization defines low birth weight (LBW) as a birth weight of less than 2,500 grams, including 2,499 grams, regardless of gestational age. LBW has a significant impact on mortality, morbidity, and disability during the neonatal, infant, and childhood stages, with long-term consequences for health in adulthood. For pregnant women, a hemoglobin level of 11g/dl or higher is considered normal. Mild anemia is diagnosed when hemoglobin falls between 10.0-10.9g/dl, moderate anemia between 7.0-9.9 g/dl, and severe anemia when it's lower than 7.0 g/dl. In healthy, iron-sufficient women, hemoglobin concentrations undergo significant changes during pregnancy to accommodate the increasing maternal blood volume and the iron requirements of the fetus. These concentrations typically decrease during the first trimester, reach their lowest point in the second trimester, and then begin to rise again in the third trimester [1].Administering iron supplementation at a dose of 60 mg/day of elemental iron along with 500 mcg/day of folic acid during the latter half of pregnancy is linked with anaverage increase in birth weight of 300 g. As per the guidelines of anemia, it is recommended to provide one tablet containing 100 mg of iron and 500 mcg of folic acid daily for a period of 100 days, starting after the first trimester, typically around 14–16 weeks of gestation. This supplementation regimen is then to be repeated for 100 days post-partum [2].

The iron transferred to the foetus remains constant even when the mother experiences iron deficiency anaemia, ensuring the newborn isn't anaemic at birth. However, due to limited iron reserves, anaemia can develop during the neonatal period, potentially increasing the likelihood of LBW babies.

OBJECTIVE

This study was to investigate the association between low maternal haemoglobin levels and the occurrence of low birth weight.

METHODOLOGY

This was a hospital-based cross-sectional study conducted at a tertiary care center in Karnataka, India. Taking 26.8% prevalence sample size was calculated to be 350 and convenient sampling was used to recruit 420 live-born babies over a 24-month period. Written informed consent was obtained from the mothers prior to participation. Stillbirths, critically ill mothers, neonates with major congenital malformations, and mothers who did not provide consent were excluded from the study.

RESULTS

Among the 420 live born babies included in the study, Table 1 and 2 depict the maternal haemoglobin levels and iron and folic acid intake during pregnancy and their association with low birth weight. There were significant statistical differences found in both the factors: low maternal haemoglobin levels ($p<0.001$), No Iron and folic acid intake during pregnancy ($p <0.001$).

Table 1: The distribution of LBW according to maternal haemoglobin levels

Variable	Hemoglobin levels	Birth		Total	Chi-square, P-value
		Low Birth Weight (<2.5Kg)	Normal (>=2.5)		
Maternalhemoglobin levels	<7 gm/dl	68 (89.5%)	8(10.5%)	76 (100%)	134.035,<0.001
	7- 9.9 gm/dl	50 (24.2%)	157 (75.8%)	207 (100%)	
	>9.9 gm /dl	22 (16.1%)	115(83.9%)	137 (100%)	

Table 2: The distribution of birth weight categorized by Fe and B9 supplementation

Variable	Category	Frequency	Percent	Chi square, p- value
Iron (Fe) and folic acid (B9) taken during pregnancy	YES	280	66.7	41.486, <0.001
	NO	140	33.3	

DISCUSSION

In this study, there is a statistically significant finding between babies born with LBW when the mother had severe anaemia.

Saini S *et al*., conducted a cross-sectional study based in Mullana, Haryana, India, published in 2016. LBW and factors like anemia, hypertension, and maternal infections during pregnancy are positively associated [2].

Sahu KK *et al*., conducted a cross-sectional study at a hospital in Lucknow, Uttar Pradesh, published in 2015. They identified maternal weight, calorie intake, weight gain duringthe third trimester, and ma-+ternal hemoglobin levels as independent predictors of low birth weight [3].

Kumari PR *et al*., conducted a study in Visakhapatnam, published in 2015, revealing a 21.3% incidence of LBW. It has found correlation amid LBW and maternal factors suchas education, nutritional status, hemoglobin levels, multigravida status, birth spacing, and weight gain in pregnancy [4].

Soujanya M *et al*., conducted a study in Guntur, Andhra Pradesh, published in 2016. They found significant associations amid LBW and maternal age, parity, and anemia. However, no positive correlation were observed between maternal height, BMI, and maternal diseases during pregnancy in this study [5].

Thomre PS *et al*., conducted a hospital-based cross-sectional study in Miraj, India, published in 2012. They found an 18.1% prevalence of LBW [6].

A study conducted by Momeni M in Iran, published in 2015, indicated that mothers who didn'ttake Fe and B9 supplements during pregnancy had a higher likelihood of delivering low birth weight neonates [7].

A study conducted by Verma S *et al*., in Gwalior, India, published in 2016, revealed a direct correlation between hemoglobin levels and infant weight. The majority of mothers with hemoglobin levels below 7.0 gm% delivered babies weighing <2 kgs, while with hemoglobin levels above 10 gm% delivered babies weighing over 3kgs [8].

Shahnawaz K *et al*., Kishanganj, Bihar, India, published in 2014. The research identified maternal factors such

as age, socioeconomic status, religion, and occupations related to LBW newborns [9].

Sunilbala K *et al*., conducted a hospital-based cross-sectional study in Imphal, published in 2015, LBW babies were 6%. The study identified significant factors affecting LBW [10].

Kaur S *et al*., conducted a hospital-based cross-sectional study in Gorakhpur, publishedin 2014, LBW babies were 32.06%. The study proposed positive link between LBW andmaternal age, parity, inter-pregnancy interval, and maternal education. However, there were no significant associations observed between LBW and father's education or religion [11].

Shoboo Rahmati *et al*., publishedin 2017, study found that maternal anemia, is a causative factor for LBW [12].Florence Bodeau *et al*., observed from a RCT conducted in Benin found link between maternal anemia and LBW [13].

Madhia Khalid *et al*., conducted a case-control study at SRI GANGA RAM HOSPITAL in Lahore, which concluded a robust correlation between anemia and low birth weight (LBW) [14].

Danmeng Liu *et al*., conducted a prospective study published in 2022, establishing a positive correlation between anemia and the occurrence of LBW and SGA babies [15].

In this study, there is a statistically significant finding between babies born with LBWwhen the mother had severe anemia. Raghunath D *et al*., Sahu KK, and Kaur S *et al*., has also proposed similar observation.

In our current study, a statistically significant increase in the percentage of low birthweight (LBW) babies was observed among mothers who did not take iron and folic acid supplementation during pregnancy. This finding is consistent with the conclusions drawn by Raghunath D *et al*., [16] and Sahu KK [3].

However, our study contrasts with the findings of Thomre PS *et al*., [6] and Dandekar RH *et al*., [17], who did not find such a statistically significant association.

Severe maternal anemia restricts maternal oxygen uptake, thereby reducing oxygen delivery to the fetus and resulting in fetal growth restriction.

During our study, it was noted that one of the primary reasons for not taking iron and folic acid tablets was mothers' lack of awareness regarding their benefits, coupled with reduced compliance.

Even though the study has its own set of limitations like small sample size, the study adds to the strength of evidence and gives insight into the modifiable factors which can be tackled to alleviate the low birth weight among newborns.

CONCLUSION

Maternal haemoglobin levels and iron and folic acid supplementation were significantly linked to low birth weight (LBW) in infants. The prevalence of LBW could be considerably reduced by addressing both modifiable and perinatal factors. It would also be beneficial to raise awareness among pregnant women about these factors through programs organized by primary healthcare centers at the grassroots level. Future research should focus more on modifiable factors and examine the impact of awareness programs on the prevalence of LBW in infants.

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