Journal of Pediatric Sciences

Iron store status in newborns born to anemic and non-anemic mothers

Sandhya V, Shruti Patil, ATK Rau

Journal of Pediatric Sciences 2012;4(1):e118

How to cite this article:

Sandhya V, Patil S, Rau, ATK. Iron stores status in newborns born to anemic and non-anemic mothers. Journal of Pediatric Sciences. 2012;4(1):e118

ORIGINAL ARTICLE

Iron store status in newborns born to anemic and non-anemic mothers

Sandhya V, Shruti Patil, ATK Rau*

MS Ramaiah Medical College, Bangalore, India

Professor and Head,Department of Pediatrics, MS Ramaiah Medical College, Bangalore

Introduction

Iron deficiency (ID) and iron-deficiency anemia (IDA) continue to be of worldwide concern. National Family Health Survey (NFHS-3) [1] of India reveals the prevalence of anemia to be 70-80% in children, 70% in pregnant women and 14% in adults. IDA has well known adverse effects on physical and cognitive performances of individuals, and also on maternal and fetal health. However, even more important, is that ID without anemia may also adversely affect long-term neurodevelopment and behavior in infants which may be irreversible.

Studies [2, 3] have documented that the haemoglobin (Hb), serum iron, iron binding capacity, and transferrin saturation at birth bear no relationship with iron status in the mother. However, the iron stores status in infants born to iron depleted mothers remains controversial and inadequately investigated. The possible relationship between iron store status at birth and later cognitive defects has clearly demonstrated an association with IDA in infancy as shown, by Lozoff et al [4, 5, 6]. Despite this, presently, no clear guidelines exist for iron therapy in newborns born to iron deficient mothers. Therefore, the aim of our study was to show that iron store status in a term newborn was dependant on maternal anemia which in turn would pave the way to guidelines on iron therapy in these newborns.

Methods,

Our study is a cross-section case controlled study conducted at a Medical College Teaching Hospital and other affiliated hospitals in Bangalore for a period of 2 months from July to August 2010. The sample size for the study was estimated based on the findings of a study conducted by Agarwal [7] et al in 1999, as 30 subjects in each group.

The study group comprised of 30 newborns born by normal vaginal delivery at term, with a birth weight of above 2500gm to mothers with Hb of less than 10gm% at delivery. The control group comprised of 30 infants born to non- anemic mothers. Newborns with major congenital anomalies, twin gestations, requiring NICU admissions, born to mothers with anemia of any cause other than ID and any factors (acute/chronic inflammation) which could adversely affect serum ferritin levels, birth weight and/or gestation were excluded from the study. All subjects were consecutively enrolled. Informed written consent was obtained from the parents before enrolment and permission was obtained from the ethics committee of the institution.

Detailed maternal history regarding age, parity, presence of any maternal illness, and regular antenatal checkups of all subjects were taken. The gestational age was determined by mother's dates and the New Ballards scores system and weight was recorded on an electronic weighing scale.

At birth, 8ml of cord blood was collected from each baby, for complete hemogram and for serum ferritin (SF) assay. Estimation of hematological indices: mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) was by Coulter® machine and a complete automated hemogram was done and confirmed by an experienced pathologist. Ferritin levels analysis was by manual ELISA [8] technique using Omega Pathozyme Ferritin kit. Statistical analysis of all the quantitative parameters was summarized in terms of descriptive statistics. Student 't' test / Mann-Whitney U test were used to evaluate the significance differences between the groups and considered significance at $p \leq 0.05$.

Results

Two newborns in the case group were excluded from the study as their SF levels were assessed to be outside the expected statistical range. Twenty eight newborns in case group and 30 newborns in control group completed the study. All the baseline characteristics in between each group were comparable (Table I).

Mean hemoglobin values compared between the two groups was 15.10 and14.94 respectively with a p value of 0.745. Mean MCV, MCH, MCHC and RDW between the

groups were 118.3 &115.7; 35.14 & 34.8; 29.8 & 30.5; 18 & 18 respectively. There was no statistically significant difference in the above parameters between the two groups. However, mean SF compared between the two groups was found to be highly significant (68.94 and 126.75 p value of 0.00) Table II.

Table I: Baseline demographic characteristics in both groups

Characteristics	Case group	Control group	p value
Maternal			
Parity score: Primi	10	13	0.190
Para 2	13	15	
Para 3	5	1	
Para 4 & above	2	1	
Maternal age: <20yrs	5	3	0.750
21-25 yrs	14	15	
26-30 yrs	11	11	
>30 yrs	0	1	
Regular ANC	20	23	0.160
Infant:			
Male	16	14	0.657
Female	14	16	
Birth weight : 2500-2999g	12	□1	0.910
3000-3499g	15	15	
>3500g	3	4	

Table II: Mean hemoglobin, red cell indices and serum ferritin (mean ±SD) of both groups.

	Case group (*n*=28)	Control group (*n*=30)	*p* value
Hb (%)	15.10± 2.3	14.94 ± 1.4	0.745
MCV (fl)	118.3±7.8	115.7 ± 6.8	0.182
MCH (pg)	35.14±2.2	34.8 ±3	0.661
MCHC (%)	29.8±2	30.5 ±3	0.330
RDW	18±1.3	18 ± 1.5	0.946
Serum ferritin (ng/dl)	68.94± 52	126.75 ± 65	**0.000**

Discussion

India is considered to have the highest prevalence of nutritional anemia in women; 60 - 80 per cent of pregnant women are found to be anemic, mainly due to iron deficiency. Studies [9,10] including ours, have shown that infants born to anemic mothers are themselves not anemic as, there was no statistical difference in the Hb, MCV,MCH , MCHC, serum iron and TIBC between infants born to anemic and non-anemic mothers. In contrast to this, some studies [11, 12] similar to ours, have shown that while infants born to anemic mother are themselves not anemic, they do suffer from low iron stores. Hence, it appears that there is a limit, to the otherwise highly efficient mechanism which transports iron from the mother to the fetus, especially in moderate to severely anaemic mothers.

There is no doubt that the best indicator of iron store status, in the absence of an acute or chronic inflammation, is the SF levels. The present study has shown that the mean cord SF was significantly lower in the study group as compared to the control group. This demonstrates the influence of maternal anaemia on iron accretion in the fetus. Similar studies [13, 14] have shown that with increasing severity of maternal anaemia, the fetus accumulates less and less of iron stores.

Further, term infants are assumed to have sufficient iron during the first three months as most of the total body iron is contained within the circulating Hb. Thereafter, iron stores are mobilized to meet the erythropoietic demands of the expanding total hemoglobin mass, as the iron in breast milk alone is insufficient to meet the demands of growth. As a result, the level of iron stores starts to decline. Hence, the AAP [15] has recommended that, exclusive breastfed infants should be supplemented with 1 mg/kg per day of oral iron after the first four months of life and until appropriate iron-containing complementary foods (including iron-fortified cereals) are introduced in the diet. But no specific recommendations are currently available to infants born with low iron stores, who maybe at a risk of developing ID earlier than their counterparts [16, 17]

Hence, we propose that term infants born to anemic mothers are screened for their iron store status at birth and to be started on iron supplements earlier than the recommended age of 4 months if found low in stores.

This study has been conducted under the aegis of the Indian Council of Medical Research (ICMR) under the Short Term Scholarship (STS 2010) programme bearing the number 2010-00972.

References

1- National Family Health Survey of India - 3 on incidence of anemia. Available from: www.nfhsindia.org/NFHS-3 Data/NFHS-3 NKF/Report.pdf

2- Kelly AM, Macdonald DJ, McDougall AN: Observations on maternal and foetal ferritin concentrations at term. Br J Obstet Gynaecol 1978; 85: 338-43.

3- Thavaraj VK, Sastry G, Reddy V: Relation between maternal and cord serum ferritin. Indian Paediat 1986; 23: 19-22.

4- Lozoff B, Jimenez E, Smith JB. Double burden of iron deficiency in infancy and low socioeconomic status: a longitudinal analysis of cognitive test scores to age 19 years. Arch PediatrAdolesc Med. 2006;160:1108–13.

5- Lozoff B, Jimenez E, Hagen J, Mollen E, Wolf AW: Poorer behavioral and developmental outcome more than 10 years after treatment for iron deficiency in infancy. Pediatrics. 2000;105(4).

6- Lozoff B, Jimene E, Wolf AW: Long term developmental outcome of infants with iron deficiency. N Eng J Med 1991;325:687-94.

7- Agrawal RM, Tripathi AM, Agarwal KN : Cord blood haemoglobin, iron and ferritin status in maternal anaemia. Acta Paediatr Scand. 1983; 72:545-8.

8- Lipschitz DA, Cook JD, Finch CA. A Clinical evaluation of Serum Ferritin as an Index for Iron Stores, N. Engl J Med 1974;290:1213.

9- Bhargava M, Iyer PU, Kumar R, Ramji S, Kapani V, Bhargava SK : Relationship of maternal serum ferritin with foetal serum ferritin, birth weight and gestation. J Trop Pediatr. 1991; 37:149-52.

10- Sweet DG, Savage G, Tubman TR, et al : Study of maternal influences on fetal iron status at term using cord blood tranferrin receptors. Arch Dis Child Fetal Neonatal Ed 2001;84:40-3

11- Hokama T, Takenaka S, Hirayama K, et al. Iron status of newborns born to iron deficient anaemic mother. J Trop Pediatr. 1996; 42(2): 75-7.

12- Ziaei S, Hatefina E, Togeh GH. Iron status in newborns born to iron deficient mothers. Iran J. Med Sci 2003;28(2): 62-64

13- Singla PN, Tyagi M, Shankar R, et al: Fetal iron status in maternal anemia. Acta Paediatr 1996; 85(11): 1327-30.

14- Manorama B, Parvathi U, Ramesh K, Siddharth R : Ralationship of maternal serum ferrtin with foetal serum ferritin, birth weight and gestation. J Trop Pediat 1991; 37:149-51.

15- Baker RD, Greer FR et al. The Committee on Nutrition. Diagnosis and prevention of Iron Deficiency and Iron-Deficiency Anemia in infants and young Children (0-3 Years of Age). Pediatrics 2010;126;1040-1050.

16- Kilbride J, Baker TG, Parapia LA, et al: Anaemia during pregrancy as a risk factor for iron deficiency anaemia in infancy: a case control study in Jordan. Int J Epidemiol 1999;28(3): 461-8.

17- Allen LH: Anemia and Iron deficiency: effects on pregnancy outcome. Am J Clin Nutr 2000;71(5Suppl1): 1280S-4S.