

# Relationship between Maternal Hemoglobin Concentration to the Newborn Cord Blood Hemoglobin and Serum Concentration

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## ABSTRACT

**Objective:** To determine the mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers.

**Study Design:** Cross sectional

**Place and Duration:** Gynae & Obs department of Dow University Hospital, a tertiary care hospital in Karachi, Pakistan during the period from January, 2018 to July, 2019.

**Methodology:** A total of 100 anemic pregnant women as per inclusion and exclusion criteria were included in this study. Cord blood sample (5ml) was obtained by sterile needle puncture immediately after cord clamping. 2ml will collected in EDTA bottle for full blood count analysis and 3ml collected in plain bottle for serum ferritin analysis. Final outcome was recorded on approved proforma.

**Results:** The average age of the patients was 29.33±3.23 years. Mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers was 14.78±1.62 g/dl and 94.10±67.47 u/ml.

**Conclusion:** We found that average hemoglobin of the women recruited in our study was 9.59±0.815 g/dl however we could find no correlation between mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers.

**Key Words:** Cord blood Hemoglobin, Ferritin, Anemic mothers.

## INTRODUCTION

Hemoglobin is a polypeptide protein that is especially adapted for a gas transport to and from lungs. It is comprised of four globin chains, each of which contains an iron containing porphyrin pigment called haem. A single haem molecule contains a ferrous iron (fe+2) to which oxygen reversibly binds (1). Excess iron in the blood is stored, usually in the form of ferritin by protein apoferritin in the liver hepatocytes (2). The cut-off values of blood hemoglobin for pregnant women is >11g/dl and serum ferritin>10ug/l, while the level for neonatal hemoglobin is >13g/dl and serum ferritin is >75ug/l (3). During pregnancy anemia is labeled when hemoglobin level are <11g/dl. Anemia is one of the most frequent complications related to pregnancy. During this period, the most common type that occurs is iron deficiency(4). As part of normal physiology of pregnancy, absorption of dietary iron from the gut is increased, in response to increased iron demand. Despite this adaption, pregnant female still require supplementary iron (5). Low iron store at birth, as well as iron deficiency in infancy adversely affect cognitive, emotional, motor, and neurophysiologic development of the child (4).

The WHO reports that around 35-75% (56% on average) of pregnant female in developing countries is anemic, whereas those affected in industrialized nations make up only 18% (6). The prevalence rates in South Asian countries are as follows: Maldives (55.4%), Bangladesh (50%), India (49.7%), Nepal (42.4%), Malaysia (35%), Sri Lanka (34%) and Iran (21.4%). (7)

In Pakistan, the prevalence is 48.2%, out of which iron deficiency is the cause of 90.5% of the anemia (8). It

has recently been discovered that 56% of children under the age of five years are anemic in Pakistan. Children aged between 6 months to 3 years are 60-90% of affected (9). The mean cord blood hemoglobin concentration and mean serum ferritin concentration was found 12.54±2.54 and 7.26±115.60 in newborn of anemic pregnant women (3).

As there is high prevalence of anemia in pregnant women in Pakistan. The purpose of the study is to determine the mean cord hemoglobin and serum ferritin in newborn of anemic mother. This study will provide the baseline data which was helpful to develop further statistics and protocol to prevent this deficiency.

## MATERIALS AND METHODS

This cross sectional study was conducted at Gynae & Obs department of Dow University Hospital, a tertiary care hospital in Karachi, Pakistan during the period from January, 2018 to July, 2019. A total of 100 anemic pregnant women with ages 18 to 40 years were enrolled in this study. Detailed demographics including age, parity, gestational age, education and family income were recorded after taking written informed consent. Gestational age <36week or >42 week by last menstrual period (LMP), twin or multiple pregnancies on ultrasound, intrauterine death/stillbirth on ultrasound, maternal age <18 yr or >40year, and women with parity>4 were excluded.

Cord blood sample (5ml) was obtained by sterile needle puncture immediately after cord clamping. 2ml will collected in EDTA bottle for full blood count analysis and

3ml collected in plain bottle for serum ferritin analysis. Final outcome was recorded on approved proforma.

Analysis will performed using SPSS version 18. Frequency was calculated for categorical variable like parity. Education Level and family monthly income. Mean and standard deviation will computed for numerical variable like age, Hb level of mother, Hb level of newborn and serum ferritin level in newborn. Stratification with respect of age. Post stratification ANOVA for more than two groups and t-test for two groups was applied. p value  $\leq 0.05$  was taken as significant.

**RESULTS**

Mean average age of the patients was  $29.33 \pm 3.23$  years, mean hemoglobin of the women was  $9.59 \pm 0.815$  g/dl. Mean gestational age was  $38.26 \pm 1.17$  weeks. Regarding parity of the women, 25% women had para 1 and 75% had parity 2 to 4. 65% patients were literate while 35% were illiterate. 32% patients had family income  $>20000$  rupees, 38% had 15000 to 20000, 25% had  $>10000$  to 15000 and 5% had  $<10000$  rupees. (Table 1)

Table No 1: Baseline details of all the included patients

Variables	Frequency No.	%age
Mean age (yrs)	$29.33 \pm 3.23$	-
Hemoglobin (g/dl)	$9.59 \pm 0.815$	-
Gestational Age (weeks)	$38.26 \pm 1.17$	-
<b>Parity</b>		
1	25	25%
2 to 4	75	75%
<b>Education</b>		
Literate	65	65%
Illiterate	35	35%
<b>Family Income</b>		
$<10000$	5	5%
10000 to 15000	25	25%
15000 to 20000	38	38%
$>20000$	32	32%

Mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers was  $14.78 \pm 1.62$  g/dl and  $94.10 \pm 67.47$  u/ml as shown in table 2. Comparison mean cord blood hemoglobin and ferritin concentration in newborn among different age groups, and found no significant difference with p-value  $>0.05$ . (Table 3)

Table No 2: Mean Cord Blood Hemoglobin and Ferritin Concentration in Newborn of anemic Mothers

Descriptive Statistics		Cord Blood Hemoglobin (g/dl)	Cord Blood Ferritin (u/ml)
Mean		14.78	94.10
Std. Deviation		1.62	67.47
95% Confidence Interval for Mean	Lower Bound	14.46	80.71
	Upper Bound	15.10	107.49
Median		14.55	82.15
Interquartile Range		2.6	77.4
Minimum		9.6	7.4
Maximum		18.4	298

Table No 3: Comparison of Mean Cord Blood Hemoglobin and Ferritin Concentration in Newborn of Anemic Mothers among Different Maternal Age Groups

Variables		Age Groups (Years)			P-Values
		$\leq 25$	26 to 30	$>30$	
Cord Blood Hemoglobin (g/dl)	n	12	57	31	0.96
	Mean	14.79	14.81	14.7	
	Std. Deviation	1.35	1.72	1.59	
Cord Blood Ferritin (u/ml)	n	12	57	31	0.95
	Mean	88.93	95.17	94.13	
	Std. Deviation	59.56	71.88	63.74	

**DISCUSSION**

Anaemia is a serious problem for women of childbearing age and it can have devastating effects on their babies. Anaemia in pregnancy is a major challenge to obstetric care in developing countries where the prevalence rate varies between 33 and 75%<sup>[10-11]</sup> when compared with figures from developed countries with a prevalence rate of 14%.<sup>[12]</sup> Since the prevalence of anaemia in non-pregnant women in developing countries is also high (43%),<sup>[13]</sup> it is possible that many of these women were already anaemic at the time of conception. Causes of anaemia during pregnancy in developing countries are multi-factorial. This include nutritional deficiencies (iron, folate and vitamin B12), and parasitic diseases such as malaria and hookworm infestation.<sup>[14]</sup> However, micronutrient deficiency, especially iron deficiency, is believed to be the main underlying cause for anaemia in pregnancy.<sup>[15]</sup> Whatever the cause, maternal anaemia has adverse consequences on the outcome of pregnancy as anaemia in pregnancies is associated with preterm deliveries, low birth weights, morbidity and perinatal mortality due to the impairment of oxygen delivery to placenta.<sup>[16]</sup>

"Newborn Haematology" recently represented as an area of study that focused in study of umbilical cord blood and its elements in general<sup>[17]</sup>. The iron content of the newborn infant is an important source of iron for haemoglobin formation in the first few months of life since the iron content of milk is low. At birth, the umbilical cord blood haemoglobin is an important haematological parameter in newborn<sup>[18]</sup>. Haemoglobin and haematocrit values have been used frequently in the diagnosis and followup of the neonatal anemia<sup>[19]</sup>. White blood cell(WBC) and platelet counts also proven to be helpful in the assessment of neonatal sepsis and the haemostatic status of infant<sup>[20]</sup>.

Multi-parity and short birth interval (less than 2 years) between pregnancies created a large demand for iron, which was needed to develop the fetus and placenta. Additional iron was lost with blood at delivery and it can appear maternal anaemia. We found in our study 75% had parity 2 to 4, but we found no relationship with age. These findings were consistent with another study by Veghari et al<sup>[21]</sup>. In contrast, in another study, women with parity  $> 2$  had higher mean haemoglobin

concentration than nulliparous ones [22]. It has been observed that younger mothers, especially teenage mothers, are prone to iron-deficiency anaemia [23], but in our study we found no relationship with age. We included mothers of age ranges from 18-40 year with mean age 29.33±3.23 years.

Many studies, with differing results, have been done on the relationship between maternal and neonatal iron status [24-25]. Rios et al. did not report any significant difference in serum ferritin level in infants of iron-depleted and non-depleted mothers [26]. Kelly, MacDonald and McDougall observed a significantly lower ferritin level in cord serum when mothers were iron deficient [27]. We did not found a significant correlation between maternal and neonatal iron status. Mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers was 14.78±1.62 g/dl and 94.10±67.47 u/ml which is normal according to our operational definition i.e. normal Cord blood hemoglobin is > 13g/dl. While serum ferritin level is normal when when newborn serum ferritin is >75µg/L. In accordance to our results Harthoorn et al, have shown that iron deficiency in mothers during pregnancy dose not influence the fetal iron supply.[28] A study on 20 normal and 6 iron-deficient mothers showed no relationship between the pre-delivery serum ferritin in the two populations of mothers and the serum ferritin of their newborns' cord blood [29]. The explanation for the findings of the present study is may be that serum ferritin and therefore iron stores are only reduced in neonates if maternal iron stores are completely exhausted, and that was not the case in any of current study subjects. In our study the average hemoglobin of the women was 9.59±0.815 g/dl.

## CONCLUSION

We found that average hemoglobin of the women recruited in our study was 9.59±0.815 g/dl however we could find no correlation between mean cord blood hemoglobin and ferritin concentration in newborn of anemic mothers.

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