Maternal Hemoglobin Level and
Neonatal Growth Parameters

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Abstract:

Introduction: Anemia is a common pathologic problem in pregnant women**,** about 52% of child bearing women are anemic in developing countries and it is caused by nutritional deficiency as well as physiological derangement. World Health Organization recommends that hemoglobin level should not fall below 11g/dL at any age during child bearing time.

Aim of study:

To determine the effect of maternal hemoglobin level on the outcome of neonate in form of length, weight and head circumference.

Method : 200 singleton pregnant women were included in this cross sectional study at Al-Sader Teaching Hospital in Misan Province, Iraq during the period from June 2015 to December 2015.

Measuring their hemoglobin levels at time of delivery then measuring length, weight and head circumference for their newborns.

Result and conclusion: A 66% of pregnant women were anemic and there was a significant association between maternal anemia and low neonatal growth parameters.

Recommendations:

- Education program for nutritional support of pregnant women.
- Education about the importance of antenatal care.
- Revision of policies of mother and child care at primary health centers.

Keyword: Maternal hemoglobin, Neonatal growth parameters, anemia.

مستوى الهيموغلوبين عند الام الحامل ومؤشرات النمو لدى حديثي الولادة

الملخص:

تم إجراء هذه الدراسة في مستشفى الصدر التعليمي في محافظة ميسان للفترة من حزيران 2015 لغاية كانون الاول 2015 حيث تم سحب عينات الدم من 200 إمرأة حامل (مكملة 9 أشهر حمل) لغرض تحديد مستوى الهيموغلوبين عند الام الحامل وقت الولادة.

وعند ولادة أطفالهم ، تم قياس مؤشرات نموهم والتي تتضمن الوزن والطول ومحيط الرأس.

وبعدها تم إجراء مقارنة بين مستوى الهيموغلوبين عند الام الحامل وقت الولادة وتأثيرها على مؤشرات النمو لدى حديثي الولادة. فكانت النتائج أن 66% من النساء الحوامل لديهم فقر دم وكان هنالك إرتباط قوي بين فقرالدم وإنخفاض مؤشرات النمو لدى المواليد الجدد بما يخص الوزن والطول ومحيط الرأس.

فلذلك نوصي بعمل برامج تعليمية حول أهمية التغذية الصحية للنساء الحوامل وحول أهمية الرعاية الصحية في فترة ما قبل الولادة. والقيام بمراجعة برامج رعاية الأم والطفل في المراكز الصحية لغرض تحقيق النتائج المطلوبة.

Aim of study:

To determine the effect of maternal hemoglobin level on the neonatal outcome in form of length, weight and head circumference.

Introduction:

Anemia is a pathologic condition in which the oxygen carrying capacity of red blood cells is insufficient to meet the body's physiological needs. [1]

In general, hemoglobin concentrations (Hb) of 11.0 g/dL or less and hematocrit of 33.0% or less are diagnosed as anemia in pregnancy, regardless of the timing in the period of pregnancy, and patients should be given treatment. [2, 3]

Anemia in pregnancy is a common problem in many developing countries. [4]

World Health Organization (WHO) reports that anemia affects nearly half of all pregnant women in the world: 52% in developing countries compared with 23% in the developed world. [3]

Anemia in pregnancy most commonly results from a nutritional deficiency in either iron or folate. Iron deficiency during pregnancy is thought to be caused by combination of factors such as previously decreased iron supply, the iron requirements of the growing fetus, and the expansion of maternal plasma volume. [5] Anemia is very often asymptomatic in pregnancy, with the diagnosis being made on routine screening. Clinical features include tiredness, dizziness, fainting and lethargy. Pallor may be apparent. [6]

According to WHO, Anemia in pregnancy is classified into: [1]

1- Mild (Hb level is 10.0-10.9 g/d L)
2- Moderate (Hb level is 7.0- 9.9 g/d L)
3- Severe (Hb level is < 7.0 g/d L)

Fetal risks: The fetus obtains the iron from maternal transferrin regardless of maternal iron stores. The placenta traps maternal transferrin, removes the iron and actively transports it to the fetus, mainly in the last four weeks of pregnancy. When maternal iron stores are depleted the fetus cannot accumulate as much iron and there is a decrease in fetal iron stores. This may have an important bearing on iron stores and the development of anemia in the first year of life. [7]

Maternal anemia in pregnancy is commonly considered as risk factor for poor pregnancy outcome and can threaten the life of mother and fetus. [8]

Adverse perinatal outcome in the form of preterm and small for gestational age babies and increased perinatal mortality rates have been observed in the neonates of anemic mothers. [9]

Patients and Methods:

A cross sectional study was conducted at Al-Sader Teaching Hospital in Misan Province, Iraq during the period from June 2015 to December 2015.

A two hundreds singleton pregnant women of gestational age more than 37 weeks who delivered at the Obstetrical Department were selected and venous blood sample was taken at time of delivery to determine their Hb level following the method that recommended by WHO. [1]

Then growth parameters of their neonates were taken; these include length, weight and occipito-frontal circumference (OFC). The weight was measured by using electronic weighing scale while length and OFC were measured using a tape measure following WHO criteria of measurement. [10]

Each neonate was examined clinically (Neuromuscular and physical criteria according to New Ballard score) for maturity [11] which help us to exclude preterm neonates. Also a thorough physical examination was helpful to exclude any anomaly. This study was including any single full-term newborn whether male or female born by vaginal delivery or by caesarian section.

Exclusion criteria: include maternal diabetes mellitus, hypertension, or those suffering from any other medical conditions, or had complication of pregnancy or delivery, and multiple pregnancy. Also prematurity, intrauterine growth restriction, twin and those neonates with congenital malformation were excluded.

The normal range values of the growth parameters for the newborn are: [12]
1. Weight : 2.5-3.5 kg
2. Length : 48-52 cm
3. OFC : 33-37 cm

Any value below the minimum of normal range is considered as abnormal for that growth parameter.

Pregnant women were divided in to three groups according to Hb level:
- With Hb level ≥11.0 g/dL (which is the normal level in pregnancy)
- With Hb level of 10.0- 10.9 g/dL
- And the last group with Hb <10.0 g/dL.

Then the relation between maternal Hb level and growth parameters (weight, length and OFC) had been studied.

The study protocol was reviewed; approval and official permission were obtained from the Ministry of Higher Education, Misan directorate of health and Al-Sader Teaching Hospital to conduct the present study. Also an informed written consent was obtained from mothers before delivery.

The analysis of data was carried out using the available Statistical Packages for Social Science, version 18(SPSS18.0). Data were presented in form of tables of numbers. Chi-square test (X^2 - test) was used for testing the significance of association between variables under study. Statistical significance was considered whenever the P-value was equal or less than 0.05.

Results:

The total 200 pregnant women were divided into 3 groups according to Hb level: 68 pregnant women had Hb ≥11.0 g/dL while 99 and 33 pregnant women had Hb10.0- 10.9 g/dL and <10.0g/dL respectively.

In studying the effect of maternal Hb on length of their newborns;

In first group mother of Hb ≥11.0 g/dL; there were 68(100%) neonates had normal length at birth while in the second group mother of Hb10.0- 10.9 g/dL; there were 50(50.5%) neonates had abnormal length, and for the last group; there were 10 (30.3%) neonates had abnormal length. Statistically these results are of high significant (P value is 0.001) as shown in table 1.

Table (1): Distribution of the length of the neonate according to the hemoglobin level of the mother.

Hb g/dL	Length			P value
	Normal No.(%)	Abnormal No.(%)	Total No.(%)	0.001
≥11.0	68 (100%)	0 (0%)	68 (100%)	
10.0- 10.9	49 (49.5%)	50 (50.5%)	99 (100%)	
<10.0	23 (69.7%)	10 (30.3%)	33(100%)	
Total	140 (70%)	60 (30%)	200 (100%)	

All neonates of mothers with Hb ≥11.0 g/dL, had been associated with normal weight parameter. While 25 (25.3%) and 6 (18.2%) neonates had abnormal length in both groups of mothers of Hb10.0- 10.9 g/dL and Hb <10.0 g/dL respectively. Statistically these results are highly significant (P value is 0.004) as shown in table2.

Table (2): Distribution of the weight of the neonate according to the hemoglobin level of the mother.

Hb g/dL	Weight			P value
	Normal No.(%)	Abnormal No.(%)	Total No.(%)	0.004
≥11.0	68 (100%)	0 (0%)	68 (100%)	
10.0- 10.9	74 (74.7%)	25 (25.3%)	99 (100%)	
<10.0	27 (81.8%)	6 (18.2%)	33(100%)	
Total	169 (84.5%)	31 (15.5%)	200 (100%)	

Finally for OFC parameter; mothers with Hb ≥11.0 g/dL gave birth to neonates with normal OFC. While second and third group mothers had 32(32.3%) and 8(24.2%) neonates delivered with abnormal OFC parameter. Statistically this is of high significant (P value is 0.001) as shown in table 3.

Table(3): Distribution of the OFC of the neonate according to the hemoglobin level of the mother.

Hb g/dl	OFC			P value
	Normal No.(%)	Abnormal No.(%)	Total No.(%)	0.001
≥11.0	68 (100%)	0 (0%)	68 (100%)	
10.0- 10.9	67 (67.7%)	32 (32.3%)	99 (100%)	
<10.0	25 (75.8%)	8 (24.2%)	33(100%)	
Total	160 (80%)	40 (20%)	200 (100%)	

Discussion:

The high prevalence of iron deficiency anemia among women during pregnancy in developing countries is of concern, and maternal anemia is still a cause of considerable perinatal morbidity and mortality. [13]

This study revealed that at delivery time; A sixty eight (34%) pregnant women were not anemic while132(66%) pregnant women were anemic which was high and it was higher than other countries like Egypt, Bahrain, Saudi Arabia, and India in which it were 30%, 38%, 40%, and 54% respectively according to WHO estimates . [14]

Among the anemic mothers and according to WHO classification of anemia in pregnancy; there were 99 (49.5%) pregnant women had mild anemia while the rest 33(16.5%) had Hb <10.0 g/dL.

The current study revealed that there is a significant association between level of Hb with anthropometric measurements of newborn in all three parameters (weight, length and OFC).

In non-anemic group; it was noticed that the normal maternal Hb level would be associated with normal growth parameters while in anemic group there were lower growth parameters at birth.

Statistically; these results were highly significant (P value is less than 0.05).

The same pattern of results for the association between maternal anemia and low birth weight was reported in several studies. [15, 16, 17]

However, some studies showed that there is substantial evidence that maternal anemia increases the risk of both preterm delivery and subsequent low birth weight. [18, 19, 20] Finally, the relation between maternal anemia and low neonatal growth parameters is very complex and anemia certainly interacts with other parameters such as nutrition or infections. A wide range study in Egypt, [21] concluded that a lot of factors can affect the anthropometric parameters of neonate other than maternal Hb like maternal anthropometric parameters, exposure to passive smoking, nutritional intake and socioeconomic status. Further study will be required in future.

Conclusion:

There was a significant association between maternal anemia and growth parameters of their newborns. It was found that neonatal outcome would be affected in form of length, weight and occipito-frontal circumference. And there was high frequency rate of anemia among pregnant women.

Recommendations:

1. Education program for nutritional support of pregnant women.
2. Education about the importance of antenatal care.
3. Revision of policies of mother and child care at primary health centers.
4. Further studies for maternal iron status and ferritin level of infant as well as fetal erythropoietin in neonates.
5. More studies at the level of Primary Health Centers to see why there were a high percentage of anemic pregnant women and to ensure the follow up of the pregnant mothers to prevent anemia during pregnancy.

Acknowledgment:

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