Original Research Article

STUDY OF CORRELATION OF MATERNAL HEMOGLOBIN WITH CORD BLOOD HEMOGLOBIN AND ANTHROPOMETRIC MEASUREMENT OF NEONATE

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ABSTRACT

Background
Pregnancy-related anaemia is very common, particularly in developing countries. There are several contributing factors, with nutritional anaemia being the most prevalent one. Anthropometric measures and other neonatal outcomes are known to be negatively impacted by maternal anaemia. The present study was done to find the correlation of maternal hemoglobin with cord blood hemoglobin and anthropometric measurement of neonate.

Methods
The prospective cross sectional study was conducted at department of obstetrics and gynecology and pediatrics among 100 admitted pregnant patients for duration of one year. Detailed demographic and clinical history was taken. A 5% threshold for significance was used to calculate results. Every p-value less than 0.05 was regarded as significant.

Results
Mean maternal age was 26 years and mean gestational age was 38 weeks. 63% had mild anemia, 34% had moderate anemia and 3% had severe anemia. The Pearson correlation coefficient of mild, moderate, and severe anemic groups were 0.787, 0.643 and 0.715 respectively with a statistically significant p value <0.001. A positive association was noted between maternal haemoglobin and birth weight, length and head circumference of the baby and was statistically significant (p<0.001).

Conclusion
We concluded that newborn cord blood haemoglobin is impacted by maternal anaemia. The results show neonates born to anaemic mothers have lower haemoglobin levels. Neonatal anthropometry is severely hampered by maternal anaemia.
Keywords – anthropometric, cord blood hemoglobin, corrleation, maternal hemoglobin,neonate.

INTRODUCTION

Throughout pregnancy, maternal physiology experiences many changes in haematological parameters, with an average increase in blood and plasma volume of 40–50% [1]. Hemodilution has a noticeable impact on hematocrit readings. The blood test that is most frequently suggested is a complete blood count. In assessing hematopoietic function and diagnosing associated disorders, it is frequently the initial step [2]. Throughout the embryonic stage, the growing foetus experiences hematopoiesis in several regions. It migrates from the embryonic yolk sack to the foetal liver and premature marrow after first beginning there. But in adulthood, hematopoiesis is mainly limited to the bone marrow [3].

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.[4] Maternal anemia has several negative consequences for both the mother and the fetus' health.

Haemoglobin from the umbilical cord blood is a key hematologic characteristic of infants. Hematocrit levels and haemoglobin have historically been used in tandem for the diagnosis and management of newborn anaemia [5]. In addition, various hematologic indicators such as the platelet and white blood cell counts are valuable in evaluating newborn sepsis and the infant's hemostatic condition [5].

Due to severe placental insufficiency and higher perinatal mortality rates, newborns of anaemic mothers experience unfavourable perinatal outcomes such as preterm and Small for Gestational Age (SGA) babies, Intrauterine Growth Restriction (IUGR), and Intrauterine Death (IUD). These infants are susceptible to illness and stunted growth because they have minimal or no iron reserves [6,7]. These babies' long-term effects include diminished cognitive abilities, trouble in school, and aberrant behaviour. Additionally, they do poorly on the Bayley scale for measuring infant development, and they are more likely to develop hypertension and cardiovascular disease as adults [8,9]. This is caused by a lack of chemical mediators in the developing brain as a result of the mother's iron deficit. Preterm exacerbates each of these problems.

In view of importance attached to such high prevalence of maternal anaemia and adverse maternal and foetal complications associated with it the present study was conducted to study the correlation of maternal hemoglobin with cord blood hemoglobin and anthropometric measurement of neonate.

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MATERIAL & METHODS

The present prospective cross sectional study was conducted at department of obstetrics and gynecology and pediatrics among admitted pregnant patients for duration of one year. Ethical permission was taken from institutional ethical committee before starting of the study. Patients were asked to sign informed consent form after explaining them about complete procedure of study.

Total 100 pregnant women who visited to hospital were taken for the study on the basis of inclusion and exclusion criteria.

Inclusion criteria

Pregnant females in the age range of 18 to 35 who had low maternal haemoglobin levels during the second or third trimester of pregnancy, a single gestation, and full-term babies.

Exclusion criteria

Females with diagnoses of renal or heart disease, connective tissue disease, hemoglobinopathies (such as thalassemia), (R)ubella, (C)ytomegalovirus, and (H)erpes Simplex infection, as well as those who were smokers, alcoholics, or known to have diabetes mellitus and hypertension prior to pregnancy, babies born prematurely, with skeletal abnormalities or any other congenital birth defects, or after repeated gestations.

Methods

An extensive history was documented. Gravida was inquired of enrolled mothers. Mother's BMI, weight, and height were computed and split into four groups. Two groups—one for IFA supplementation taken, the other for IFA not taken—were requested to participate.

Peripheral vein punctures were used to obtain blood samples from the pregnant individuals under aseptic precautions so that the Cyanmethaemoglobin technique could be used to determine their haemoglobin levels before to birth.

The basic idea behind this technique is to convert haemoglobin to cyanmethaemoglobin by adding ferricyanide and potassium cyanide, the absorbance of which is measured in a photoelectric calorimeter at 540 nm in comparison to a reference solution [9]. According to WHO guidelines, anaemia in pregnancy is defined as having a haemoglobin concentration of less than 11 g/dL. Based on the maternal haemoglobin levels, pregnant anaemic women are classified into three groups: (a) mild anaemia, defined as 10.9–9.0 g/dL; (b) moderate anaemia, defined as 8.9–7.0 g/dL; and (c) severe anaemia, defined as <7 g/dL [10]. Within 48 hours of birth, every singleton live birth included in the study was investigated. A birth weight of more than 2.5 kg was regarded as normal. The birth weight was measured using an electronic digital weighing scale with an accuracy of 10 grammes. An infantometer was used to measure length, and a non-stretchable tape was used to measure head circumference. The proforma contained documentation for every parameter.

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Results were noted, and descriptive statistics like mean and standard deviation (SD) were used to convey quantitative data, while frequency and percentage were used to present qualitative data. Tests like the Wilcoxon Mann-Whitney U test, the Kruskal-Walis test, and the Spearman's correlation test for association were used to help with additional statistical analysis. A 5% threshold for significance was used. Every p-value less than 0.05 was regarded as significant.

RESULTS

In the present study mean maternal age was 26 years and mean gestational age was 38 weeks. Out of 100 females 45% had primigravida and 55% had multigravida. 63% had mild anemia, 34% had moderate anemia and 3% had severe anemia. 40% of females doesn’t took any IFA supplementation and 60% took IFA supplementation. 75% of females had BMI 18.5-22.9. The mean baby birth weight was 2487.23 gms, mean baby length was 48 cm, mean baby head circumference was 35 cm.

Table 1 demographics of maternal and neonatal history

Maternal parameters		Mean ± SD/ percentage
Maternal age (years)		26.78± 4.21
Gestational age (weeks)		38.76±2.31
Gravida	Primigravida	45%
	Multigravida	55%
Anaemia	Mid	63%
	Moderate	34%
	Severe	3%
IFA supplementation	Not taken	40%
	Taken	60%
Maternal BMI	<18.5	6%
	18.5-22.9	75%
	23-24.9	17%
	25-29.9	2%
Neonatal parameters	Birth weight (gm)	2487.23±330.2
	Baby length (cm)	48.12±2.13
	Head circumference (cm)	35.23±1.03

Correlation between maternal Haemoglobin (Hb) (g/dl) and cord Hb (g/dl) among pregnant women was determined. The Pearson correlation coefficient of mild, moderate, and severe anemic groups were 0.787, 0.643 and 0.715 respectively with a statistically significant p value <0.001showing a positive correlation between maternal Hb and cord Hb as shown in table 2.

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Table 2 Correlation between maternal Haemoglobin (Hb) (g/dl) and cord Hb (g/dl) among pregnant women

Type of anemia	Frequency	Mean ± SD maternal Hb in g/dl	Mean ± SD cord Hb in g/dl	Pearson correlation	P value
Mild	63	10.43±0.27	15.43± 0.96	0.787	<0.001
Moderate	34	8.68±0.87	15.03±0.64	0.643	<0.001
Severe	3	6.23±0.71	14.39±0.58	0.715	<0.001

A positive association was noted between maternal haemoglobin and birth weight, length and head circumference of the baby (better maternal haemoglobin resulted in improved neonatal anthropometry) and was statistically significant ($p<0.001$) as shown in table 3.

Table 3 Effect of maternal hemoglobin on neonate anthropometric measurement

Maternal hemoglobin	Mean±SD birth weight in grams	Mean±SD baby length in cm	Mean±SD baby head circumference in cm
Mild anemia	2739.17±267.32	47.32±2.10	35.41±0.54
Moderate anemia	2287.38±280.09	45.21±2.18	34.08±1.87
Severe anemia	1879.07±181.20	42.19±2.09	32.90±1.90
P value	<0.001	<0.001	<0.001

DISCUSSION

Pregnant women may experience both pathological and physiological anaemia. The most frequent cause, nutritional anaemia, might be mild or severe. Of the 100 mothers in the current study cohort who were anaemic, the majority (63%) had mild anaemia.

The majority of participants in comparable trials by Desalegn S and Lokare PO et al. had moderate anaemia (74.3% and 54.4%, respectively) [11,12]. This change may have resulted from better supplement intake and improved nutrition over time in the urban area where the study was done.

In order to determine whether there was any association between the two values, the current study compared maternal Hb to neonatal cord Hb. In our investigation, we found a linear association between cord Hb and maternal Hb, with the mean cord Hb falling as the mean maternal Hb decreased. This suggests that cord Hb is impacted by maternal anaemia. This demonstrates that placental iron transport pathways may malfunction at higher anaemia levels, leading to a reduction in cord haemoglobin.

The results of our investigation were in line with those of a study by Timilsina et al., which found a somewhat favourable association between maternal and foetalhaemoglobin.[13] Our results were in line with a study by Sareen et al. that found that newborns born to anaemic mothers had lower cord blood haemoglobin levels than babies delivered to non-anemic mothers.[14] Additionally, our results were similar to a study by Najeeba et al. at Babylon

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University that discovered a linear association between mother haemoglobin and newborn cord haemoglobin.[15] Similar to the current investigation, Debbarma et al. discovered a linear correlation between the cord and maternal Hb.[16] Contradictory results from a another study by Mamoury et al. from northeastern Iran indicated that there is no connection between maternal and cord blood Hb.[17]

Low maternal haemoglobin levels limit the body's ability to circulate oxygen, resulting in an environment of persistent hypoxia or oxidative stress. This can lead to foetal growth restriction, which lowers the newborn's anthropometric measurements [18]. The current study's findings showed a statistically significant inverse relationship between the mean newborn birth weight, length, and head circumference with the degree of anaemia.

In the current study, the mean birth weight of neonates with mildanaemia was determined to be 2739.17±267.32 gm, for mothers with moderate anaemia to be 2287.38±280.09 gm, and for mothers with severe anaemia to be 1879.07±181.20 gm. Similar studies by Behal M et al., Al-Hilli NM, Kumar NP, and Pabbati J found that the mean birth weight in cases of mild anaemia was 2560 gm, 3100 gm, and 2844 gm; in cases of moderateanaemia, the mean birth weight was 2536 gm, 2700 gm, and 2670 gm; and in cases of severeanaemia, the mean birth weight was 2261 gm, 2200 gm, and 2227 gm [19-21]. In line with the current investigation, these data also revealed a statistically significant association between maternal haemoglobin and birth weight.

In the current study, the mean baby length for mothers with mild, moderate, and severe anaemia was 47.32cm, 45.21 cm, and 42.19 cm, respectively. In a related study, Behal M et al. discovered that the mean baby length in moms with mild, moderate, and severe anaemia was 49 cm, 48 cm, and 45 cm [19]. When baby lengths from anaemic and non-anemic moms were compared in a different study by ParamahamsaRRK and Chakravarthi GK, it was discovered that 74.1% of neonates with short crown heel length were born to anaemic moms. [22]. Each of these outcomes was consistent with the current investigation and statistically significant.

In our investigation, the mean neonate head circumference was 35.41, 34.08 and 32.90 cm for mothers who were mildly, moderately, or severely anaemic; in the study conducted by Behal et al., it was 34 cm, 33 cm, and 32 cm, respectively [19]. According to a study by ParamahamsaRRK and Chakravarthi GK, low head circumference was present in 67.9% of newborns born to anaemic moms [22]. These outcomes were consistent with the current investigation and also statistically significant. The mean length and head circumference of neonate at birth dramatically decreased as the severity of anaemia rose, as established in all prior investigations, which was consistent with the current study.

The prospective nature of this study, which described the maternal haemoglobin effect on all neonatal anthropometric characteristics, was its strongest point.

One of the study's limitations was that the mother's serial haemoglobin samples could not be taken according to trimester, and the participants could not be followed up on over an extended period of time to track improvements in neonatal development.

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CONCLUSION

This study found that newborn cord Hb was impacted by maternal anaemia. The results show that neonates born to anaemic mothers have lower haemoglobin levels. The results show a linear relationship between the mother's and her neonates cord blood haemoglobinlevels. anaemia in Pregnancy was associated with a statistically significant detrimental effect on the baby's birth weight, length, and head circumference in proportion to the anemia's severity. It highlights even more how important it is for women in the reproductive age group to have access to a comprehensive public health programme that guarantees sufficient intake of micro- and macronutrients, both of which are necessary for a successful pregnancy.

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