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Effects of Third Trimester Maternal Hemoglobin Upon Newborn Anthropometry

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Abstract

Introduction: Maternal anemia during pregnancy can lead to poor fetal outcome as risks of morbidity and mortality is increased. **Materials and Methods:** All Singleton pregnancies delivered in MMIMSR, Mullana, Ambala from 5 April 2012 to 5 October 2012 fulfilling the criteria were included. The pregnant mothers were grouped into 4 categories according to the corresponding hemoglobin concentration: normal (=or>11), mild (10.9-9.0g/dl), moderate (8.9-7.0 g/dl), and severe anemia (less than 7 g/dl). **Results:** Out of 334 pregnant women included in the study 249 (74.6%) were found to be anemic. Among anemic mothers 9 had severe (2.7%), 51 had moderate (15.3%) and 189 had mild (56.6) anemia. The anthropometric measurements (birth weight, length, chest circumference, head circumference) with decreasing severity of anemia showed statistically significant difference (p = 0.000, p = 0.000, p = 0.017, p = 0.001) respectively. It was seen that as the number of pregnancies (gravida) increases the severity of anemia increases with each pregnancy. **Conclusion**: Anemia during pregnancy negatively affected the anthropometric measurements of a newborn and severe anemia had significant negative effect on neonatal anthropometric measurements.

Key words: Maternal hemoglobin, Head circumference, Birth weight, Length, Chest circumference

Introduction

Pregnant women are vulnerable to develop physiological and pathological anemia. Maternal anemia is a burden throughout the world, especially in developing countries. Maternal anemia is defined as a Hemoglobin (Hb) level of <11g/dl, or Hematocrit (Hct) of <33% in all trimesters of pregnancy as defined by the World Health Organization (WHO)[1].

Maternal anemia during pregnancy can lead to poor fetal outcome as risks of morbidity and mortality is increased. Several surveys found that maternal anemia was related to small sized baby[2] and infant mortality. WHO reports that anemia affects nearly half of all pregnant women in developing world: 52% in developing countries and 23% in developed world[3].

During pregnancy in women the hemoglobin concentration of the maternal blood falls from a non-pregnant average of about 13.3g/dl to an average of about 11.0 g/dl at 36 weeks.The fall is steepest up to 20 weeks gestation, the concentration remains fairly constant up to 30 weeks and then rises slightly thereafter. Thus, any estimation of hemoglobin concentration taken after 20 weeks gestation will be reasonably representative of the fall induced by pregnancy[4]. Hence, hemoglobin levels of 3rd trimester of pregnancy were taken as a reference value throughout pregnancy in our study. Anemia is one of the most prevalent nutritional deficiency problems affecting pregnant women[5]. The high prevalence of iron deficiency among women during pregnancy in developing countries is of concern, and maternal anemia is still a cause of considerable perinatal morbidity and mortality[6]. The most common causes of anemia are poor nutrition, deficiencies of iron and other micronutrients, and malaria[7]. Sufficient maternal prenatal care during pregnancy by increasing mother's knowledge in nutrition and by supplementation of iron during pregnancy would be beneficial for both the mother and the neonate[8].

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Our study was designed to evaluate the correlation of 3rd trimester Hb and neonatal anthropometry in Haryana.

Materials and Methods

This prospective study was conducted from 5 April 2012 to 5 October 2012. A total of 334 cases were included in the study. Maternal haemoglobin (Hb) levels after 20 week of pregnancy were studied in relation to certain anthropometric parameters at birth in apparently normal pregnancies. The newborns birth weight, length, head and chest circumference, and gestational age were recorded. Mothers with hemoglobin concentration less than 11g/dl were taken as anemic according to WHO definition. The pregnant mothers were grouped into 4 categories according to the corresponding hemoglobin concentration: normal (=or>11), mild (10.9-9.0 g/dl), moderate (8.9-7.0 g/dl) and severe anemic (less than 7 g/dl). The anthropometric measurements of newborns from non-anemic and anemic mother groups were compared. Gestational age was calculated from LMP and was confirmed by clinical examination. A multiple linear regression table was used to study associations between hemoglobin levels and anthropometric parameters. All the parameters were measured after 6 hours from birth to allow edema to subside and not more than 24 hours after delivery. All measurements were made by the same researchers. The neonates wore no clothes. All parameters were recorded as per standard protocol in Neonatal intensive care unit[9]. Each measure was recorded as the mean of 3 consecutive readings. Detailed medical and obstetric history of the mothers was recorded. Maternal complications known to influence fetal growth *(i.e.* hypertensive disorder of pregnancy, cardiac failure, acute or chronic infection, multiple pregnancy and metabolic disorders like diabetes mellitus) were excluded. Newborns with obvious congenital anomalies, hemolytic disease of the newborn were also excluded from the study. The babies were classified in relation to gestation. The data was thus collected, analyzed statistically. The tests of significance like Student's t-test and analysis of variance (ANOVA) and Chi square test were applied wherever required.

Results

Out of 334 pregnant women included in the study, 249 (74.6%) were found to be anemic. Among anemic mothers 9 had severe (2.7%), 51 had moderate (15.3%) and 189 had mild (56.6) anemia. The anthropometric measurements (length, birth weight, chest circumference, head circumference) with decreasing severity of anemia showed statistically significant difference (p=0.000, p=0.000, p=0.017, p=0.001).

Table 1: Distribution of birth weight (kg) of children according to hemoglobin level of mothers (n=334)

Hemoglobin Levels	No.	Birth weight (kg)			
		Minimum	Maximum	Median	Mean±SD
Severe	9	1. 2	3. 4	2. 4	2. 2 ± 0.8
Moderate	51	1. 3	3. 5	2. 5	2. 4 ± 0.5
Mild	189	1. 5	3. 7	2. 7	2. 7 ± 0.5
Normal	85	0.8	4.0	2. 7	2. 7 ± 0.6

(F, p-value - 6.389, 0.000*)

Table 2: Distribution of length (cm.) according to hemoglobin level of mothers (n=334)

Hemoglobin level	No.	Length (cm)			
		Minimum	Maximum	Median	Mean±SD
Severe	9	26.0	48.0	40.0	40.1±7.0
Moderate	51	27.0	51.0	47.0	45.7±4.5
Mild	189	30.0	57.0	48.0	47.4±3.2
Normal	85	38.0	56.0	48.0	47.4±2.7

(F, p-value - 15.495, 0.000*)

Table 3: Distribution of chest circumference (cm.) according to hemoglobin level of mothers (n=334)

Hemoglobin level	No.	Chest circumference (cm)			
		Minimum	Maximum	Median	Mean ± SD
Severe	9	21.0	32.0	31.0	28.9±3.9
Moderate	51	22.0	35.0	31.0	30.7±2.7
Mild	189	23.0	35.0	31.0	30.7±2.5
Normal	85	27.0	36.0	31.4	31.0±2.0

(F, p-value - 3.438, 0.017*)

Table 4: Distribution of head circumference (cm.) according to hemoglobin level of mothers (n=334)

Hemoglobin level	No.	Head circumference (cm)			
		Minimum	Maximum	Median	Mean ±SD
Severe	9	25.0	35.0	33.0	31.4±3.8
Moderate	51	25.0	37.0	33.0	32.9±2.4
Mild	189	28.0	37.0	34.0	33.7±1.6
Normal	85	29.0	45.0	34.0	33.7±2.1

(F, p-value - 5.490, 0.001*)

Discussion

In developing countries, prevalence of anemia in pregnancy is reported to be 52%[6]. In the study of Malhotra et.al.[10] and Marti-Carvajal et.al.[11], the overall prevalence of anemia among pregnant women was estimated to be 72.5%, and 34.4% respectively. In our study, we found the prevalence of anemia in pregnant mothers to be 74.6%. Among the mothers, 56.6% had mild, 15.3% had moderate, and 2.7% had severe anemia in our study. Among 630 pregnant women Marti-Carvajal et.al.[11] found that 83% had mild, 15.2% had moderate, and 1.8% had severe anemia. In the study of Malhotra et.al.[10] including 447 pregnant women, 31 of 447 (6.9%) were found to be severely anemic. Geelhoed et al[12] found that the average age of severely anemic mothers was 22 years, and 57% were nulliparous. In our study, severely anemic group the minimum hemoglobin level was found to be 5.1 g/dl, and 43.4% were nulliparous. Malhotra et.al.[10], found severely anemic had 3 or more children, similar to our study.

These results may reflect the wide range of variations of prevalence and the degree of anemia in pregnant women from developing countries. It is clear that maternal anemia during pregnancy may have adverse affects on the fetus, and the anthropometric measurements of the neonate, however, the effect depends on the degree and severity of maternal anemia. In the study of Steer et al[13] evaluating 153,062 pregnant women, the highest average birth weight was found in the mother group with a hemoglobin concentration of 8.5-9.5 g/dl. We found that the highest birth weight belongs to the mother s with hemoglobin of 9-11 g/dl, suggesting the optimum minimum hemoglobin concentration for normal birth weight to be 9 g/dl. The data from our study pointed out that optimal maternal hemoglobin concentration during pregnancy that is lower than the accepted levels should be evaluated with further studies. A statistical significant difference was found in our study when anthropometric measurements were compared with that of mothers Hb.

One study conducted by Godhia M[14] et al showed that maternal third trimester hemoglobin concentration correlated with birth weight, length, of pre-term newborns only but our study showed that birth weight, length, head circumference were significant in both preterm, term and postterms.We found that as severity of anemia in third trimester decrease the mean birth weight of newborns increased from 2.4 kg to 2.7 kg where p value is highly significant (< 0.000) in table 1 but Hamalainen H et al[15] conducted study and concluded that third trimester anemia has no correlation rather it is the first trimester hemoglobin that affects the birth weight of newborns. In 2002, Brown et al observed that third-trimester maternal Hb did not predict weight, length or HC of the newborn but it did predict newborn's ponderal index.Our study showed that birth weight, height, head circumference and chest circumference were affected by third trimester hemoglobin. It was seen in our study as the severity of anemia decreased the mean length of the babies increased from 40.1 cm to 47.4 cm and p value is found to be significant. Similar results were seen with chest circumference and head circumference.

Our study has some limitations: Firstly, since it was performed in a single center, and the sample size is not so big, it may not be representative of the whole population. Secondly, mothers were not categorized for some other maternal factors like low height and body mass index, which could contribute to low birth weight.

Conclusion

To summarize, our study showed that maternal anemia during pregnancy negatively affected the anthropometric measurements of the neonates. However, the severe form of maternal anemia has the most significant effect. A randomized, nationwide, multi-center study incorporating other maternal factors, like body height and body mass index may yield more representative results of the whole population.

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