

ORIGINAL RESEARCH

Estimation of Serum Iron Level in Undernourished Children in Rohilkhand Region U.P Bareilly

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ABSTRACT

Background: The overall objective is to “Assess the serum iron level in moderate & severe undernourished children (1-5 years)” in Rohilkhand Medical College & Hospital, Bareilly.

Materials and Methods: The nutritional status of the children was assessed by plotting the weight and height of the children on WHO 2006 Growth Standards growth charts. Weight for age and height for age assessment was done by plotting the study subject’s weight and height on different growth charts for boys and girls. Nutritional status as per BMI for age criteria was also assessed by plotting the study subject’s BMI for their respective age.

Results: Out of 202, 103 children were undernourished children and 99 children were healthy children which were control. Total cases were 51%, among cases 22.8% were severe malnourished children and 28.2% Serum Iron level of control were 139.31 ± 20.19 ug/dL and moderate and severe malnourished children were 99.49 ± 10.05 and 75.71 ± 10.92 ug/dL respectively. Serum iron level of malnourished cases was significantly low having p value less than 0.001.

Conclusion: Serum iron profile can be used as a prognostic marker in PEM patients. Routine measurement of serum iron and its subsequent supplementation in PEM children could improve the management of this group of patients.

Keywords: Protein energy malnutrition (PEM), Socio-economic factors, iron deficiency, developing countries, Nutritional anemia.

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INTRODUCTION

Protein energy malnutrition (PEM) is one of the most important public health problems in many developing countries including India, South East Asia and Africa. It is a wide-spread deficiency disease among children of low socio-economic groups. According to UNICEF in India, around 46 percent of all children below the age of three are malnourished and underweight 1 in 3 of the world’s malnourished children lives in India.^[1] Nutritional deficiency in infants and children may occur as a result of inadequate intake, impaired absorption, hyper—excretion or occurrence of disease that affect metabolism of nutrient, increase losses due to diarrhea, along with a lack of breast feeding.^[2] Although clinical features of PEM are well defined, its pathophysiology is stil poorly understood. Recently free radicals have been implicated in pathophysiology of PEM.^[3] India, like other developing countries, has a high burden of micronutrient deficiencies, with almost 75% of its children suffering from iron deficiency anemia and over 50% of children from zinc deficiency.^[4,5] Iron is an essential part of hemoglobin, myoglobin and various enzymes. Its deficiency leads,

mainly to anemia.^[6] Iron is an important integral component or essential cofactor for several metabolic processes which is deranged in PEM.^[7] Nutritional deficiency adversely affects immune function and reduces the effectiveness of the host defence; 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] Nutritional anemia is one of the major causes of growth retardation, decreased physical activities and defect in cognitive function in children.^[10] Hence the present study is to assess the intensity of iron deficiency in undernourished children 1-5 years of age by measuring serum Iron levels.

MATERIALS & METHODS

The proposed study was conducted in Rohilkhand Medical College and Hospital (RMCH), Bareilly, Uttar Pradesh, India, after getting approval from Institutional Ethical Committee. After explaining aim and objectives, informed consent was taken from parents of children for participation in this study.

Source and Data: The source of data for the study is from the patients attending Pediatrics OPD in Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

Study Period: From January 2014 to December 2014.

Study design: Institutional based Case control study.

Study population: Moderate and Severe undernourished children (age- 1-5 years) according WHO classification attending out patients department of Pediatrics, RMCH, and Bareilly.

Sampling Frame: Children under 5 years of age coming to pediatric outpatient department of Rohilkhand Medical College & Hospital, Bareilly, whose parents/guardians gave voluntary consent for interview and examination of their child.

Sample Size: Sample size was calculated according to the aims and objective of the study by using an appropriate statistical formula for determination of sample size for valid inferences a minimum sample size was required, the procedure as given below.

Sample size is calculated on the basis by formula $4PQ/L^2$ Where P is 46%¹, Q=100-P = 100 - 46 = 54, L = 10% of P which comes to be 117, which are rounded up 200.

Inclusion criteria

Moderate and Severe undernourished children (age- 1-5 years) according WHO classification.

Exclusion criteria

1. Child with sepsis or any acute illness.
2. Any systemic illness/ liver disease, nephrotic syndrome, Thalesemia etc.
3. Children on micronutrient supplementation (Zn, Se, Cu, Mg, etc.)
4. Children on Vitamin C or Vitamin E supplementation.
5. Those not giving consent/ child refusal.

Assessment of Nutritional Status

The nutritional status of the children was assessed by plotting the weight and height of the children on WHO 2006 Growth Standards growth charts using z - scores. Weight for age and height for age assessment was done by plotting the study subject's weight and height on different growth charts for boys and girls. Weight for height assessment was done by plotting on different graphs for 0-2 years and 2-5 years, as per the study subject's age, separately for boys and girls. Nutritional status as per BMI for age criteria was also assessed by plotting the study subject's BMI for their respective age.

Nutritional Status of the Children was classified as per the who Classification

| | | | |
|-------------------|--------|-------------------|--|
| Weight for age | + 2 SD | SD score < - 2 SD | SD score < - 3 (severely underweight) |
| Height for age | + 2 SD | SD score < - 2 SD | SD score < - 3 (severe stunting) |
| Weight for height | + 2 SD | SD score < - 2 SD | SD score < - 3 (severe wasting) |

| | | | |
|-------------|--------|-------------------|---|
| BMI for Age | + 2 SD | SD score < - 2 SD | SD score < - 3 (severe undernutrition) |
|-------------|--------|-------------------|---|

Methodology:

Specimen collection & Processing: Five ml of venous blood was taken from each subject in a plain vacutainer with proper antiseptic precaution. After allowing 30 minutes for spontaneous blood clotting, the serum was separated from the blood cells by centrifugation at 2000 rpm for 10 minutes at 37 C. The removed serum were stored at 2-8 c until analysis in a capped epindorf disposable serum tubes. The investigations were performed in laboratory of Biochemistry department, RMCH on daily basis Iron was estimated by Ferrozine method.

Determination of Serum Iron: Iron, bound to Transferrin, is released in an acidic medium and the Ferric ions are reduced to ferrous ions. The Fe (II) ions react with Ferrozine to form a violet colored complex. Intensity of the complex formed is directly proportional to the amount of Iron present in the sample.

Consent: Written consent was obtained from the relatives of patients after explaining them the nature and purpose of the study. They were assured that confidentiality would be strictly maintained. The option to withdraw from the study was always open.

RESULTS

An institutional based Case control study was conducted in the Biochemistry department, among undernourished children (age 1-5 year) attending the outpatient Department of Pediatrics Rohilkhand Medical College And Hospital, Bareilly, Uttar Pradesh, a tertiary care hospital.

[Table – 1] depicts the distribution of cases and control subjects. Total of study subjects were divided into two groups of cases that is undernourished children and one group of control subjects, overall into three groups which are as follows:

Group 1 - Severe malnourished children (n=46)

Group 2 – Moderate malnourished children (57)

Group 3 – Healthy children (99)'

Table 1: Distribution of Malnourished (Case) and Control Subjects

| Groups | Type of Children | Frequency | Percentage (%) |
|---------|--------------------------------|-----------|----------------|
| Group 1 | Severe Malnourished Children | 46 | 22.8 |
| Group 2 | Moderate Malnourished Children | 57 | 28.2 |
| Group 3 | Control | 99 | 49 |
| | Total | 202 | |

Table 2: Depicts the Serum Iron Level in Pem in Malnourished Children and Healthy Children

| | | | | | |
|--|--------------------|-------------------|-------------------|--------|--------|
| Iron ($\mu\text{g}/\text{dl}$) | 139.31 \pm 20.19 | 99.49 \pm 10.05 | 75.71 \pm 10.92 | 278.87 | <0.001 |
|--|--------------------|-------------------|-------------------|--------|--------|

A total of 202 children of age 1 to 5 years were taken in study after inform consent from parents. Out of these, 103 children were undernourished children and 99 children were healthy children which were control. The demographic characteristics of three groups, cases and control subjects are summarized in table 1. Total cases were 51%, among cases 22.8% were severe malnourished children and 28.2% Serum Iron level of control were 139.31 \pm 20.19 $\mu\text{g}/\text{dL}$ and moderate and severe malnourished children were 99.49 \pm 10.05 and 75.71 \pm 10.92 $\mu\text{g}/\text{dL}$ respectively. Compare serum iron level of control and malnourished cases. Serum iron level of malnourished cases was significantly low having p value less than 0.001.

Statistical Analysis:

The collected data was summarized by using frequency, percentage, mean & S.D. To compare the qualitative outcome measures Chi-square test or Fisher's exact test was used. To compare the quantitative outcome measures Independent t test was used. If data was not following normal distribution, Mann Whitney U test was used. SPSS version 22 software was used to analyse the collected data. p value of <0.05 was considered to be statistically significant.

DISCUSSION

Malnutrition among under-five children is a major public health problem in India. This is reflected by the fact that the prevalence of under-weight children in India is among the highest in the world, and is nearly double that of subsaharan Africa. It is also observed that the malnutrition problem in India is a concentrated phenomenon that is, a relatively small number of states, districts, and villages account for a large share of the malnutrition burden — only 5 states and 50% of villages account for about 80% of the malnutrition burden. Each year approximately 2.3 million deaths among 6-60 months aged children in developing countries are associated with malnutrition, which is about 41% of the total deaths in this age group.^[12]

Protein and energy malnutrition and deficiencies of specific micronutrients (including iron, zinc, and vitamins) increase susceptibility to infection. Trace element deficiencies are common in children with protein energy malnutrition and, as a result, they may suffer from various nutrient-specific deficiency disorders.^[13]

Iron is an important integral component or essential cofactor for several metabolic processes which is deranged in PEM. Nutritional deficiency adversely affects immune function and reduces the effectiveness of the host defense; thus inviting more infection and causing iron loss.^[14] In present study serum iron level of malnourished children were significantly low (p value <0.001) when compared with normal children, similar observation was also seen in study of Shaheen B et al,^[15] (2013), Amare B et al,^[16] Margo G. et al,^[17] A study of Ejaz M S et al,^[18] conducted on malnourished children, had iron deficiency anemia having low serum iron and ferritin level. A study conducted by Velaquez Rodriguez et.al,^[19] showed "Free" iron, ferritin levels in serum and their relation with severe malnutrition and concluded that total proteins, albumin and ferritin were lower in children with edema than in those with marasmus.

CONCLUSION

In conclusion, severely wasted malnourished children, the mean serum concentration of iron level decreased in malnourished children when compared to control group. Serum iron profile can be used as a prognostic marker in PEM patients. Future work in this area will provide a clearer picture when iron profile is correlated with dietary and humoral factors. This suggests that routine measurement of serum iron and its subsequent supplementation in PEM children could improve the management of this group of patients.

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