COMPARISON OF IRON STATUS BETWEEN BREAST FED AND NON BREAST FED INFANTS"

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ABSTRACT

Objective: The objective of this study is to compare the iron status of breast fed and non breast fed infants.
study design Cross- sectional analytical study.
Setting: This study was done in department of Pediatrics Medicine Services Hospital, Lahore.
Duration with Dates: Twelve months **(**15-3-07 to 14-3-08)
Methods: Hundred infants with age ranging from 4 to 6 months were selected. The patients were divided into two groups of 50 each. Group A included exclusively breast fed infants and group B included non breast fed infants. Both groups were assessed for iron status by specific investigations including hemoglobin level (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), RBC's morphology, serum iron and ferritin levels.
Results: The mean age of infants in group A was 5.5 + 0.7 months. Mean age of infants in group B was 5.6 + 0.7 months. Mean Hb of infants in group A was 12.69±0.61 g/dl and group B was 11.1±0.73 g/dl with statistically significant p value of < 0.05. Mean MCV of infants in group A was 91.9±3.5 fL and group B was 84.5±3.5 fL with p-value of < 0.05. Mean MCH of infants in group A was 29.8±0.89 pg and group B was 27.1±1.0 pg with p value of < 0.05.Mean MCHC of infants in group A was 35.4±1.9 g/dl and group B was 32.8±1.6 g/dl with p value of < 0.05.
Mean serum iron of infants in group A was 26.27±2.8 micromole/l and group B was 19.66±3.3 micromole/l with p value of < 0.05. Mean serum ferritin of infants in group A was 118.6±12.5 microgram/l and in group B was 88.1±9.4 microgram/l with statistically significant p value of < 0.05.
Conclusion: It is concluded from the study that exclusive breast feeding is sufficient to maintain adequate iron status in initial six months of infancy.

Key Words: Breast fed infants, non breast fed infants, iron status.

INTRODUCTION

Iron is one of the most well-known micronutrients and is the key element in the metabolism of almost every living organism on the planet. It is one of the top six nutrients that are found to be commonly deficient in people globally.[1] Anemia is one of the most common and intractable nutritional problems in the world today.[2] It is defined as a clinical abnormality characterized by reduction in hemoglobin concentration below the normal for age, sex, physiological condition and altitude from the sea level of a person.[3]

Iron deficiency refers to decreased total iron contents of body and iron deficiency anemia occurs when there is insufficient erythropoiesis owing to iron deficiency.[3] The prevalence of iron deficiency without anemia is much greater than the prevalence of iron deficiency with anemia, with the potential for a much greater public health impact. It is the most common type of anemia and most frequent cause of microcytosis and hypochromia.[4] Major causes of iron deficiency are nutritional inadequacy, malabsorption and blood loss. On a world wide basis iron deficiency is the most prevalent deficient state. U.S children aged below 2yrs have prevalence rates of >10% and 30% for iron deficiency and iron deficiency anemia respectively.[5] Whereas in Pakistan 2/3 children are anemic, the most frequent cause being the Iron deficiency. Iron deficiency is higher in developing countries, lower socioeconomic groups and with poor education status.[4] Predictably, the prevalence of anemia in developing countries is three to four times higher than in industrialized countries.[6]

As deficiency develops slowly after the depletion of iron stores in body and bone marrow, the adaptation occurs and disease may remain unrecognized for sometime. Iron deficiency ranges from iron depletion causing little physiological damage to iron deficiency anemia leading to organ dysfunction. Iron deficiency is diagnosed by various parameters Peripheral blood smear is a significant and old diagnostic tool.[7] A sufficiently low hemoglobin and haematocrit value with microcytosis (low MCV) is suggestive of iron deficiency anemia. Biochemical indicators include serum iron, serum transferrin, Transferrin saturation and serum ferritin.[7,8] Other variables include serum circulating transferrin receptor (TfR) and Reticulocyte hemoglobin equivalent (Ret He).[9,10] Iron and iron-containing compounds play vital roles in cellular function in all organ systems. In the human body, iron is a key ingredient of hundreds of proteins and important enzymes. It has many vital functions in the body. It is involved in synthesis of DNA and in the regulation of cytokine production and thus plays a role in immune function.[11] Iron is involved in energy metabolism as an oxygen carrier in hemoglobin and as a structural component of cytochromes in electron transport. Iron deficiency has been known to be associated with decreased physical activity, poorer cognition and marked difficulties in visual-spatial and motor skills.[12,13] These children are twice more at risk of neurodevelopmental impairment both from iron deficiency and CNS damage due to associated lead absorption.[14]

Global prevalence is quite high below 2yr of age. Iron deficiency anemia occurs frequently in term infants between 9 and 24 months of age, and it is observed at 3 to 6 months of age in infants of low birth weight who have not received an exogenous source of iron.[5,15] Iron status during infancy and early childhood reflects highly dynamic processes, which are affected by both internal and external factors.[15] Fetal iron status is dependant on maternal iron reserves. Severe maternal iron-deficiency anemia adversely affects cord blood and breast milk iron status. Babies who are born premature or with lower birth weight or Intrauterine growth restriction are likely to develop iron deficiency.[16] Iron deficiency is high in infants from poorer, less educated families because of poor dietary iron and worse maternal iron status (that is due to poor diet or a greater number of children).[6]

Healthy, full-term babies have enough iron stores in their bodies to last for at least the first six months.[17] The iron in breast milk is better absorbed than that from other sources. Human milk contains just the right amount of fatty acids, lactose, water, and amino acids for human digestion, brain development, and growth. In addition, breast fed infants are less likely to suffer from infectious illnesses and their symptoms.[18,19] The consumption of whole bovine milk during the first year of life is linked to the production of iron deficiency anemia. This is partly due to the fact that both the concentration and the bioavailability of iron are low in cow milk.[20] During the second half of infancy, the iron content of weaning foods is important in preventing iron deficiency.[15] Identification of Iron deficiency anemia in young children is important because of its adverse effect on behavior and development. Children anemic in infancy continue to have poorer cognition, school achievement, and more behavior problems into middle childhood.[12,13] Therefore feeding in first 6 months of life is very important. It is possible for infants to remain iron-sufficient on a diet composed solely of breast milk so iron deficiency is extremely rare in exclusively breast-fed infants during this period.[17]

The rationale of this study is to compare the iron status of exclusively breast fed infants and the infants feeding exclusively fresh milk and / or formula milk in early six months of life.

OBJECTIVE

To compare the iron status of breast fed and non breast fed infants.

OPERATIONAL DEFINITIONS:

Breast-Fed Infants: Infants taking mother feed as the only source of food.

Non Breast-Fed Infants: Infants taking only formula milk and/or fresh milk like buffalo, cow, goat and/or camel milk.

Iron status: Iron status was assessed by serum Iron and serum ferritin levels. Normal serum iron level ranges from 4 – 33 micromole/l for infants. Normal serum ferritin level ranges from 50 -200 microgram / l for infants.

Hypothesis: Breast feeding or fresh/ formula feeding has no effect on the iron status of infants.

MATERIALS AND METHODS

STUDY DESIGN

This is a Cross- sectional analytical study conducted at Department of Pediatric Medicine (unit II), Services Hospital,Lahore from **15-3-07 to 14-3-08 .** Total One hundred infants were selected through convenient non-probability sampling.Fifty breast fed and fifty non breast fed infants were assigned to group A and group B respectively.

Healthy Infants of both sexes with age between 4 months – 6 months on exclusive breast or exclusive

fresh and/or formula feeding were selected. The infants born born premature or with congenital anomalies or taking iron supplements were excluded from the study.

DATA COLLECTION:

One hundred cases who fulfill the inclusion and exclusion criteria were included through OPD, emergency and indoor department of pediatric medicine Services Hospital Lahore. Demographic information including name, age, sex and address was recorded. An informed consent was taken from their parents for including them in study and using their private data in research. Detailed information regarding birth events, feeding practice, vaccination status, past illness was obtained.

Venous blood (5 ml) of all 100 babies was drawn with the help of scalp vein needle (SV needle) after explaining the procedure to mother. One ml blood was transferred to a vial containing EDTA and mixed thoroughly and was sent to the laboratory for determining Hb and erythrocyte indices (MCV, MCH, and MCHC). Blood left in the syringe (about 4ml) was transferred to the laboratory and centrifuged for 15 min. at 3000 rpm. The clean sera were then transferred to a separate syringe and stored at – 20 c for analysis of serum iron, and serum ferritin. Serum was analysed to determine iron level. Serum ferritin was determined by immunoenzymatic method by ELISA. All the information was recorded in pre- designed proforma (copy attached).

DATA ANALYSIS:

All collected information was entered in SPSS version 10 and analyzed. Variables in demography like age were presented as mean and standard deviation; variables like sex were presented as percentage. Normal serum iron level ranges from 4 – 33 micromole /l for infants. Normal serum ferritin level ranges from 50 -200 microgram / l for infants. A cut-off value of <4 micromole/l for serum iron and below 50 microgram/l for serum ferritin was considered abnormal for infants. Serum ferritin and serum iron levels were described in terms of mean and standard deviation. The outcome of the two groups in infants was compared for any difference in terms of their mean and standard deviation values. These values being quantitative, t-test was applied for estimating significance. A p-value of 0.05 or less was considered significant.

RESULTS

In this study one hundred infants of age 4- 6 months and their mothers were selected. They were divided into two groups, 'A' and 'B'. Breast fed infants were assigned to group A and non breast fed infants to group B. Mean age of infants in group A was 5.5 + 0.7 months group B was 5.6 + 0.7 months (Table 1).

In group A there were 24 (48%) male infants and 26 (52%) female infants. In group B there were 22 (44%) male infants and 28 (56%) female infants (Table 2).

Mean Hb of infants in group A was 12.69± 0.61g/dl and group B was 11.1±0.73 g/dl with statistically significant p value of <0.05. Mean MCV of infants in group A was 91.9±3.5 fL and group B was 84.5±3.5 fL with statistically significant p value of <0.05. Mean MCH of infants in group A was 29.8±0.89 pg and group B was 27.1±1.0 pg with statistically significant p value of <0.05. Mean MCHC of infants in group A was 35.4±1.9 g/dl and group B was 32.8±1.6 g/dl with statistically significant p value of <0.05 (Table 3).

Table 1: Distribution Of Infants By Age

Age (Months)	Group A (n=50)		Group B (n=50)		Total (n=100)	
	No.	% age	No.	% age	No.	% age
4 - 5	18	36%	20	40%	38	38%
>5 - 6	32	64%	30	60%	62	62%
Mean + S.D	5.5 + 0.7		5.6 + 0.7		5.54 + 0.7	

Key: SD Standard deviation

Table 2: Distribution Of Infants By Sex

Sex	Group A (n=50)		Group B (n=50)	
	No.	Percentage	No.	Percentage
Male	24	48%	22	44%
Female	26	52%	28	56%

p >0.05

Table 3: Comparison Of Infant's Hb And RBC Indices

RBC indices	Group A (n=50)	Group B (n=50)	p-Value
	Mean±SD	Mean±SD	
Hb	12.69±0.61	11.1±0.73	<0.05
MCV	91.9±3.5	84.5±3.5	<0.05
MCH	29.8±0.89	27.1±1.0	<0.05
MCHC	35.4±1.9	32.8±1.6	<0.05

Key: SD Standard deviation

Table 4: Comparison Of Infants Serum Iron And Ferritin Level.

Serum Levels	Group A (n=50)	Group B (n=50)	p – Value
	Mean±SD	Mean±SD	
Iron (micromole/l)	26.27±2.8	19.66±3.3	<0.05
Ferritin (microgram/l)	118.6±12.5	88.1±9.4	<0.05

Key: SD Standard deviation

Mean serum iron of infants in group A was 26.27±2.8 micromole/l and group B was 19.66±3.3 micromole/l with statistically significant p value of <0.05. Mean serum ferritin of infants in group A was 118.6±12.5 microgram/l and in group B was 88.1±9.4 microgram/l with statistically significant p value of <0.05 (Table 4).

DISCUSSION

On a world wide basis iron deficiency is the most prevalent deficient state. U.S children aged below 2 yrs have prevalence rates of >10% and 30% for iron deficiency and iron deficiency anemia respectively.[4] Whereas in Pakistan 2/3 children are anemic, the most frequent cause being the Iron deficiency.[5] Among children, iron deficiency is seen most often between six months and three years of age due to rapid growth and inadequate intake of dietary iron. The first 2 years of life are also crucial for their mental, physical, and emotional development. For the first few months of life, exclusively breastfed normal–weight children consume enough iron from their mother's breast milk to meet their needs. However, after 6 months infants require an additional source of iron to prevent deficiency.[18,19]

In this study, a total of one hundred infants were selected and divided into two groups (breast fed infant in Group A and non breast fed infants in Group B). The mean age of infants in group A was 5.5 + 0.7 months and group B was5.6 + 0.7 months. Both the groups were comparable not only in regard to age but also gender distribution.

In this study, the comparison of the mothers of two groups showed that both groups were not different in their Hb level, RBC's indices, and serum iron ferritin levels.

In this study Mean Hb, MCV, MCH and MCHC were significantly better in group A (breast fed babies) as compared to group B (non breast fed babies) with p-value <0.05. This is in conformation to some other studies. Duncan et al.[21], in a study of thirty-three infants showed that the infant who is exclusively breast-fed for the first 6 months of life is not at high risk for the depletion of iron stores during that time. This study was a non comparative whereas we have compared breast fed infants with bottle fed infants showing similar results.

Mean serum iron of infants in group A was 26.27±2.8 micromole/l and group B was 19.66±3.3 micromole/l (p value <0.05). Mean serum ferritin of infants in group A was 118.6±12.5 microgram/l and in group B was 88.1±9.4 microgram/l (p value <0.05). Saarinen et al[18] studied the relationship of breast and cow milk feeding to absorption of iron and to iron status. Forty term infants at about six months of age were included in their study as compared to the 100 term infants in my study. Laboratory assessment of iron status was based on the serum ferritin, hemoglobin, mean corpuscular volume, and transferrin saturation. In comparison, in my study iron status was assessed by Hb, RBC indices, serum iron and serum ferritin concentration. Their study indicated that infants fed on breast milk during the entire first six to seven months of life attained greater iron stores than did those fed on cow milk or formula milk. This result is comparable to our conclusion which showed better iron reserves in breast fed infants (Serum Ferritin 118.6±12.5 microgram/l) than non breast fed infants (Serum Ferritin 88.1±9.4 microgram/l).

CONCLUSION

From this study it is concluded that Iron status of breast fed infants is better than iron status of non-breastfed babies' up to 6 months of age.

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