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Original Research Article

Effect of maternal anemia on cord blood haemoglobin of newborn

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ABSTRACT

Background: Anemia during pregnancy is linked to major maternal and fetal problems. The aim of the study was to find any correlation between maternal anemia and neonatal cord blood haemoglobin (Hb) levels.

Methods: This cross-sectional study was done in the department of pediatrics and department of obstetrics and gynaecology at the Hind Institute of Medical Sciences, Barabanki over 9 months from January 2021 to September 2021. A total of 308 pregnant females more than 34 weeks of gestation who delivered participated in the study and cord blood hemoglobin of their new-born was collected. The mean maternal hemoglobin and mean cord blood hemoglobin were compared using the Pearson correlation coefficient in different groups i.e., non-anemic, anemic, mild, moderate, and severe anemic groups.

Results: Out of 308 pregnant women, 198 (64.3%) were anemic, and 110 (35.7%) were nonanemic. The mean maternal hemoglobin among non-anemic mothers and anemic mothers was 11.91 (0.70) and 9.14 (1.56) respectively. The Pearson correlation coefficient of non-anemic, anemic, mild, moderate, and severe anemic groups were 0.6985, 0.8453, 0.7772, 0.6321, and 0.7226 respectively with a statistically significant p value < 0.05 showing a positive correlation between maternal hemoglobin and cord hemoglobin.

Conclusions: From this study, we concluded that maternal anemia affects neonatal cord blood hemoglobin. According to the findings, anemic women deliver new-born with lower hemoglobin levels than non-anemic mothers. The findings revealed a linear correlation between maternal hemoglobin and cord blood hemoglobin of their new-born.

Keywords: Cord hemoglobin, Maternal anemia, New-born

INTRODUCTION

Anemia during pregnancy is very common in developing countries. According to data from the WHO/World Health Statistics, 40.1 percent of pregnant women worldwide were anemic in 2016.¹ The problem is particularly prevalent in Southeast Asian countries, where anemia is responsible for about half of all maternal mortality worldwide, with India accounting for nearly 80% of all maternal deaths in South Asia¹.

In India, the prevalence of anemia in pregnant women aged 15-49 years has decreased somewhat from 57.9 percent in the NFHS-3 (National Family Health Survey-2005-06) to

50.4 percent in the NFHS-4 survey (2015-16) but in NFHS-5 (2019-21) it has increased to 52.2 percent.²⁻⁴

Maternal anemia during pregnancy is defined as a Hb level of less than 11 g/dl, according to the WHO. Mild, moderate, and severe anemia in pregnancy is defined by Haemoglobin (Hb) values of 10 to 10.9 g/dl, 7 to 9.9 g/dl, and less than 7 g/dl, respectively.⁵ Maternal anemia has several negative consequences for both the mother and the fetus' health. Iron deficiency is the most prevalent cause of maternal anemia either due to reduced iron availability or increased iron demand by a developing fetus.⁶ Although, it can also be caused by dietary deficiencies (folic acid and vitamins A, B, and C), infections like

malaria or helminthiasis, or chronic diseases like TB or HIV.⁶ Previous studies have found a link between maternal anemia and negative pregnancy outcomes such as Low birth weight (LBW), preterm birth, Small-for-gestational-age (SGA), postpartum hemorrhage, and eclampsia.⁷

The umbilical cord blood Hb is an essential predictor of anemia in newborns at delivery.⁸ It was formerly assumed that regardless of the mother's Hb level, the baby would not be anemic. According to several research, women who had iron deficiency anemia during pregnancy gave birth to babies with decreased Hb levels in their cord blood.⁹ Recent research has discovered a linear correlation between mother Hb and cord blood Hb of newborns.¹⁰ Umbilical cord blood for newborn laboratory testing is a promising new method that has been found to enhance neonatal outcomes.¹¹ As a result, full implementation of this method is a critical step toward improved usage of umbilical cord blood in improving neonatal outcomes.

More research is required to validate the significant correlation between maternal Hb levels and neonatal cord blood Hb levels. The aim of the study was to see how maternal anemia affected newborn cord blood Hb.

METHODS

This cross-sectional study was done in the department of pediatrics and department of obstetrics and gynaecology at the Hind Institute of Medical Sciences, Safedabad, Barabanki over 9 months from January 2021 to September 2021. All pregnant women more than 34 weeks of gestation and their new-borns were included in the study. We excluded those mothers who had risk factors like antepartum haemorrhage, gestational diabetes mellitus, pregnancy-induced hypertension, renal diseases, hypothyroidism, and those newborns with twin deliveries, birth asphyxia, congenital anomalies, and pathological jaundice e.g., Rh incompatibility. A total of 308 pregnant females participated in the study and the cord blood Hb of their new-borns was collected after obtaining informed consent from them. Maternal Hb was tested before delivery and mothers were divided into two groups based on maternal Hb levels: non-anemic (Hb \geq 11 g/dl) and

anemic group (Hb <11 g/dl). The anemic group was further divided into mild (Hb 10-10.9 g/dl), moderate (7-9.9 g/dl), and severe anemia groups (Hb<7 g/dl). The conventional spectrophotometric cyanmet Hb methodology was used to quantify the Hb concentration.

The sample size was calculated to be 264 with a confidence interval of 95% and a margin of error of 5% by using the formula:

$$\frac{4PQ}{L^2}$$

taking 78 percent prevalence of anemia at the time of delivery in antenatal mothers from a recent study from Northern India.¹² The actual study was done on 308 mothers. Data were analyzed in descriptive statistics using SPSS software version 26. The Pearson correlation coefficient was used to find a linear correlation between maternal anemia and cord blood Hb with a p value of less than 0.05 was considered statistically significant.

RESULTS

In the present study, 308 pregnant females were enrolled. Table 1 depicts the demographic profile of subjects. Out of 308 pregnant women, 198 (64.3%) were anemic, and 110 (35.7%) were nonanemic. The mean age [standard deviation (SD)] of non-anemic women and anemic women were 26.44 (4.78), and 25.96 (4.47) respectively. Among the 198 anemic mothers, 89 (44.94%) had mild anaemia (Hb level:10-10.9 g/dl), 84 (42.42%) had moderate anaemia (9.9-7 g/dl) and 25 (12.62%) had severe (<7 g/dl) anaemia (Figure 1).

The mean maternal Hb and mean cord blood Hb were compared among non-anemic groups using the Pearson correlation coefficient (R=0.6985) and found to be positively correlated with statistically significant with a p value of <0.00001. Similarly, the Pearson correlation coefficient of anemic, mild, moderate, and severe anemic groups were 0.8453, 0.7772, 0.6321, and 0.7226 respectively with a statistically significant p value<0.05 showing a positive correlation between maternal Hb and cord Hb (Table 2).

Table 1: Demographic profile of subjects (n=308).

Parameters	Number of subjects		
	N	%	
Age of mother (year)	<20	21	6.8
	20-30	230	74.7
	>30	57	18.5
Livelihood	Rural	199	64.6
	Urban	109	35.4
Education	Illiterate	25	8.1
	Below high school	96	31.2
	Above high school	187	60.7
Socio-economic status	Low	67	21.8

Continued.

Parameters	Number of subjects		
	N	%	
	Middle	212	68.8
	Upper	29	9.4
Religion	Hindu	152	49.3
	Muslim	108	35.1
	Sikh	15	4.9
	Christian	10	3.2
	Others	23	7.5
Gestational age (weeks)	34-<37	165	53.6
	≥37	143	46.4
Primigravida		139	45.1
Multigravida		169	54.9
Mode of delivery	Vaginal	189	61.4
	Caesarean section	93	30.2
	Instrumental delivery	26	8.4
Birth weight (g)	<2500	185	60.1
	≥2500	123	39.9
Sex of new-born	Male	171	55.5
	Female	137	44.5

Note: *Number in parenthesis indicates the percentage.

Table 2: Correlation between maternal Haemoglobin (Hb) (g/dl) and cord Hb (g/dl) among pregnant women (N=308).

Pregnant women Hb in g/dl	N	Mean maternal Hb in g/dl (SD)	Mean cord Hb in g/dl (SD)	Pearson correlation coefficient (R)	P value**
Non-anemic (Hb≥11)	110	11.91 (0.70)	16.82 (1.48)	0.6985	<0.00001
Anemic (Hb<11)	198	9.14 (1.56)	15.38 (0.99)	0.8453	<0.00001
Mild anemic (Hb 10-10.9)	89	10.45 (0.28)	15.97 (0.98)	0.7772	<0.00001
Moderate anemic (Hb 7-9.9)	84	8.65 (0.86)	15.06 (0.64)	0.6321	<0.00001
Severe anemic (Hb<7)	25	6.13 (0.72)	14.32 (0.55)	0.7226	0.000045

Note: *Data presented as mean [Standard deviation (SD)]; **p value less than 0.05 being statistically significant.

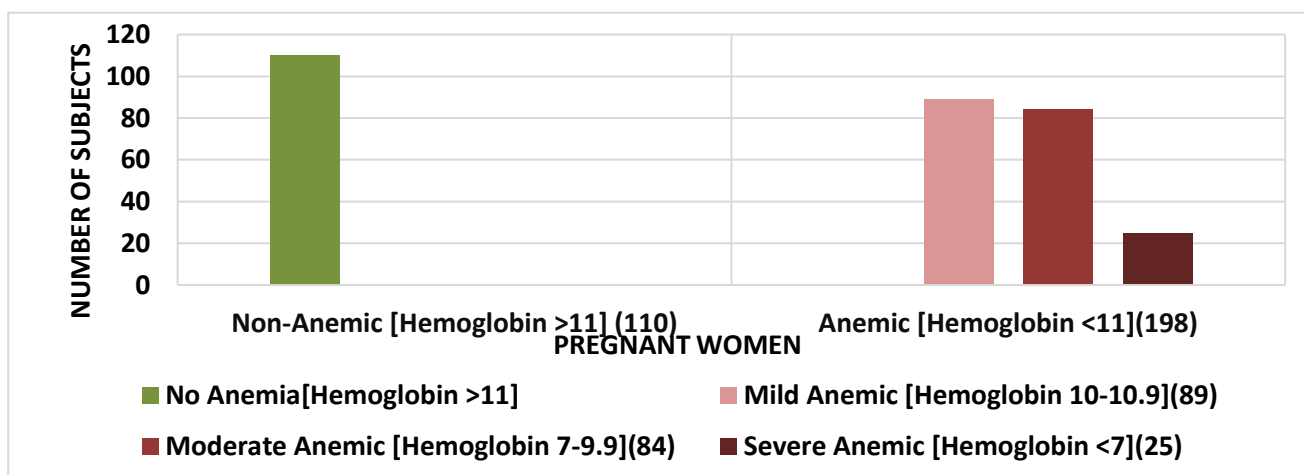


Figure 1: Distribution of pregnant mothers according to Hb values (g/dl) (N=308).

DISCUSSION

In the present study, 230 (74.7%) pregnant women were between the age of 20-30 years, 199 (64.6%) were from rural livelihood, 187 (60.7%) were educated above high school standard, 212 (68.8%) were from middle

socioeconomic status, 152 (49.3) were Hindus and 108 (35.1) were Muslims, 165 (53.6%) were between 34-<37 weeks gestational age, 169 (54.9%) were multigravida, 189 (61.4%) delivered vaginally, 185 (60.1%) delivered babies with birth weight <2500 g and 171 (55.5%) were males (Table 1). Our study findings matched those of

Klebanoff et al (1991) and Lu et al (1991), who reported a relationship between maternal anemia and a higher risk of preterm delivery.^{13,14} The present study findings were similar to a study done by Prasad et al who reported a positive significant association with an increasing number of children and gravida status.¹⁵ Our findings were comparable to those of Tembhare et al who discovered that the number of vaginal deliveries, instrumental deliveries, and caesarean sections (LSCS) was similar in both anemic and non-anemic mothers, but that more anemic mothers required induction of labor.¹⁶ Our findings matched those of Figueiredo et al who found that maternal anemia was linked to low/insufficient birth weight, indicating that it was a risk factor for the gestational outcomes evaluated.¹⁷

The present study compared maternal Hb to neonatal cord Hb to see if there was any correlation between the two measurements. As the mean maternal Hb decreased, the mean cord Hb fell as well indicating a linear correlation between cord Hb and maternal Hb in our study. This indicates that maternal anemia affects cord Hb. This shows that at higher levels of anemia, placental iron transport mechanisms may fail, resulting in a drop-in cord Hb.

Findings from our study were similar to a study done by Timilsina et al which reported maternal and foetal Hb had a moderately positive correlation.¹⁸ Our findings were comparable to a study done by Sareen et al which concluded that neonates born to anemic mothers had lower cord blood Hb as compared to non-anemic mothers.¹⁹ Also, our findings were akin to a study conducted at Babylon University by Najeeba et al which found a linear relationship between maternal Hb and new-born cord haemoglobin.²⁰ Debbarma et al found a linear association between the cord and maternal Hb, which is similar to the current study.²¹ In another study done by Mamoury et al from North-eastern Iran reported contradictory findings that there is no association between cord blood Hb and maternal Hb.²²

Limitations

Limitations of the study were as follows: (a) the iron status of the mother was not determined; and (b) maternal Hb levels were not determined in the first and second trimesters.

More research could be done by correlating maternal Hb levels and iron status in the first, second, and third trimesters of pregnancy to low cord Hb levels in anemic mothers.

CONCLUSION

This study concluded that maternal anemia affected neonatal cord Hb. According to the findings, anemic mothers deliver babies with lower Hb levels than non-anemic mothers. The findings reveal a linear correlation between maternal Hb and cord blood Hb of their newborns. Prophylaxis during pregnancy might prevent

anemia in underdeveloped nations like India, perhaps lowering the risk of foetal and maternal problems thereby improving overall new-born survival rates.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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