

Original Research Article

Role of maternal Anemia on cord hemoglobin and infant hemoglobin and ferritin level at nine months of age

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ABSTRACT

Background: Primary objective was to compare hemoglobin at 9 months and secondary objective was to compare birth weight, cord hemoglobin and serum ferritin at 9 months between infants born to anaemic and non anaemic mothers.

Methods: In this prospective cohort study, we compared cord hemoglobin, birth weight, hemoglobin at 09 months & serum ferritin at 09 months in infants of anaemic and non anaemic mothers. Subject of the study was all inborn term infants (n = 344).

Results: Cord blood hemoglobin was similar between infants born to anaemic and non anaemic mothers. However, infants born to anaemic mothers weighed less at birth and had lower hemoglobin at 9 months of age.

Conclusions: Infants born to anaemic mothers are at higher risk of developing anaemia in late infancy which may remain undetected at birth.

Keywords: Anaemia, Cord blood haemoglobin, Infancy, Pregnancy

INTRODUCTION

Anemia is a public health problem resulting in considerable morbidity and mortality. It is one of the important factors affecting the perinatal outcomes. The World Health Organization (WHO) ranked anemia as the 8th leading cause of disease in girls & women in the developing world. As per WHO, 41.8% of pregnant women from all over the globe and 54% in India are anaemic with iron deficiency being the commonest amongst all.¹ Decreased intake and increased demand of iron, altered metabolism, multiple gestations at shorter intervals and maternal malnutrition are some of the well-known factors precipitating anaemia in pregnancy. As per the national guidelines on prevention of anaemia in pregnancy, iron and folic acid supplementation is

routinely given to all pregnant ladies from first trimester itself and is continued throughout pregnancy. In spite of this the incidence of anaemia in pregnancy is still high in India.

Though anaemia may severely affect maternal outcome in form of morbidity and mortality, its incidence causing adverse fetal outcome is rare, taking into consideration that the fetus acts as a parasite, extracting maximum micronutrients even from severely anaemic mother.^{2,3} But failure of adequate iron store accretion during fetal life may predispose these infants to develop iron deficiency anaemia, sometimes severe enough to cause growth faltering during infancy. It may also affect the duration of gestation, intrauterine growth of fetus and birth weight of newborn baby.⁴⁻⁶ Hence, identification of this group of

children at birth would aid in formulation of better hospital policy for their early management, supplementation and follow up. In view of this, the present prospective study was undertaken to study whether there is a difference in the cord hemoglobin level & birth weight as well as hemoglobin and serum ferritin level at 09 months between infants born to anaemic and non anaemic mothers.

METHODS

This prospective cohort study was conducted at a peripheral hospital in eastern India, from January 2016 to December 2017. The status of mother being anaemic or not was based on her third trimester hemoglobin level, as per WHO criteria of anaemia in pregnancy.¹ Anaemic mothers were assumed for iron deficiency based on their hematological indices (mean corpuscular volume [MCV] < 75fl and mean corpuscular hemoglobin [MCH] < 27pg, suggestive of microcytic hypochromic picture) so as to exclude lower hemoglobin levels due to hemodilution in third trimester. All term inborn infants were included in the study after obtaining informed consent from parents and mother was counseled for exclusive breastfeeding of infant till 06 months. Neonate with major congenital malformations, twin pregnancy, preterm delivery, neonate requiring NICU admission, infants requiring frequent blood sampling, parents likely to be moving out of the location over the next 9 months (not being available for follow up, as ours being a service hospital) and non-consent were excluded. Anaemia at 9 months was defined as hemoglobin level < 11 gm/dl as per WHO definition.¹ The study was approved by the hospital ethical committee.

A Performa was made depicting all relevant antenatal and perinatal events. Maternal hematological indices and anthropometry were recorded. Prophylactic iron, folic acid and calcium supplements were given to all mothers at first antenatal visit onward. Our institute has an exclusive breast feeding policy and supports it strongly.

Cord blood hemoglobin was collected at time of delivery. Weight was recorded by a digital electronic weighing machine (ADE electronic baby scale M10615, Germany). Hemodynamically stable neonates were roomed in with mother in the postnatal ward. Neonates were discharged on maintaining hemodynamic stability and on establishment of breast feeding by mother. Parents were counseled adequately about the danger signs, follow-up protocol, exclusivity of breast feeding, and weaning at six months. At all visits for immunization, exclusive breastfeeding was reinforced.

The infants were followed up till nine completed months of chronological age. Hemoglobin and serum ferritin level were estimated at nine months of age when they reported for immunization against measles. Infants were started on oral iron supplementation thereafter.

Sample size calculation and statistical analysis

Sample size was estimated based on a previous study by Kilbride J et al, that found a mean hemoglobin of 10.3 (0.9) and 10.8 (0.9) at 9 months of age in the infants born to anaemic and non-anaemic mothers, respectively.⁷ Assuming 10% loss to follow up, 77 infants were needed in each group using a 2- tailed t test with the significance level of 0.05 and the power of 90%.

Data on birth weight and cord blood hemoglobin, serum ferritin and hemoglobin level at 9 months were compared between anaemic and non anaemic mothers using Chi-square test, Fisher's exact test and Levene's test for equality of variances as applicable. Statistical analysis was done using statistical software SPSS version 20. *P* value < 0.05 was considered significant.

RESULTS

There were a total of 612 live births in hospital during the study period. 234 infants who were not fulfilling the inclusion criteria were excluded from the study. The details are depicted as below. 35 mothers had normocytic normochromic anaemia. 115 mothers were about to move out from station and not available for follow up at 9 months. 4 babies had major congenital malformation. 28 mothers refused consent. 6 babies were born twins. 46 babies were born preterm and required NICU admission. Remaining 378 infants were divided to anaemic and non anaemic group as per mother's third trimester hemoglobin levels. 123 mothers were anaemic and 255 mothers were non anaemic. However, out of 378 infants, 34 infants (15 from anaemic and 19 from non anaemic group) were lost to follow up. Hence 344 infants (108 infants of anaemic and 236 infants of non anaemic mothers) finally completed the study. The study population belonged to same socio-economic status. The flow diagram is depicted in Figure 1.

A 22 mothers had mild anaemia and 86 mothers had moderate anaemia (Table 1). Mean maternal hemoglobin for non anaemic mothers was 12.06 gm/dl (0.69) and for anaemic mothers was 9.29 gm/dl (1.059). The infants born to anaemic mothers weighed less compared to those of non-anaemic mothers. The mean baby birth weight was 2930 gm (0.426) for anaemic mothers and 3170 gm (0.543) for non anaemic mothers (*P* = 0.001). We found no significant difference in the mean cord hemoglobin between anaemic and non anaemic groups (15.35 gm/dl vs 15.44 gm/dl *P*=0.646). On follow up at 09 months, the mean hemoglobin level of the infants born to anaemic mothers was significantly lower than the non anaemic mothers (9.44 gm/dl vs 10.14 gm/dl *P*=0.001). The mean serum ferritin level was not found to be significant (25.62 ng/ml vs 28.21 ng/ml *P*=0.115). The incidence of babies found to be anaemic at 9 months was higher in the anaemic mother group compared to non anaemic mother group 81.5% vs 71.6% (*P*=0.015). The details are depicted in Table 2.

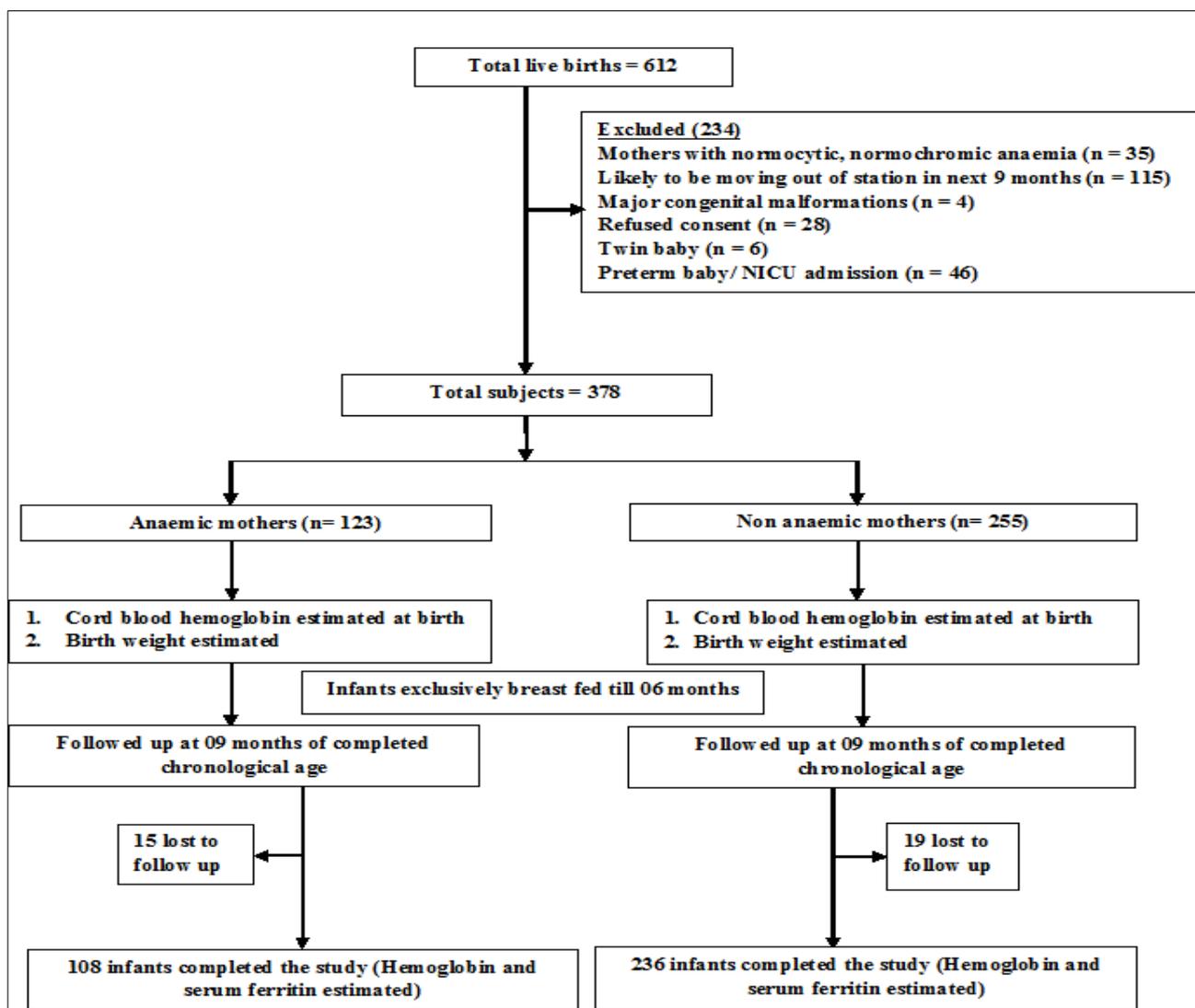


Figure 1: Flow diagram of the study.

Table 1: Mean maternal hemoglobin of anaemic and non anaemic mothers.

Severity of anemia in pregnant ladies	No of cases	Mean maternal Hb (gm/dl) ± SD
No anemia (Hb >=11 gm/dl)	236 (68.6%)	12.06 (0.69)
Anaemia (Hb < 11 gm/dl)	108 (31.4%)	9.29 (1.059)
Mild anemia (Hb 10 gm/dl – 10.9 gm/dl)	22	10.41 (0.32)
Moderate anemia (Hb 7 gm/dl - 9.9 gm/dl)	86	8.93 (0.88)

Table 2: Outcome measures.

Outcome	Anaemic mothers (n=108)	Non anaemic mothers (n=236)	p value	95% CI
Mean infant birth weight (kg) ±SD	2.93 (0.426)	3.17 (0.543)	0.001	0.14 - 0.35
Mean cord Hb (gm/dl) ±SD	15.35 (1.642)	15.44 (1.585)	0.646	-0.27 - +0.46
Mean Hb at 9 month (gm/dl) ±SD	9.44 (1.596)	10.14 (1.278)	0.001	0.37 - 1.06
Mean serum ferritin (ng/ml) ±SD	25.62 (15.607)	28.21 (11.761)	0.115	-0.64 - +5.92
Infants anaemic at 9 months (Hb <11gm/dl)	88 (81.5%)	169 (71.6%)	0.015	1.0 - 3.06

DISCUSSION

Our study demonstrated no significant difference in the cord hemoglobin level of infants born to anaemic and non anaemic mothers. Similar findings were observed in previous study of mothers with mild and moderate anaemia.^{7,8} This implies that fetus' iron endowment remains unaffected, irrespective of maternal hemoglobin status, so long as anaemia is not severe. Few studies have also found a linear correlation between maternal and cord blood hemoglobin in severe anaemia cases, but we did not find any severely anaemic mother in our study.⁸

Our study also found the infants of anaemic mothers to weigh lesser. Similar findings were also observed in previous studies.^{9,10} A U-shaped association between maternal hemoglobin and neonatal birth weight, seen by some authors was not seen, probably due to absence of severe anaemia cases in our study.³

Follow up of our patients at 9 months revealed lesser mean hemoglobin of infants born to anaemic mothers. Similar findings were observed in previous studies.^{6,7,11} While there was no difference in cord blood hemoglobin in these groups, anaemia was significantly higher in infants of anaemic mother at 9 months. The cumulative incidence of anaemia at 9 months as per their study was 77% in anaemic mother and 58% in non anaemic mother infants.⁷ We found the same to be 81.5% and 71.6% respectively (Table 2). This once again confirms that iron endowment strongly depends on mother's antenatal iron store.

Incidence of maternal anaemia remained 31.4% in our study population in spite of the fact that oral hematinic supplementation was given to all the mothers from first trimester itself. This may imply that anaemia due to poor maternal diet is unlikely to develop in isolation and antenatal hematinic supplementation alone may not be sufficient to correct iron deficiency anaemia. Rather, hematinic supplementation may need to be started even before pregnancy and continued throughout the reproductive period.⁶ Few authors in their study also attributed that poor fetal iron endowment alone may not be the lone risk factor for anemia in infancy, but that breast milk of these mother's may also be iron deficient.^{12,13}

The present study has few limitations. We did not take into account the hemoglobin status of the mothers in first trimester. We also did not measure the serum ferritin level of the mother for confirming iron deficiency. But taking to consideration, iron deficiency being the commonest cause of anemia in pregnancy, we tried to exclude hemodilution by including only mothers having microcytic hypochromic anemia as per her hematological indices (surrogate marker for iron deficiency). We did not start any iron supplementation of infants before 9 months

and relied on weaning at six months with continuation of breast feeds.

Our findings add a new dimension to the popular belief that the fetal iron endowment remains un-altered in mild to moderate anaemia, as the decreasing hemoglobin and iron stores of these infants in infancy remains unexplained otherwise. Taking into consideration that the infants were exclusively breast fed for 06 months, this study also raises question whether breast milk iron content of anaemic mothers are also less. With paucity of data on iron content of breast milk in anaemic mothers, we hope the present study acts as an encouragement for future larger population based studies, and also for formulation of policy guidelines for management, follow up and early supplementation of these infants. Also it may emphasize the need for further interventions to aggressively manage and prevent anaemia in women of reproductive age group, rather than only giving supplementation in pregnancy.

To conclude, Infants born to anaemic mothers are at higher risk of developing anaemia in late infancy which may remain undetected at birth.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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