

Correlation of Maternal Hemoglobin with Birth Weight: A Hospital Based Study

Hamzullah Khan, Khalid Khan, Neelum Shehzadi, Huma Riaz

ABSTRACT:

Objectives: To determine the correlation of maternal Hemoglobin concentration in labor with birth weight.

Study design and setting: This was cross sectional study conducted in Qazi Hussain Ahmed Medical Complex, (QHAMC) Medical Teaching Institution Nowshera, from 20th April 2019 to 31st Jan 2020.

Methodology: A total of 254 deliveries were assessed. All pregnant ladies in labor, presenting to labor room of QHAMC Nowshera, irrespective of age were included. The weight of babies was recorded at birth. Pearson correlation and logistic regression and relative risk analysis were used to show the relationship and probability of occurrence of low birth weight babies in anemic and non anemic patients.

Results: The mean with standard deviation of hemoglobin in mothers was 10.76+1.63 g/dl. The mean with standard deviation of birth weight was 2.71+0.6 kg. The frequency of low birth weight babies was 68(26.77%) with weight less than 2500g at birth. A positive linear correlation of birth weight with level of hemoglobin of mother in labor was statistically significant ($p=0.001$, $r=0.35$). Using logistic regression analysis, it was observed that the probability of LBW in pregnant women with hemoglobin<11g/dl was 3.31 times higher ($p=0.001$, $OR=3.31$).

Conclusion: The frequency of LBW is 26.7% markedly higher and maternal anemia is a risk factor for it. The relative risk is 2.4 times higher in anemic pregnant ladies as compared to the non anemic mother.

Key words: Low birth weight, Iron deficiency anemia, Risk analysis

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INTRODUCTION:

The causes of low birth weight are multifactorial and many factor including; maternal, genetic and fetal can contribute and play vital role in this regard. These factors interplay with each other and contribute individually as well as in combination.¹ A meta-analysis from different cohort and case control studies carried out in several countries of the world concluded that there is a statistically strong relationship of the maternal anemia with low birth weight.² In general practice maternal anemia is defined as maternal hemoglobin less than 11g/dl during the gestational period.^{1,3,4} Regarding

the prevalence and definition of the low birth weight deliveries, a textbook William obstetrics reports 7 to 10% of the infants in the United States weigh less than 2500grams irrespective of gestational age/anemia⁴. The prevalence of low birth weight in Pakistan is reported as 10.04%.⁵

In general, the biochemical parameters of maternal nutrition have minimal effects on the birth weight of offspring. However mean birth weight of the non anemic and anemic groups have statistically significant difference.^{1,4} Bhargava V et al reported that the desired weight of the babies is achieved in the body of the mother, that has a strong correlation with the maternal Hb%.⁶

The anemia of different gestational period has been reported to have an impact on the outcome, some have reported even the maternal anemia of the first trimester of pregnancy has a relationship to the deliveries of low birth weight babies, and the risk increases with the progression of anemia in next trimesters.⁷ A study from Turkey reported that low Hb% of mother during the third trimester of pregnancy were strongly associated with low birth weight babies. They further reported that maternal anemia can be a direct cause of the deterioration of in-utero fetal growth due to lack of oxygen supply from the placenta to the fetal tissues. They extended their study and further reported that treatment of anemia during pregnancy is directly correlated with better outcomes in

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terms of birth weight.⁸ A cross sectional study from India reported 4.86 time higher risk of preterm and low birth weight babies in pregnant women with severe anemia, followed by a risk of 3.18 time in pregnant ladies with moderate anemia.⁹

The prevalence of anemia in pregnant ladies in Pakistan reported as 29%.¹⁰ Considering the high prevalence of anemia present study was aimed to determine the correlation of maternal hemoglobin concentration with birth weight of the newborn in a tertiary care hospital of Nowshera.

METHODOLOGY:

A cross sectional study was conducted in the Pathology department in collaboration with the Department of Gynecology and Obstetrics, Qazi Hussain Ahmed Medical Complex, Medical Teaching Institution Nowshera, from 20th April 2019 to 31st Jan 2020. Ethical approval for the survey was obtained from the Ethical Review Committee of Nowshera Medical College/QHAMC. ERC letter with reference number No-102, Dated 19 June 2019 was issued. Total number patients studied were 254. The calculated sample size was 139 on the basis of 10.04% prevalence of low birth weight in Pakistan.⁵ The inclusion criteria was all expecting women in labor, presenting to the labor room of QHAMC Nowshera, irrespective of age. While the expecting women taking oral or intravenous iron therapy for their already diagnosed Iron deficiency anemia were excluded. Blood samples were collected from these women. The technique for the blood sampling collection was to collect 3 ml of venous blood using disposable syringes under aseptic techniques. The blood was added in an EDTA vacutainer and mixed gently. Complete blood count was calculated on hematology analyzer. Anemia was labeled when the pregnant women had a hemoglobin level of < 11 g/dl in accordance with the definition of World Health Organization¹¹. This study was conducted in collaboration of gynecology department and pediatric/nursery department. The weight of the baby (in kg) after deliver was noted using manual weight machine and recorded in the patient file. The low birth weight was taken as weight less than 2.5 kgs as defined by the World Health Organization (WHO).¹²

Data was entered in SPSS Version 25. Descriptive statistics were used for numerical variables like Hb and ferritin of mother and weight of babies. The independent t-test was used for hemoglobin and ferritin levels in gender groups. Nominal variable were the mode of delivery and gestational age were presented with frequency and percentages using pi-charts. The Pearson Correlation test was used to determine the correlation of hemoglobin concentration of mother with weight of babies. Regression analysis was used to determine the probability of low birth weight in anemic and non anemic groups. Relative risk (RR) was calculated for stratification of anemic and non anemic groups based on the concentration of hemoglobin in group with deliveries

of low birth weight babies using risk analysis statistics.

RESULTS:

Total of 254 cases were studied. The mean with standard deviation of hemoglobin in mothers was 10.76+1.63 g/dl. The minimum Hb% recorded was 6.2g/dl to a maximum of 18g/dl with a range of 11.8. The mean with standard deviation of birth weight was 2.71+0.6 kg. The minimum birth weight recorded was 1.5kg to a maximum of 4.6kg with a range of 2.1kg. (Table 1). It was observed that 68(26.77%) of the new born had weight less than 2500g, while 186(73.22%) had equal or more than 2500g weight. Out of total 254 cases 229(90.2%) were in full term with gestation period of more than 37weeks. 19(7.5%) were preterm with gestational history of less than 37 weeks, while 6 (2.4%) were post-term. Figure 1. Similarly, 234(92.1%) cases delivered through Normal vaginal delivery (NVD), 14(5.5%) through Cesarean -section) and 6(2.4%) through forcep assisted deliveries (Figure 1)

The correlation of mother's hemoglobin with baby weight was assessed using Pearson correlation test and found a moderate uphill positive linear relation of birth weight with level of hemoglobin of mother at labour that was statistically significant ($p= 0.001$, $r=0.35$). (Table 2)

Using logistic regression analysis to show the probability of occurrence of LBW in relation with hemoglobin concentration dividing the patients in 2 categories. One groups with Hb% less than 11g/dl and another with more than 11 g/dl. It was observed that the probability of LBW in pregnant ladies with hemoglobin<11 was 3.31 times more than cases with Hb>11g/dl. (p-value 0.001, OR=3.31). (Table 3) The risk analysis for low birth weight deliveries in anemic and non anemic categories taking Hb% concentration in consideration were assessed. It was noted that the risk of low birth weight for cohort (category with Hb <11g/dl) was 2.4 times as compared to 0.56 times in cohort (category with Hb>11g/dl). The Odds ratio was 4.2 when measured with anemic mothers only. (Table 4)

DISCUSSION:

Intrauterine growth and development is most vulnerable process that affects and has a profound and lasting influence on the physical, mental and developmental growth after birth and in later life that largely depends on the maternal health and well being. we observed that the mean of hemoglobin in pregnant ladies in labor was 10.76+1.63 g/dl, that falls in anemic group as per definition of the WHO.¹¹ Likewise 68(26.77%) of the new born had weight less than 2500g. Many studies from Pakistan have reported low birth weight to have an established association with a group of maternal factors like weight and height of mother, social-economic status and maternal anemia.^{13,14} Our findings are higher than Khan A¹⁵ reported from Karachi as 10.6% of LBW deliveries and Najmi RS¹⁶ reported the prevalence of total LBW deliveries from Lahore as 19%. UNDP reports

Table 1. Descriptive Statistics of Hemoglobin and birth weight

	Hb of Mother	Babies weight at birth
Number of patients	254	254
Mean	10.76	2.71
Median	11	3
Mode	11	3
Std. Deviation	1.63	0.6
Range	11.8	3.1
Minimum	6.2	1.5
Maximum	18	4.6

a. Multiple modes exist. The smallest value is shown

Figure 1. Gestational history and Mode of Delivery

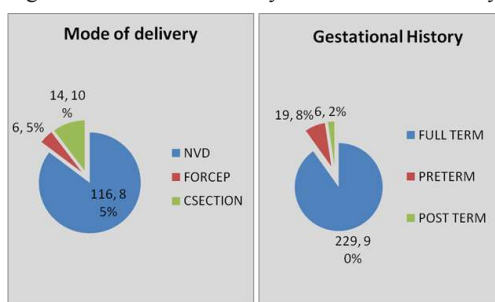


Table 2. Pearson Correlation of hemoglobin of mother with baby weight

		Birth weight
Hb%	Pearson Correlation	.347**
	Sig. (2-tailed)	0.001

** . Correlation is significant at the 0.01 level (2-tailed)
 * . Correlation is significant at the 0.05 level (2-tailed)

Table 3. Regression analysis of the birth weight with anemia of mother

Observed		Predicted				
		Hb Categories				
		Hb<11	Hb>11			
Birthweight	<2.5kg	49	44			
	>2.5kg	24	137			
Variables In Equation						
	B	S.E.	Wald	df	Sig.	Exp(B)
Birthwt	1.197	0.244	24.055	1	0	3.311
Constant	-2.637	0.653	16.296	1	0	0.072

the incidence of LBW deliveries as reported globally varies with 19% in developed countries, 31% from South Asia, followed by Africa & north America 15%.¹⁷

UNICEF reports that across the globe neonatal mortality increases by 20 times in newborn with low birth weight as compared to normal or heavier babies more than 2.5kg.¹³ In Pakistan the prevalence of LBW births varies from 5 to 23% in different parts.¹⁸

Table 4. Risk Estimate of low birth babies in anemic and non anemic groups

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Weight categories (1.00 / 2.00)	4.288	2.488	7.390
For cohort Hb% category-1 = Hb<11g/dl	2.409	1.733	3.350
For cohort Hb% category-2 = Hb>11g/dl	.562	.440	.718

The correlation of mother’s hemoglobin using Pearson correlation test was assessed and found a moderate uphill positive linear relation of birth weight with level of hemoglobin of mother at labor (P-value 0.001, r=0.35). Lumbanraja SN et al¹⁹ observed that LBW was the only indicator out of multiple variables that statistically significantly correlated with Maternal anemia (p<0.05) that matches our findings. Our findings also matched with a study from Rawalpindi that reported that a total of 64% LBW deliveries with a statistical correlation with anemia in the third trimester of gestation (p=0.001).¹⁹

The same way, the probability of LBW in mother with hemoglobin<11 at labor, was 3.31 times more than mothers with Hb>11g/dl. Lone et al reported from a multivariate analysis that the risk of LBW babies in anemic population is 1.9 times higher than non anemic population(95% CI= 1.0–3.4) that was in concordance with our findings.²⁰

An article published in the Bulletin of world health organization revealed an increased in incidence of LBW babies in anemic mothers, however the difference in anemic and non anemic mother in term of LBW deliveries was not statistically significant (p=0.112). Failure to control a decline in Hb below 10g/dl was also associated with preterm deliveries and was considered as high risk for LBW outcome.²¹

The risk of low birth weight for the cohort category with Hb <11g/dl) was 2.4 times. Another local study from Punjab reported a higher risk of LBW in pregnant ladies with low hemoglobin in their last trimester.²² Another metaanalysis where 7243 articles were found in Medline, out of which 68 were selected for the study, revealed an increase in risk of LBW of 1.43 times associated with maternal anemia.²³

There are few study limitations. Firstly, we were unable to check the serum ferritin levels of all the pregnant women in labor, therefore future studies should focus on the correlation of serum ferritin with the fetal weight at birth. Similarly, second limitation is that we were unable to separately explain the low birth weight and pre-term babies in both anemic and non anemic, so therefore the future

research studies should focus on these two different groups (Pre-term and LBW) and identify its correlation with maternal Hb and ferritin that can help the decision maker to decide best in the interest of mother and child.

CONCLUSION:

The frequency of LBW is 26.7% markedly higher and maternal anemia is a risk factor for it. The relative risk is 2.4 times higher in anemic pregnant ladies as compared to the non anemic mother.

Authors Contribution:

Hamzullah khan: Concept design, data collection, data analysis, manuscript writing

Khalid Khan: Data Collection, manuscript writing, critical review

Neelum Shehzadi: Data collection, manuscript writing, critical review

Huma Riaz: Manuscript writing, critical review

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