Original Research Article

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A study of prevalence of iron deficiency anaemia in infants and toddlers (6-24 months) by measuring serum ferritin levels

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ABSTRACT

Background: Nutritional anemia is a worldwide problem with the highest prevalence in the developing countries. One of the most vulnerable groups is 6-24 months of age. NFHS-3 survey shows that the incidence of anemia in children aged 6-35 months is 79.2% with 72.7% in urban areas and 81.2% in rural areas. First stage of iron deficiency is depletion of iron stores, which is reflected by decreased serum ferritin levels and increased total iron binding capacity (TIBC) levels. The objective of this study was to detect presence of iron deficiency in children even before clinical appearance of anemia by measuring serum ferritin levels.

Methods: The study was conducted from March 2017 to November 2017 in the Department of Pediatrics of Sir Sayajirao Gaekwad General Hospital, a tertiary level hospital and government medical college, Vadodara. A cross sectional study was done in which a total of 111 asymptomatic infants and toddlers in age group of 6-24 months presenting to well-baby clinic were enrolled randomly. Haemoglobin, RBC indices and serum ferritin levels were estimated. The children were classified into mild, moderate and severe anaemia according to their haemoglobin levels. Correlation with their serum ferritin levels was carried out by using statistical analysis.

Results: Prevalence of anaemia (Hb <11gm/dl) was 84.14% in 6-12 months age group, 81.25% in 13-18 months age group and 84.61% in case of 19-24 months age group. Overall 83.78% of infants and toddlers were found to be anemic among 6-24 months age group. 55 infants (49.54%) among 111 infants had mild anaemia, 29 infants (26.12%) had moderate anaemia, 9 infants (8.1%) had severe anaemia. Majority of children (87 of 111 infants) had microcytic and hypochromic RBCs in their peripheral smear examination. 78 infants (72.07%)) had low serum Ferritin levels while only 31 infants had normal ferritin levels which is statistically significant (p=0.0084). Out of these, 4 infants had normal hemoglobin level.

Conclusions: Anaemia is highly prevalent in the age group of 6 to 24 months even in otherwise healthy infants. Serum ferritin level is a good indicator of iron deficiency in children.

Keywords: Iron deficiency anaemia, MCV, Serum ferritin

INTRODUCTION

Nutritional anaemia is a worldwide problem with the highest prevalence in developing countries.¹ More than 30% of the world population i.e. 1500 million people are suffering from anaemia. Anaemia is the commonest

cofactor encountered in pediatric patients in both indoor as well as outdoor practice.²

A child is said to be anemic when the hemoglobin and/or hematocrit is two standard deviations below the mean for that particular age and sex.¹

Anaemia is a serious concern for young children because it can result in impairments in cognitive performance, behavioral and motor development, coordination, language development, and scholastic achievement as well as increased morbidity from infectious diseases.3 One of the most vulnerable groups is 6-24months of age.⁴ Up to 6 months breast milk provides required iron to the infant. After that daily requirement of iron is not met as complementary feeds are poor sources of iron and food fortification is not widely practiced in India. Iron deficiency and resultant anaemia especially mild and moderate form are seen even in healthy infants. First stage of iron deficiency is depletion of iron stores, this is reflected by decreased serum ferritin level and increased total iron binding capacity (TIBC) levels, last stage is anaemia. If iron deficiency is picked up in early stage, supplementation can be started. This would prevent development of anaemia as well as enhance cognitive and intellectual development. Hence, we conducted this study at Department of pediatrics, S.S.G. Hospital and government medical college, Vadodara to know prevalence of iron deficiency in healthy infants and toddlers of 6-24 months by measuring serum ferritin level.

METHODS

The study was conducted from March 2017 to November 2017 in the Department of Pediatrics of Government Medical College, Vadodara. It was a cross sectional study in which a total of 111 asymptomatic infants and toddlers in age group of 6-24 months attending well baby clinic were enrolled randomly. A thorough physical examination was carried in each patient to rule out other causes of anaemia like hemolytic anaemia, anaemia of chronic disease etc. Blood was drawn for investigations like CBC, Hb indices and peripheral smear. Serum ferritin levels were estimated in all children.

Inclusion criteria

- Infants and toddlers from 6 months to 24 months.
- Infants and toddlers having normal weight (>3SD as per age group).

Exclusion criteria

- Children having severe malnutrition (weight<3SD for age)
- Children having infections (Serum ferritin level is falsely raised in infection)
- Children having other causes of anaemia (e.g. haemolytic anaemia)
- Children having chronic malabsorption or major cardio respiratory diseases
- Each child was classified depending upon his hemoglobin level into⁵
- Mild anaemia: 9-11gm/dl
- Moderate anaemia: 7-9gm/dl

- Severe anaemia:<7gm/dl
- Microcytosis was defined as MCV<80femtolitre, macrocytosis as MCV>95femtolitre, normocytosis as MCV between 80-95femtolitre⁵
- The acceptable reference value for serum ferritin was considered to be between 12-400ng/ml.⁵

RESULTS

During the study 111 infants and toddlers in age group of 6-24months attending well baby clinic were examined and investigated for iron deficiency and anaemia. The age and sex distribution of the cohort are as under (Table 1).

Table 1: Profile of the cohort (n=111).

Sex	No.	Percentage
Male	57	51.35
Female	54	48.65
Total	111	100

Above data shows that prevalence of anaemia (Hb <11gm/dl) in 6-12 months age group was 84.14%, in 13-18 months age group was 81.25%, in case of 19-24 months age group was 84.61%. Overall, 83.78% of infants and toddlers were found to be anemic. Fifty infants (49.54%) among 111 infants had mild anaemia, 29 infants (26.12%) had moderate anaemia, 9 infants (8.1%) had severe anaemia. These infants came for routine follow up and they did not have any symptoms including infants with moderate and severe anaemia (Figure 1).

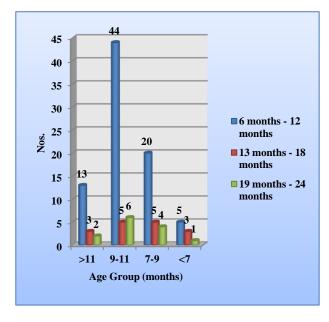


Figure 1: Prevalence of anemia among different age group.

Present study shows that majority of children (87 of 111 infants) had microcytic and hypochromic RBCs in their peripheral smear examination. Only 19 children had

Normocytic Normochromic PS picture. In present study, it was found that among 78 infants having iron deficiency, 76 had microcytic hypochromic RBCs, 1 had normocytic normochromic RBCs and 1 had dimorphic RBCs. Statistical analysis using chi square test showed that the results were statistically significant. (p=0.00486).

While looking at the serum ferritin levels of the enrolled patients it was found that 78 out of 111 patients (72.07%) had low serum ferritin levels and only 31 had normal levels. Low levels were found even in patients having mild anaemia. These results were statistically significant. (p=0.0084) (Table 2).

Table 2: Hemoglobin level and serum ferritin level.

Haemoglobin level	S. Ferritin (ng/ml)				
(mg/dl)	<12	12-400	>400	Total	
>11	4	14	0	18	
9-11	41	14	0	55	
7-9	27	02	0	29	
<7	6	1	2	9	
Total	78	31	2	111	

In present study, it was found that, among 111 infants and toddlers 103 had low MCV level. Amongst these 78 infants and toddlers had low serum ferritin levels. Statistical analysis using chi square test showed that, the results were statistically significant (p=0.0023). All iron deficient infants have low MCV value though not all infants having low MCV had iron deficiency. Two of 111 infants had serum ferritin level >400ng/ml. So, in those cases authors have to rule out other causes like acute infection, thalassemia syndromes and other hemolytic anaemia (Table 3).

Table 3: MCV level and serum ferritin level.

MCV (FI)	S. Ferritin level (ng/ml)			
	<12	12-400	>400	Total
<80	78	25	0	103
80 - 95	0	6	1	7
>95	0	0	1	1
Total	78	31	2	111

Authors found that the diet of most infants in present study consisted of cereals, milk, breast milk and small amount of fruits and vegetables. Sources of iron in the diet were negligible supplying less than 2-3mg of iron per day. Number of infants received iron supplements or was taking iron fortified formula diet.

DISCUSSION

NFHS-3 survey shows that the incidence of anaemia in children aged 6-35 months is 79.2% with 72.7% in urban areas and 81.2% in rural areas. Similar study was carried out by Kapur D, Agarwal KN, Department of Pediatrics, University College of Medical Sciences and Guru Teg

Bahadur Hospital, Delhi, on iron status of children aged 9-36 months in an urban slum integrated child development services project Delhi. It included 361 children. The study found that 64% children (9-36 months of age) were anemic; of those 7.8% had severe anaemia. Eighty-eight percentage of children (subsample study) were iron deficient as determined by low serum ferritin levels.

In India, 95% of children are breastfed. The WHO recommends introduction of complementary food at six months as breast milk is not sufficient to maintain growth after this age. Various Indian studies show that only 45% of children at 6-8 months age receive adequate complementary foods. Also, only 10% of breastfeeding children aged 6-35 months eat meat, fish or eggs which are rich in heme iron with high bioavailability.^{6,7}

Due to all this, NIPI (national iron plus initiative) recommends iron supplementation in the form of IFA syrup containing 20mg/ml of concentrated iron, 1ml biweekly along with deworming.⁸

NIPI guidelines are not stringently followed in urban areas due to absence of ASHA/anganwadi workers. Even private pediatricians do not routinely supplement infants >6 months with iron. Iron supplementation should be started in at 6 months of age and carried on up to 24 months. Iron supplementation should be started in at 6 months of age and carried on up to 24 months.

Serum ferritin is a good early marker of iron deficiency. It should be carried with RBC indices and other parameters like TIBC and serum Iron.

CONCLUSION

Ninety-three infants (83.78%) out of 111 had anaemia (Hb <11). Among them, 55 infants (59.13%) had mild anaemia, 29 (31.18%) had moderate anaemia and 9 (9.67%) infants had severe anaemia in present study 87 (78.31%) infants have microcytic hypochromic RBCs among them 78 (83.87%) infants are iron deficient. Association between iron deficiency and low MCV was significantly seen in present study. Present study highlights the need for iron supplementation aim all healthy infants as early as 6 months.

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