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EFFECTS OF THE MATERNAL HEMOGLOBIN DURING PREGNANCY UPONNEWBORN'S BIRTH-WEIGHT MEASUREMENTS.

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ABSTRACT

Introduction: Maternal anemia during pregnancycan affect newborn's weight at birth and can also lead to poor fetal outcome as risks of morbidity and mortality is increased. **Materials andMethods:** All Singleton pregnancies delivered at the institute from January 2013 to 2014 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 220 pregnant women included in the study 71.9% were found to be anemic. Among anemic mothers 4.7% had severe, 16.3% had moderate and 50.9% had mild anemia. The anthropometric measurements (birth weight, length, head circumference) with decreasing severity of anemia showed statistically significant difference ($p = 0.001$, $p = 0.000$, $p = 0.001$, $p = 0.001$) respectively. It was seen that as the number of pregnancies increases the severity of anemia increases with each pregnancy. **Conclusion**: Anemia during pregnancy can adversely affect the birth weight measurements of a newborn and severe anemia hasmore significant impact onthese newborn's measurements.

KEY WORDS: Maternal hemoglobin, Birth weight, Maternal anemia.

INTRODUCTION

Women are more likely than men to have low iron stores because of blood loss at the time of menstruation. During pregnancy, the fetal demand for iron increases maternal daily iron requirements from ≈1 to 2.5 mg/d in early pregnancy and 6.5 mg/d in the third trimester. The

average daily diet in the developed world contains ≈10–14 mg nonhemeiron[1] but not all of this can be absorbed. Evidence from stable-isotope studies suggests that the percentage of nonheme iron absorbed from food during normal pregnancy increases from 7% at 12 wk of gestation to 36% at 24 wk and 66% at 36 wk. These dramatic changes enable the healthy pregnant woman to cope with the extra demands of pregnancy without becoming anemic[1], but only if there is adequate iron in her diet. If the woman's diet is deficient in iron, as is the case in many developing countries, fetal requirements can be met only by additional contributions of iron from maternal stores. This demand by the developing fetus may cause the mother to develop iron deficiency anemia if she had inadequate iron stores at the beginning of pregnancy.

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 pregnancy as defined by the World Health Organization (WHO).[2] 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[3] 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.[4] 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.[5] 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.[6] 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.[7] The most common causes of anemia are poor nutrition, deficiencies of iron and other micronutrients, and malaria.[8] 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.[9] Our study was designed to evaluate the correlation of 3rd trimester Hb and neonatal birth weight measurments.

MATERIALS AND METHODS

This prospective study was conducted from January 2013 to January 2014. A total of 220 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 measurementswere made by the same researchers. The neonates wore no clothes. All parameters were recorded as per standard protocol in Neonatal intensive care unit.[11] 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 220 pregnant women included in the study, 249 (71.9%) were found to be anemic. Among anemic mothers 4.7% had severe, 16.3% had moderate and 50.9% had mild anemia. The anthropometric measurements (length, birth weight, chest circumference, head circumference) **[table-1, 2, 3]** with decreasing severity of anemia showed statistically significant difference (p=0.001, p=0.000, p=0.001, p=0.001).

Table 1: Distribution of weight (kg.) according to hemoglobin level of mothers (n=220)

Hemoglobin Levels	NO.	Birth weight (kg)			
		Minimum	Maximum	Median	Mean±SD
Severe	10	1. 1	3. 5	2. 4	2. 2 ± 0.8
Moderate	35	1. 3	3. 6	2. 5	2. 4 ± 0.5
Mild	111	1. 6	3. 7	2. 7	2. 5 ± 0.5
Normal	64	0.9	3.9	2. 7	2. 7 ± 0.9

Table 2: Distribution of length (cm.) according to hemoglobin level of mothers (n=220)

Hemoglobin level	No.	Length (cm)			
		Minimum	Maximum	Median	Mean±SD
Severe	10	26.0	47.0	40.0	39.1±7.0
Moderate	35	27.0	50.0	46.0	44.7±4.5
Mild	111	30.0	56.0	47.0	46.4±3.2
Normal	64	38.0	58.0	48.0	48.4±2.7

Table 3: Distribution of head circumference (cm.) according to hemoglobin level of mothers (n=220)

Hemoglobin level	No.	Head circumference (cm)			
		Minimum	Maximum	Median	Mean ±SD
Severe	10	25.0	34.0	32.0	31.4±3.8
Moderate	35	25.0	36.0	33.0	31.9±2.4
Mild	111	28.0	37.0	34.0	32.7±1.6
Normal	64	29.0	44.0	35.0	33.7±2.1

DISCUSSION

In developing countries, prevalence of anemia in pregnancy is reported to be 52%.[7] In the study of Malhotra et.al.[11] and Marti-Carvajal et.al.[12], 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 71.9%. Among the mothers, 50.9% had mild, 16.3% had inmoderate, and 4.7% had severe anemia in our study. Among 630 pregnant women Marti-Carvajal et.al.[12] found that 83% had mild, 15.2% had moderate, and 1.8% had severe anemia. In the study of Malhotra et.al.[11] including 447 pregnant women, 31 of 447 (6.9%) were found to be severely anemic. Geelhoed et al.[13] 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 6.1 g/dl, and 38.4% were nulliparous. Malhotra et.al.[11], 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.[14] 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 hemoglobin. One study conducted by Godhia M[15] 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.[16] conducted study and concluded that third trimester anemia has no correlation rather it is the fi rst 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 ponderalindex.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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