Iron Status in Malnourished Children : A Cross Sectional Study

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Abstract

Objectives: Malnutrition is a common condition among children and iron status varies in different types of malnutrition. So the present study is aimed to find the different iron status among severe malnourished children in our context. **Methods:** A hospital based cross sectional study was done in the Paediatrics ward Chittagong Medical College Hospital in a period of 6 months from January to July 2013 among the 50 cases of malnourished children of age range between 1 to 5 years and Weight for Height Z score(WHZ) was <-2 SD. Sampling technique was continuous purposive sampling. Venous blood was collected to assay the different iron profile mainly serum iron level, total iron binding capacity(TIBC) and transferrin saturation(TSAT). Data was analyzed after correction by SPSS-19. **Results:** Among the 50 study children of different age groups 15 patients were 1 to 2 years, 18 patients were 2 to 3 years, 10 patients were 3 to 4 years and 7 patients were at 4-5 years of age groups. Among the patients, 29 (58%) of patients were female and 21(42%) of the patients were male. Most of the children were from the families of low socioeconomic status 38(76%). 2(4%) children were from upper middle class who had step mother. Among the selected patients the dominating clinical features were anemia was found among 45(90%) of patients which was mild(66.6%), moderate(26.6%) and severe(6.6%). Skin changes(32%), eye changes(10%) and hair changes(48%) were also found. Among the 50 study subjects prelacteal feeding was given among 43(86%) children, breast feeding was given 45(90%), exclusive breast feeding was given to 24(48%) of children and complementary feeding after 6 months was given to 29(58%) patients. Among the 50 patients -2 to -3 SD weight for height was found in 20(40%) patients and <-3 SD was found in 30(60%) patients. Most of the children was found to have Mid Upper Arm Circumference (MUAC) 115-125 mm(50%). Iron status was measured among all patients where serum iron level was found 77.72 ± 11.22 mcgm/dl, TIBC was found 340.07 ± 22.67 mcgm/dl and transferrin saturation was found 22.38 ± 2.9 %. Iron status were measured among the different types of malnutrition where serum iron level and transferrin saturation was high among all patients with malnutrition while TIBC was lower than standard level in all patients. Different biochemical status were measured among the different types of malnutrition where serum total protein, serum albumin, Hb% were lower than standard level in all patients. **Conclusion:** Change in different iron status is a common findings in malnourished children. Screening of all children for anemia and providing iron and folic acid (IFA) or multiple micronutrients (MMN) supplements to children and Infant and Young Child Feeding (IYCF) should be addressed at all level to overcome the situation.

Key words: Serum iron; TIBC; TSAT.

INTRODUCTION

Protein-energy malnutrition (PEM) is one of the important causes of under 5 morbidity and mortality in our country[1]. Each year 240,000 deaths among children under 5 years of age in Bangladesh can be attributed to malnutrition (more than 600/day).

Two-thirds of under 5 children are malnourished in Bangladesh[1]. The national child nutrition survey conducted in 2000 demonstrated that among the children of 6-71 months of age, almost 49% were found stunted and nearly 12% wasted and 52% were under weight. Bangladesh Demographic and Health Survey (BDHS)-2011 showed that 41% of children under five are stunted and 15% are severely stunted, 16% of children are considered wasted, 4% are severely wasted and 36% children are undernourished(low weight for age)[2]. It was found that among the South Asian countries (Surveyed from 1990-2000) prevalence of wasting were in Bangladesh 11.6%, India 18%, Pakistan 11%, Nepal 11%, Srilanka 14%. Bhutan 4%, Maldives 17%, South Asia 18%, and World 11%[3].

Iron deficiency is a major contributor to the morbidity and mortality of children in Bangladesh. Nutritional surveillance project showed that 50% of all preschool children of Bangladesh are anemic and 34% of school children had low level of hemoglobin concentration[3-4]. In case of severely malnourished wasted children, serum total protein and albumin are expected to be normal or reduced[4]. Raised globulin level is also anticipated since malnutrition is commonly associated with infections[5]. Iron is an important integral component or essential cofactor for several metabolic processes which is deranged in PEM[6]. Transferrin plays a key role in infection resistance during the period or physiological low concentration of immunoglobulin in growing children[7]. Nutritional deficiency adversely affects immune function and reduces the effectiveness of the host defense; thus inviting more infection and causing iron loss[8]. Socio-economic factors also have an important role in iron deficiency especially in developing countries[9-12]. Nutritional anemia is one of the major causes of growth retardation, less physical activities and defect in cognitive function in childre[10].

There are different components of iron status that can be assessed to see its condition in the body. If iron status can be evaluated early it might be possible to give adequate supplements and advice for adequate and appropriate foods to the children to overcome the malnutrition and anemia. With this view the aims and objectives of this study is to observe level of serum iron, Total Iron Binding Capacity(TIBC) and transferrin saturation present in malnourished children in our country and to compare the result, among different types of malnutrition.

MATERIALS & METHODS

This is hospital based cross sectional study done in the Department of Paediatrics in collaboration with Department of Biochemistry, Chittagong Medical College Hospital over a period of 6 months from January to July 2013 among the 50 cases of malnourished children of age range between 1 to 5 years and Weight for Height Z score(WHZ) was <-2 SD. The general objective of the study was to find out the pattern of Iron status among the malnourished Children with some specific objectives like to assess the nutritional status of the study population, to identify levels of different iron profile like, Serum Iron level, TIBC and Transferrin Saturation, to evaluate interrelationship among the different Iron status with malnutrition.: A total of 50 consecutive cases of malnourished

children were enrolled in this study by purposive sampling technique where inclusion criteria was children 1-5 years age, weight for Height Z score(WHZ) <-2 SD, bipedal edema and voluntarily given consent by legal guardian to participate in the study and exclusion criteria was children between 1-5 years of age having anemia due to hemolytic anemia, leukemia, bleeding disorders and other malignant disease.

Malnourished Children was defined male and female children aged 1-5 years of age with weight-for-height (WHZ) <-2 SD with a history of faulty feeding having no pre-existing systemic diseases. Levels of Serum Iron, TIBC and Transferrin Saturation(TSAT) were assessed.

From all eligible subjects after getting consent some clinical history was taken and then details regarding malnutrition were asked and noted. 5 cc of venous blood were collected and sent for analysis of different iron profile, serum protein and albumin and also Hb%. All biochemical tests was done in the Biochemistry Department of CMCH. All relevant data were noted in the pre tested data sheet. All data were be checked and rechecked to avoid error. Serum total protein, serum albumin, serum iron and TIBC were estimated by spectrophotometric technique Transferrin saturation was calculated by (Serum iron x 100)/ TIBC formulae. The data were analyzed by statistical software packages SPSS method version 15. The student's test was done for statistical analysis. Table of frequencies was drawn and proportions were calculated for relevant variables. Mean and standard deviation was measured and proportion was expressed in percentage. P value <0.05 will be considered significant. To conduct the study, written approval from the concerned department and authority was taken with due procedure from Chittagong Medical College Hospital, including ethical clearance.

RESULTS

Regarding analysis of socioeconomic status most of the children were from the families of low socioeconomic status 38(76%). 2(4%) children were from upper middle class who had step mother (Table 1). Among the selected patients the dominating clinical features were anemia was found among 45(90%) of patients which was mild (66.6%), moderate(26.6%) and severe(6.6%). Skin changes (32%), eye changes (10%) and hair changes (48%) were also found (Table 2). Among the 50 study prelacteal feeding were given among 43(86%) children, breast feeding was given 45(90%), exclusive breast feeding was given to 24(48%) of children and complementary feeding after 6 months were given to 29(58%) of the patients (Table-3). Among the 50 patients -2 to -3 SD weight for height was found among 20(40%) patients and <-3 SD was found among 30 patients. Most of the children was found to have MUAC 115-125 mm (50%) (Table 4). Iron status was measured among all patients where serum iron level was found 77.72 ± 11.22 mcgm/dl, TIBC was found 340.07 ± 22.67 mcgm/dl and transferring saturation was found 22.38 ± 2.9 %. (Table 5). Iron status were measured among the different types of malnutrition were serum iron level and transferring saturation was high among all patients with malnutrition whereas TIBC was lower than standard level among the all patients (Table 6). Different biochemical status were measured among the different types of malnutrition where serum total protein, serum albumin, Hb% and were lower than standard level among the all patients (Table 7).

Table 1: Socioeconomic status(SES)* of the study patients (n=50)

Socioeconomic status	Frequency	Percentages
Poor	38	76%
Lower middle class	10	20%
Upper middle class	2	24%
Affluent	0	0%

* Status were evaluated by Rahaman et al-2009, (ICDDRB).

Table 2 : Table showing clinical features of the patients(n=50)

Clinical features		Number	Percentages
1.	Anemia	45	90%
	Mild	30(66.6%)	
	Moderate	12(26.6%)	
	Severe	3(6.6%)	
2.	Edema	30	60%
3.	Leuconychia	1	2%
4.	Skin change	16	32%
	Hypopigmentation	2(12.5%)	
	Hyperpigmentation	3 (18.7%)	
	Desquamation	15(93.75%)	
	Ulcer	5(31.5%)	
	Exudation	3(18.75%)	
5.	Eye change	5	10%
	Bitot's spot	0(0%)	
	Conjunctival xerosis	4(80%)	
	Corneal ulcer	1(20%)	
6.	Hair change	24	48%

Table 3 : Feeding habit of the patients (n=50)

Findings	Yes Number(%)	No Number(%)
Prelacteal feeding:	43(86%)	7(14%)
Breast feeding:	45(90%)	5(10%)
Exclusive breast feeding:	24(48%)	26(52%)
Complementary feeding:	29(58%)	21(42 %)

Table 4 : Table showing examination findings of the patients (n-50)

Anthropometric Variables	Number	Percentages
Weight for height		
-2 to -3 SD	20	40%
< -3 SD	30	60%
MUAC		
<115 mm	20	40%
115-125 mm	25	50%
>125 mm	5	10%

Table 5 : Iron status among the study patients (n=50)

Findings	Range	Mean	±SD
Serum Iron Level (mcgm/dl)	62.3-89.0	77.72	11.22
TIBC(mcgm/dl)	313.5-369.3	340.07	22.67
Transferrin saturation(%)	18.9-25.4	22.38	2.90

Table 6 : Iron profile and different types of malnutrition (n=50)

Findings	Marasmus (N=20)	Marasmic kwashiorkor (n-25)	kwashiorkor (N=5)	P value
Serum Iron Level (mean ± sd) (mcgm/dl)	74.34± 11.4	77.72 ± 12.4	78.9± 13.4	0.856*
TIBC (mean ± sd) (mcgm/dl)	342.07± 23.4	340.87± 22.5	334.50± 21.5	0.09*
Transferrin saturation(%) (mean ± sd)	21.40± 2.50	23.05 ± 3.2	29.05± 2.8	0.021**

* Statistically not significant **Statistically significant

Table 7 : Iron profile and different types of malnutrition (n=50)

Findings	Marasmus (N=20)	Marasmic kwashiorkor (n-25)	kwashiorkor (N=05)	P value
Serum total protein (mean ± sd) (mcgm/dl)	61.72 ± 2.94	60.9± 1.54	54.34 ± 1.34	0.01**
S albumin (mean ± sd) (mcgm/dl)	30.07± 3.4	28.87± 4.5	25.50 ± 4.5	0.5*
Hb% (mean ± sd)	10.3 ± 2.2	9.2 ± 2.4	8.1 ± 2.1	0.21*

* Statistically not significant **Statistically significant

DISCUSSION

Malnutrition is one of the important causes of under 5 mortality and morbidity in our country. Two-third of under 5 children are malnourished[12]. In Bangladesh 50% of all preschool children are anemic and 34% of school children had low level of hemoglobin concentration[12]. Malnutrition associated with iron deficiency is more common in kwashiorkor but less in marasmic children[13].

This present study was done between January to July 2013, in a tertiary care hospital of Chittagong where 50 cases of malnourished children were included as per inclusion criteria. Most of the children were from poor socioeconomic status. As nutrition is maintained in the children of affluent families.

Malnourished children were not found among them. A study done by Rahaman et al also found that malnourished children are more common among poor socioeconomic condition[14].

Serum total proteins and albumin levels were lower among the patients (p<0.05). This well expected finding was very much similar to the observations of the previous study[15]. Nutritional and metabolic condition may play a role among the malnourished children for these findings.

Serum Iron level and transferin saturation (TSAT) was found more higher among the children of kwashiorkor then the children of marasmus. But total iron binding capacity (TIBC) was found low among the children with kwashiorkor. Similar to the observation of this study iron status was mentioned in association with kwashiorkor, but not with marasmus[16].

Some dissimilarity was noted between the present study and the previous one done by Begum and Islam[2]. This could be due to the fact that age range was 3 months to 8 years and Gomez classification was taken in the previous study and here in this study only 1 to 5 years of age group child were included and WHO classification was the basis of the categorization of the study.

In this study iron status was clearly analyzed where iron status in terms of TIBC was found lower among the study populations. This observation and statistically acceptable inferences are explainable as iron deficiency is very common in our community regardless of the status of PEM[15]. Also the severely malnourished children admitted in the tertiary level hospitals are usually seen by some of the doctors and treated by certain vitamins and supplements which might have affected the iron profile of the cases in the current study.

CONCLUSION

Malnutrition is a common problem in Bangladesh and anemia is associated with the malnutrition where serum iron profile in terms of TIBC is low among them. Children with kwashiorkor were more affected then marasmus or marasmic kwashiorkor. Serum total protein are also affected by malnutrition which becomes lower.

DISCLOSURE

All the authors declared no competing interest.

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