

A study to assess the relationship between maternal haemoglobin with birth weight and crown heel length in term neonates.

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Abstract

Background: Anaemia in pregnancy is a major risk factor for poor neonatal outcomes such as low birth weight, prematurity, small for gestational age babies. The present study aimed at evaluating the association between maternal haemoglobin and outcome in the parameters of birth weight and length in term neonates.

Objectives: To find out the association of maternal haemoglobin with the birth weight and crown heel length of the term neonate.

Methods: It was an observational study including 350 term neonates over a period of 6 months carried out at PDMMC, Amravati. The data was collected and bio statistically analysed to obtain the results.

Results: It was observed that before delivery, 51% and 9.7% mothers had normal and high haemoglobin levels respectively. The remaining were identified as anaemic with 20.9% mild, 17.7% moderate and 0.6% severe anaemia. At the 10% level of significance, the results revealed a significant relationship of maternal haemoglobin with neonatal birth weight. It was found that high haemoglobin levels did not affect the birth weight of the baby. However, we did not find any significant association of maternal haemoglobin with the length of the neonate. The observations recorded a remarkable impact on the length of the females as compared to males born to anaemic mothers.

Conclusion: Our study concluded that mothers with mild, moderate and severe anaemia gave birth to low birth weight neonates. But this relationship is insignificant in association with the length of the neonate.

Keywords Maternal haemoglobin; Anaemia; Neonate; Term

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Introduction

Anaemia has been defined as a condition in which there is a diminished capacity of blood of carrying oxygen because of a less than normal number of RBCs (Red Blood Cells) and/or a reduced haemoglobin concentration [1]. It has been recognized as a crucial health concern in the public affecting developed as well as developing countries. It is more common in pregnant women and kids. According to the 2021 Global Nutrition Report (GNR) [2], one in two Indian women of the reproductive age is anaemic and a gradual increase was observed in its prevalence since 2016 to 2020 from 52.6%-53%. Pregnant women in the reproductive age group having haemoglobin level less than 11 grams/decilitre are reckoned to be anaemic as defined by the World Health Organization (WHO) [3]. Indian Council of Medical Research (ICMR) has classified anaemia in pregnancy as mild anemia having haemoglobin levels 10-10.9 grams/decilitre, moderate anemia having haemoglobin levels 7-9.9 grams/decilitre, severe

anemia having haemoglobin levels 4-6.9 grams/decilitre and very severe anemia having hemoglobin levels less than 4 grams/decilitre [4]. The leading source of anaemia is deficiency of iron which can occur before and/or during pregnancy. This may be due to the inadequate dietary intake associated with increase in the demand of iron, which pose a greater risk for iron deficiency in pregnant mothers [5]. Other possible causes may include previous pregnancy within the gap of two year and the history of heavy menstrual flow before the women became pregnant. Iron is a critical component for fetal growth. The placenta transfers iron from the mother to the fetus, with 80% transmitted in the course the 3rd trimester of pregnancy [6]. Third trimester has been said to remarkably increase the process of fetal growth and development. And as the development of the fetus depends on the nutrient consumption and oxygen delivery through the placenta of the pregnant mother, low iron concentration during this time may affect the outcome of pregnancy. There are various studies suggesting that women with anaemia have a higher probability of

delivering babies with Low Birth Weight (LBW), preterm babies and Small for Gestational Age (SGA) babies [7-9]. A few studies have found significant association between anemic mothers and neonatal anthropometric measurements. Ali et al., P N Singla et al., Manpreet Kaur et al., has observed that the weight, length and other anthropometry were less in neonates who were born to mothers having anaemia vs mothers which did not have anaemia [10-12]. However, certain studies found no apparent association between maternal anaemia and neonatal anthropometry [13-15]. K Rasmussen concluded that birth weight was only affected in low (<8 g/dl) and high concentrations of maternal haemoglobin. N Milman stated that increased concentrations of maternal haemoglobin can affect neonatal birth weight because of inappropriate hemodilution when associated with pre-eclampsia and eclampsia during pregnancy, and only anaemia which was classified as severe that is having haemoglobin less than 8.5 g/dl affected the birth-weight of neonate. Sandra lucia et al., results differed from the above conclusions and reported no pronounced association of maternal haemoglobin with birth weight of the newborns born to mother with Hb more than 11 grams/decilitre and mothers with haemoglobin less than 11 grams/decilitre. The present study carried out in a tertiary care unit aims to evaluate the maternal haemoglobin level before birth as well as its impact on the neonatal growth parameters in term babies namely birth weight and length.

Aim

To assess the association of maternal haemoglobin with the neonatal birth weight and length.

Objectives

- To find out the association between maternal haemoglobin and birth-weight of the term neonate.
- To find out the association of maternal haemoglobin with crown-heel length of the term neonate.

Materials and Methods

Study design and population

The present study was an observational study carried out in Dr. Panjabrao Deshmukh Hospital and Research Centre, Amravati which is a tertiary health care centre, for over a duration of six months from November 2021 to April 2022. The study area chosen for data collection was Postnatal Care Ward (PNC).

Study sample size

The calculated sample size was 322, which could round upto 350. Thus, as per the inclusion and exclusion criteria we included 350 neonates in the study. Where, the confidence interval was 95%, margin of error was 0.05% and the sample proportion was 70%.

Ethics Committee Approval

The project was approved by Symbiosis School for Open and

Distance Learning, Constitute of Symbiosis International (Deemed University) with Ref. No: 3781.

Inclusion Criteria

Both male and female term neonates having gestational age ranging from 37-42 weeks were included in the study.

Exclusion Criteria

- 1 Preterm babies
- 2 Post-term babies
- 3 Twins or multiple births
- 4 Babies admitted to the NICU
- 5 Neonates with congenital anomalies
- 6 Babies delivered to mothers with pre-existing disease conditions such as diabetes mellitus, hypertension, thyroid, asthma, etc.
- 7 Unwillingness of subject's parents/guardian to give consent.

Data collection procedure

We obtained an informed written consent from the parents prior to the collection of the data. Data was collected primarily from subject's medical chart and interview method. Baby's details such as sex, gestational age, birth weight, time of birth, date of birth, and mode of delivery was recorded. In addition, relevant history of mother such as age, LMP, EDD, gravida, parity, iron and folic acid supplementation, haemoglobin level, pre-existing medical condition was collected and recorded.

Birth weight

Babies were weighed naked immediately after birth by means of a digital weighing scale.

Length

The length was obtained within 24 hours after birth by placing the baby in supine position on the board and markings the head and foot ends and then measured using a tape.

Maternal haemoglobin

It was recorded from investigations done before delivery.

Statistical analysis of the data

In this study, we applied a Fisher's exact test for examining the relationship of maternal haemoglobin with neonatal birth weight and length. The interrelation was carried out using 10% level of significance. Where, normal range of haemoglobin was 11-13 g/dl. Mothers with haemoglobin levels below this estimation were considered as anaemic. Normal birth weight was 2500-3500 grams. LBW neonates have been categorized as the neonates who weighed less than 2500 grams at birth. Normal length of the neonate ranges from 46 cm to 53 cm. Neonatal length range less or more than this estimation was considered abnormal.

Results

In the present study, 174 and 176 out of the total 350 neonates were included in the study. The study noted that from haemoglobin levels obtained before delivery, 9.7% of the mothers had high haemoglobin levels (>13.5 g/dl), and 51.1% had normal haemoglobin levels (11-13.5 g/dl). Out of the remaining mothers, 20.9% were found to have mild, 17.7% were found to have moderate and 0.6% were found to have severe anaemia.

Section I

Analysis of data related to association of maternal haemoglobin with the weight of the term neonate (Table 1).

Hb	Weight			p-value
	High	Low	Normal	
High	2	4	25	0.096
Normal	10	25	145	
Mild	0	15	60	
Moderate	2	16	44	
Severe	0	1	1	

Table 1: The association of maternal haemoglobin levels with the weight of the term neonate (N=350).

In this study, we used the Fisher's exact test to determine the relationship between maternal hemoglobin and weight of the term neonate. Since p-value corresponding to this test is 0.096 which is greater than 0.05 but less than 0.10, so this association is significant at 10% level of significance. Majority of the neonates with high weight had normal maternal haemoglobin and majority of the neonates with normal weight had normal maternal haemoglobin (Table 2).

Gender	Weight			p-value
	High	Low	Normal	
Female	8	33	133	0.646
Male	6	28	142	

Table 2: Relation between gender of the baby and birth weight (N=350).

In the present study, we used the Fisher's exact test to determine the relationship of the gender of the term neonate with weight. Since p-value corresponding to this test is 0.646 which is >0.10, so the association of gender with weight of the neonate is not statistically significant at 10% level of significance.

Section II

Analysis of data related with the association of maternal haemoglobin with the length of the term neonate (Table 3).

Hb	Length		p-value
	Abnormal	Normal	
High	4	27	0.411
Normal	19	161	
Mild	7	68	
Moderate	5	57	
Severe	1	1	

Table 3: Fisher's exact test for the association of maternal haemoglobin with the length of the term neonate (N=350).

In the present study, we applied Fisher's exact test for the association of maternal haemoglobin with the length of the term neonate. Since p-value corresponding to this test is 0.411 which is greater (greater than 0.10), so the association between haemoglobin and length is not significant at 10% level of significance (Table 4).

Gender	Length		P-value
	Abnormal	Normal	
Female	23	151	0.08
Male	13	163	

Table 4: Relation between gender of the baby and length (N=350).

In the present study, we applied the Fisher's exact test for the association between genders with the length of the term neonate. Since p-value corresponding to this test is 0.080 which is >0.05 but <0.10, so the association of gender with length of the neonate is significant at 10% level of significance. 13.2% of the female neonates had abnormal length whereas 7.6% of the male neonates had abnormal length.

Discussion

In the present study, we found a significant association of maternal haemoglobin levels (7-10.9 g/dl) which indicate anaemia in pregnant women and weight of the neonate at birth. Our result is similar to the studies done by Yunus Yildiz et al., [16], Manpreet Kaur et al., [17], K Jagadish Kumar et al., [18] and Elhassan M Elhassan et al., [19] who have mentioned that the severity of anaemia increases the risk of low birth weight in neonates.

There were no remarkable findings in association between maternal haemoglobin and length of the neonate. And this result is contradictory to the findings in studies done by Paramahamsa RRR et al., [20], Manpreet Kaur et al., [17] and Adhikari et al., [21]. Also, no significant relationship between gender and weight of the neonate was noted.

The present study showed a significant relationship between the gender and the length of the neonate which is supported by the past studies. This finding is similar to the study done by Samta Gaur et al., who stated that the length of the female babies is less than males born to anaemic mothers.

The shortcoming of the study was that the sample size was less. In addition, the study included only a single value of haemoglobin which was taken antenatally before the delivery.

The strength which support the result is that the women included on the study had term neonates (37-42 weeks gestation) with no previous medical conditions or health problems during pregnancy and most importantly majority of the women had taken iron and folic acid supplements during pregnancy. As a result, the obtained result was less significant.

Conclusions

In the present study,

- The neonates born to the mothers with mild, moderate and severe anaemia that is haemoglobin levels (7-10.9 g/dl) had low birth weight.
- There was a significant relationship between anaemic mothers and birth weight of the neonate.
- There was no association between the maternal haemoglobin level and large for gestational age babies.
- There was no significant finding in relation to the maternal haemoglobin and length of the baby.
- The gender of the baby did not show any association with the birth weight.
- The gender of the baby showed a positive correlation with the length of the neonate.
- The length of the female babies were more affected than the males.

References

1. NHLBI. Your guide to anaemia. National Heart a Blood Institute 2011;11(8):7629.
2. WHO. Global Health Observatory Data/World Health Statistics. Prevalence of anaemia in women of reproductive age 2022.
3. WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System 2011.
4. Raut AK, Hiwale KM, Hiwale KM. Good clinical practice recommendations for iron deficiency anemia in pregnancy (IDA) in pregnancy in India. J Obstet Gynaecol India. 2011;61(5): 569–571.
5. Allen LH. Anemia and iron deficiency: Effects on pregnancy outcome. Am J Clin Nutr 2000; 71(5): 1280S-1284S.
6. Cerami C. Iron nutriture of the fetus, neonate, infant, and child. Ann Nutr Metab 2017; 71(Suppl. 3):8-14.
7. Sekhavat L, Davar R, Hosseinidezoki S. Relationship between maternal hemoglobin concentration and neonatal birth weight. Hematology 2011; 16(6):373-376.
8. Steer P, Alam, M Wadsworth, et al. Relation between maternal haemoglobin concentration and birth weight in different ethnic groups. BMJ 1995; 310(6978), 489-491.
9. Kozuki N, Lee AC, Katz J, et al. Moderate to severe, but not mild, maternal anemia is associated with increased risk of small-for-gestational-age outcomes. J Nutr. 2012 1;142(2):358-362.
10. Ali SM, Murad AM. Effect of maternal hemoglobin on anthropometric measurements of full term newly born babies. Iraqi J Med Sci 2013; 11(2):176-180.
11. Singla PN, Tyagi M, Kumar A, et al. Fetal growth in maternal anaemia. J Trop Pediatr 1997; 43(2):89-92.
12. Kaur M, Chauhan A, Manzar MD, et al. Maternal anaemia and neonatal outcome: A prospective study on urban pregnant women. J Clin Diagn Res 2015; 12:QC04.
13. Al-Hajjiah NN, Almkhadree MA. The effect of maternal anemia on the anthropometric measurements in fullterm neonates. Asian J Pharm Clin Res 2018; 11(4):422-424.
14. KHAN MM. Effect of maternal anaemia on fetal parameters. J Ayub Med Coll Abbottabad 2001; 13(2): 38-41.
15. Paramahamsa R, Chakravarthi GK. Study on relationship between maternal haemoglobin and the early neonatal outcome in term babies. Int J Contemp Pediatr 2019; 6(5): 1938-1942.
16. Yildiz Y, Özgü E, Unlu SB, et al. The relationship between third trimester maternal hemoglobin and birth weight/length; results from the tertiary center in Turkey. J Matern Fetal Neonatal Med 2014; 27(7):729-732.
17. Kaur M, Chauhan A, Manzar MD, et al. Maternal anaemia and neonatal outcome: A prospective study on urban pregnant women. J Clin Diagn Res 2015; (12):QC04.
18. Kumar KJ, Asha N, Murthy DS, et al. Maternal anemia in various trimesters and its effect on newborn weight and maturity: An observational study. Int J Prev Med 2013; 4(2):193.
19. Elhassan EM, Abbaker AO, Haggaz AD, et al. Anaemia and low birth weight in Medani, Hospital Sudan. BMC Res Notes 2010; 1:1-5.
20. Paramahamsa RR, Kumar SS, Thayi S, et al. Incidence of early-onset neonatal sepsis in relation to prolonged rupture of membranes. Indian J Child Health 2019:552-554.
21. Mahamuda B, Tanira S, Feroza W, et al. Effects of maternal anaemia on neonatal outcome-a study done in the specialized urban hospital set up in Bangladesh. Bangladesh J Medical Sci 2011; 10(3).

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