Maternal hemoglobin level a major risk factor for low birth weight: A hospital-based study

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Abstract

Background: Anaemia is one of the most important factors influencing maternal morbidity and mortality and also the health of the newborn. It is a global health issue affecting nearly half of pregnant women. This study aimed to assess the association of maternal hemoglobin level with birth weight of new borns.

Methods: It was a cross-sectional study that included 2 study centers. As per inclusion/exclusion criteria, this study included 650 post-partum mothers. Using Stratified random sampling study participants were enrolled. Data were collected and analyzed in SPSS 23. Using statistical tests i.e., Chi-square, etc data was analyzed.

Results: Hemoglobin level of mothers had a statistically significant association with low birth weight (2-19.921, p-0.000).Using multivariate logistic regression analysis mother having low hemoglobin level having higher odds of having low birth weight (OR-1.453, p-0.000, CI-1.212-1.741).Difference of mean birth weight of new born with different category of hemoglobin level below 11is between 0.001 to 0.4533 gm.

Conclusions: Improving hemoglobin status during pregnancy can reduce the burden of low birth weight among new born.

Keywords: Maternal hemoglobin level, Low birth weight, anemia.

Introduction

Low birth weight has been widely studied and is an important risk factor for morbidity and mortality of infants. The major risk factors for low birth weight are associated with unfavourable biological, social and environmental conditions that may occur before or during the pregnancy period. Nutritional determinants, such as pre-gestational weight and weight gain during pregnancy, influence birth weight of new born.

Thus, inadequate maternal caloric intake, which may be theresult of a diet that is nutritionally poor, leads to lower absorption of essential micronutrients, such as vitamin B12 and iron, for foetal growth. Birth weight of a child is an important indicator of its vulnerability for childhood illness and chances of survival[1]. A large number of mortalities among newborn and infants can be prevented by proper management of low birth weight and avoiding factors associated with it[2].The prevalence of anemia during pregnancy is highest in South Asia and central and west Africa[3]. In India, acc, to NHFS 5 survey, the percentage of pregnant women having hemoglobin level below 11 g/dl were found to be 52.2% with the urban and rural percentage of 45.7% and 54.3% respectively[4]. Acc to NHFS 5 survey, in Madhya Pradesh, 52.9% of pregnant women were having hemoglobin levels below 11g/dl. Out of the total percentage, 54.9% of pregnant women from the rural parts of Madhya Pradesh were having anemia[5].

This study aims to evaluate the association of maternal hemoglobin level with birth weight of new born.

Method

This study was conducted among women who delivered in two hospitals Chandrikaben Rashmikant Gardi Hospital (CRGH) and Charak hospital (District Mother and Child Hospital), Ujjain. MP during the data collection period. Charak hospital is a 450 bedded hospital and about 800-900 deliveries are being conducted in a month and CRGH is 820 bedded tertiary care hospital and about 150-200 deliveries are being conducted in a month.

Anemia was classified based on the WHO criteria; HB concentration of <11 g/dl was considered as anemia. HB concentration of 10–10.9 g/dl, 7–9.9 g/dl, and <7 g/dl was considered as mild, moderate, and severe anemia, respectively.

Study design and study population

The study was conducted using a cross-sectional design. The study population included women who delivered in these two hospitals during the data collection period. Those admitted in ICU or those not present on the bed at the time of visitor with incomplete information were excluded from the study.

Sample size and sampling technique: A sample of 629 was calculated using the sample size formula for a single proportion. A total of 650 postpartum mothers were enrolled. Stratified random sampling was used for the selection of participants from 2 centres along with simple random sampling.

Data collection: Data was collected after getting permission from the institute's ethical committee. The duration of the study was one and a half years. A pre-designed pre-tested questionnaire was used to collect data from postpartum mothers. Written consent was obtained after explaining the need and importance of the study to the participant. Most of the details were obtained by interview, however, some of the details like investigation etc were taken from mother and child protection card (MCP card)/ inpatient file.

Statistical analysis: Data were analysed using IBM statistical package for the social sciences (SPSS) version 23 for Windows10. For Analysis descriptive statistics were calculated to summarize the sample characteristics. A Chi-square test was applied to see the association with LBW. Logistic regression was applied for predicting poor pregnancy outcomes. A p-value of less than 0.05 was considered to be statistically significant. ANOVA test was applied for mean difference.

Ethical consideration: Ethical approval was obtained from the institutional ethical committee of R. D. Gardi medical college, Ujjain. Confidentiality and data security were assured.

Participation was made voluntary as each participant was at liberty to opt out at any point in the study.

Result

Frequency distribution of sociodemographic factors of study participants:

Mothers' age ranges from 17 years to 40 years with a Mean age was 25.38 years. Only 31.2% of post-partum mothers had education more than high school. Only 19.1% of post-partum mothers belong to the socioeconomic class above III (i.e., class I & II of modified BG Prasad). It was observed that 64% of post-partum mothers belong to below poverty line (BPL) families. About 57.3% of post-partum mothers reside in rural areas. Parity distribution of postpartum mothers was 59.8% were multipara. About 70.8% of mothers were married before 20 years of age. It was found that 63.4% of post-partum mothers live in a joint or 3 generations family About 42.5% live in Kutcha houses. It was observed that 27.5%

of study participants do not have access to toilet facilities at their homes. Similarly, 27.4% of study participants do not use toilet facility, rather they practice open field defecation

Hemoglobin level and birth weight

Hemoglobin level is inversely proportional to poor pregnancy outcomes. As seen in Table 1 that as the hemoglobin level increases the percentage of babies born with low birth weight also decreases. It was revealed that hemoglobin level <7gm/dl had a higher proportion of having low birth weight (75%). The risk of having babies born with weight less than 2.5 kg increases by 1.4 times with a decrease in hemoglobin level. It was observed that hemoglobin level at the time of delivery was highly significantly associated low birth weight (2-19.921, p-0.000) of newborn as shown in table 1.

Table 1: Hemoglobin level and birth weight

Hemoglobin level	Birth weight		Total
	< 2.5 kg	>= 2.5 kg	
<7 g/dl (severe)	12 (75.0%)	4 (25.0%)	16 (100%)
7.0-9.9 g/dl (moderate)	73 (46.5%)	84 (53.5%)	157 (100%)
10.0-10.9 g/dl(mild)	62 (36.0%)	110 (64.0%)	172 (100%)
>=11 g/dl (non anaemic)	96 (31.5%)	209 (68.5%)	305 (100%)
2-19.921, p-0.000			
OR-1.453, p-0.000, CI-1.212-1.741			

* 2- chi-square, OR -odd's ratio, 95% CI- confidence interval

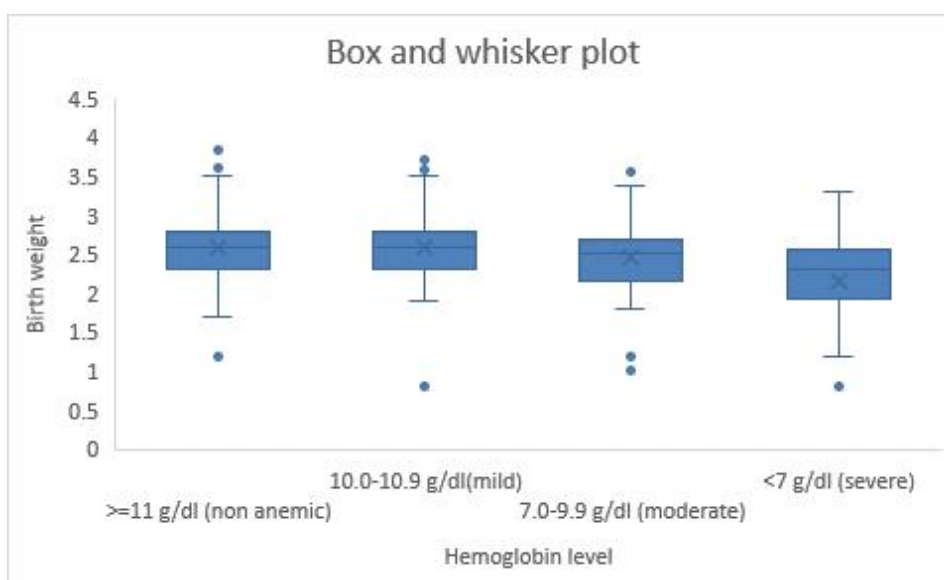## Hemoglobin level and mean birth weight

In the study it was found that there is a significant increase in mean birth weight of newborn along with increase in haemoglobin level. Difference of mean birth weight of new born with different category of hemoglobin level below 11is between 0.001 to 0.4533 gm.

Table 2: Hemoglobin level and mean birth weight

	Category	N	Mean	SD	F	Sig.
Haemoglobin	<7 g/dl (severe)	16	2.1438	.59550		
	7.0-9.9 g/dl (moderate)	157	2.4522	.41665		
	10.0-10.9 g/dl(mild)	172	2.5961	.44878	9.734	.00001
	>=11 g/dl (non anaemic)	305	2.5971	.39663		

Figure 1: Box and whisker plot of birth weight with hemoglobin level

Discussion

Out of 650 pregnant women in this study, more than half (54.5%) of them were having hemoglobin level below 11 gm/dl. In this study we found that hemoglobin level is a major risk factor for low birth weight among new born. In present study we found that hemoglobin level below <11 gm/dl had 1.4 times increased odds of having low birth weight. It is similar to previous study stating that in the third trimester, hemoglobin below 11 g/dL was 1.30 (95% CI: 1.08–1.58) times higher risk of low birth weight[6]. In our study, it also shows that as hemoglobin level decreases birth weight of new born also decreases from 0.001 to 0.4533 gm. Similar finding was found in a study stating that there was a 21-g decrease (p = 0.03) in the weight of the newborn per 1 g/dl of reduced maternal hemoglobin during the gestational period[7,10]. A unit increase in mean haemoglobin concentration in the third trimester or at delivery linearly increased birth weight by 14.0 (6.8 to 21.8) g[8]. Iron deficiency anaemia during pregnancy is a known risk factor for preterm birth, low birthweight and small-for-gestational age babies and increases the risk of postpartum haemorrhage (PPH)[9,11-12]. So it needs to be treated as soon as possible.

Limitations: This was a cross-sectional hospital-based study. Many of the data on the study variable was collected from hospital records. Hemoglobin levels were not analysed at different pregnancy trimesters. In some of our comparisons, the sample size may have limited our ability to detect a significant association.

Conclusion

The study findings suggest a significant association between low birth weight and hemoglobin levels during pregnancy. These issues need to be resolved to reduce the burden of low birth weight. Improving anaemic status through compliance with medication and nutrition will reduce this burden.

Recommendations

Since Anaemia is highly prevalent instead of so many government efforts. Compliance with IFA tablets need to be assessed. Educating pregnant women and family members for availing antenatal care should be ensured especially their spouse for compliance if IFA tablets and proper nutrition. Adequate sleep and proper nutrition are to be pregnant women must be adhered to.

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Conflict of interest: None

Ethical approval: Ethical clearance for the study was taken from the institutional ethical committee of R.D. Gardi Medical College, Ujjain, Madhya Pradesh before starting the study. Ethical clearance number IEC Ref no-136

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