Cord Blood Iron Status In Maternal Iron Deficiency Anaemia

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Abstracts: Background**:** Iron deficiency (ID) and iron-deficiency anaemia (IDA) during pregnancy continue to be of worldwide concern.The purpose of this study was to determine the effect of maternal iron status on neonatal iron status and anthropometric characteristics.Methodology: A total of 86 pregnant women aged between 19 and 31 years delivering singleton live births at term gestation (37-41weeks) were included in the study. The pregnant women were divided into three groups according to their pre-delivery haemoglobin (<11gm/dl) and serum ferritin concentration (<12ng/dl) levels. Analysis of maternal and cord blood for estimation of haemoglobin level and serum ferritin was performed. Weight, length and head circumference of neonates was also recorded. Results: Amongst the pregnant women, 32.6% were anaemic and 17.4% were iron deficient. Neonatal haemoglobin and neonatal serum ferritin was significantly different ($p<0.001$) across 3 groups suggesting that maternal anaemia affected the iron status including iron stores of the newborn. Neonatal haemoglobin and neonatal serum ferritin had a significant positive correlation with maternal iron status. However no significant correlation was found between maternal iron status and neonatal anthropometric parameters except in case of neonatal birth weight which had a significant positive correlation with maternal haemoglobin levels. Conclusion: This study showed that maternal iron deficiency anaemia has an adverse effect on iron status of their newborns. Thus effective strategies are urgently needed to control maternal anaemia in the developing world. [Agrawal V NJIRM 2016; 7(3):21 - 24]

Key Words: Iron deficiency anaemia, cord blood , haemoglobin , ferritin.

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Introduction: Iron deficiency anaemia in pregnant women continues to remain a major preventable cause of unfavourable perinatal outcome in several developing countries. Anaemia remains widely prevalent in India. Studies from India indicate that 75% of young children , 90% adolescent girls and 85% of pregnant women suffer from anaemia, mostly because of Iron deficiency [1,2].

Iron deficiency is the most common nutritional deficiency in pregnancy with an impact on maternal and fetal morbidity and mortality. Iron deficiency anaemia during pregnancy is associated with a number of perinatal complications such as preterm deliveries, intrauterine growth retardation, and maternal and neonatal morbidity and mortality[3,4]. Iron deficieny in infants may also adversely influence cognitive development. Some studies have shown that cognitive function may not improve in iron deficient anaemic infants even following iron therapy[5].

Maternal iron is the only source of foetal iron, it is logical therefore that the maternal iron status will affect iron status of neonate[6]. Iron is received by the fetus from maternal circulation via syncytiotrophoblast of the placenta. Thus iron transfer from mother to the fetus occurs against the concentration gradient .

Several studies have been done to find a relationship between maternal and neonatal iron status.But the results are conflicting and uncertain. Many studies have supported the belief that iron transport from the mother to their fetus occurs independently of maternal iron levels, and that it might even induce deficiency in the mother as a result of "fetal parasitism" [7,8]. However, later studies have questioned this belief and suggested that maternal iron deficiency can cause depletion of fetal iron stores [9,10,11].

Also maternal nutrition has a critical role in fetal development. Optimal fetal growth is dependent on receiving an adequate materno placental nutrient supply. Evidence suggests that fetal growth is most vulnerable to maternal dietary deficiencies of nutrients during early pregnancy[12].

Considering the high prevalence of iron deficiency anemia in pregnant Indian women and since the relationship between maternal and neonatal iron status is still a matter of dispute, we aim to conduct the study to evaluate the effects of maternal iron deficiency on neonatal iron status and their growth indices.

Material and Methods: It is a prospective cross sectional study of eighty six pregnant women of ages between 19-31years delivering singleton live births at term gestation(37-41weeks) to determine the effect of maternal iron status on neonatal iron status and

anthropometric characteristics. A written informed consent was taken from all the women.

Women having chronic medical condition,bleeding during pregnancy,pre-mature labour pain,high-risk pregnancy (eg. history of repeated abortion ,history of trauma and severe infection during pregnancy) ,severe hyperemesis,pre-eclampsia and previous history of haemoglobinopathy were excluded from the study.
Age, parity , educational status , occupation and duration of antenatal care was recorded for each mother.

The pregnant women were divided into three groups according to their pre-delivery haemoglobin (<11gm/dl) and serum ferritin concentration (<12ng/dl) levels: iron deficient anaemic mother, non – anaemic iron deficient mother and non-anemic non –iron deficient mother(normal group).Neonatal anaemia was defined as cord blood haemoglobin level<14gm/dl.

Blood samples were obtained from mother just before delivery and cord blood was taken immediately after clamping the cord and before delivery of the placenta. Hemoglobin was estimated using the Cyanmethaemoglobin method. Serum ferritin was estimated by Fully automated biochemistry analyser (Biosystems A25). Birth weight, length and head circumference of the neonates was also recorded.

Statistical analysis was carried out using SPSS version 16. The mean and standard deviation was calculated for each group. Using one Way ANOVA , comparison of means was determined between the 3 groups .The correlation between maternal iron status and iron status of the neonate and anthropometric parameters was analyzed by Pearson's correlation coefficient . P value < 0.05 was considered statistically significant.
The research protocol was approved by the institutional ethics committee.

Results: On the basis of haemoglobin levels and serum ferritin; 32.6% of the pregnant women studied were anaemic & 17.4% were non anaemic but iron deficient.

Table 1: Pre delivery maternal iron status in 3 groups

Characteristic	NC (n=43)	NAID (n= 15)	IDA (n=28)
Maternal Hb (g/dl)	12.5 ± 1.8 (12.2 – 12.7)	11.7± 1.0 (11.4 – 11.9)	9.9 ± 1.3 (9.7– 10.2)
Maternal Ferritin (ng/dl)	44.0 ± 5.9 (34.9 – 53.1)	10.7±1.2 (10.4 – 11.0)	9.4± 2.1 (9.0 – 9.8)

All values in the three groups are reported as Mean ± 2SD (95 % CI)
NC – Non iron deficient non anaemic
NAID – Non anaemic iron deficient
IDA – Iron deficient anaemia

Table 2: Comparison of Neonatal anthropometrics and iron status in 3 groups by 1 – way ANOVA

Characteristic	NC (n=43)	NAID (n= 15)	IDA (n=28)	P-value	
Haemoglobin (g/dl)	16.0±2.2 (15.7 – 16.4)	14.9±1.2 (14.5 – 15.2)	13.7±1.6 (13.3 – 13.9)	.000	S
Ferritin (ng/dl)	270.3±129.2 (250.5 – 290.2)	150.2±55.4 (134.9 – 165.6)	109.2±94.4 (90.9 – 127.5)	.000	S
Birth weight (kg)	2.8±1.0 (2.6 – 2.9)	2.8±1.02 (2.5 – 3.1)	2.6±0.9 (2.6 – 2.8)	.112	NS
Birth height (cm)	42.9±8.3 (41.6 – 44.1)	43.3±6.8 (41.4 – 45.2)	42.9±8.8 (41.2 – 44.6)	.928	NS
Head circumference (cm)	32.7±3.9 (32.0 – 33.3)	32.3±2.9 (31.5 – 33.0)	32.3±2.3 (31.8 – 32.7)	.584	NS

All values in the three groups are reported as Mean ± 2SD (95% CI)
S – Significant: NS – Non significant

Table 3: Correlation of neonatal iron status and anthropometric characteristics with maternal iron status

	Maternal Hb	Maternal serum ferritin
Neonatal Hb	0.589*	0.392*
Neonatal Serum ferritin	0.699*	0.563*
Neonatal Weight	0.241*	0.209
Neonatal Height	0.029	-0.028
Neonatal Head circumference	0.062	0.071

*Correlation is significant at the 0.001 level (2 tailed)

Table 4: Multiple Group Comparisons of Neonatal Hb

Anaemic status (I)	Anaemic status (J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	1.18589*	.28422	.000	.4914	1.8804
	3	2.38256*	.23016	.000	1.8202	2.9450
2	1	-1.18589*	.28422	.000	-1.8804	-.4914
	3	1.19667*	.30327	.000	.4556	1.9377
3	1	-2.38256*	.23016	.000	-2.9450	-1.8202
	2	-1.19667*	.30327	.000	-1.9377	-.4556
* The mean difference is significant at the 0.05 level.						

1 – Non iron deficient non anaemic
2 – Non anaemic iron deficient
3 – Iron deficient anaemia

Discussion: About half of the pregnant women in our study were iron deficient even if they did not have manifest anaemia. This prevalence was high and was similar with a report from India where 246 pregnant and non pregnant women across 7 villages were studied and showed prevalence of anaemia to be between 25 – 68 %[13].

A study by Singla et al showed that maternal haemoglobin had a linear correlation with haemoglobin and cord blood iron levels[14]. Various studies show that maternal iron status affects iron status of the newborn[15,9,16] . The present study documented that iron deficiency anemia during pregnancy compromises fetal iron status; since significantly lower levels of hemoglobin and ferritin were found in the cord blood of infants born to anemic mothers.

For assessing the effect of maternal anaemia on neonates, we considered neonatal weight, height and head circumference as growth indices in our study. In the current study; newborns of anemic mothers had slightly lower birth weight than the neonates of non anaemic mothers but the difference was not statistically significant. However a significant positive correlation was seen with maternal haemoglobin levels. This was in accordance with Scholl et al who showed that mothers with iron deficiency anaemia had a 3 times greater risk of giving birth to infants with low birth weight[17]. Another study has reported that the birth weight, head circumference, chest circumference, mid-arm circumference and crown heel length were significantly lower in infants born to anaemic mothers.[14] However in our study no significant difference was found in neonatal height and head circumference between anaemic and non anaemic mothers.

The present study was limited by the fact that it did not assess maternal iron and nutritional status from early gestation, which would have been more meaningful to see its effect on fetal iron nutrition. However, it was not possible to do so, since it would have been unethical to study the impact of maternal anaemia from early pregnancy without supplementing them with iron.

Conclusion: In conclusion the present study indicates that maternal iron deficiency anaemia adversely affects the cord blood iron status and haemoglobin levels. Thus, effective strategies are urgently needed to control maternal anaemia in the developing world. New strategies are needed for ensuring that mothers take iron supplementation regularly and nutrition education may be beneficial to improve the dietary intake of pregnant mothers.

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