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## Estimation of serum albumin and serum total protein levels in children with protein energy malnutrition

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### Abstract

**Background and Aim:** Protein energy malnutrition (PEM) continues to be a major public health problem throughout the developing world. PEM is associated with reduced synthesis of plasma proteins. The present study has been conducted to study the effect of PEM on plasma protein levels.

**Materials & Methods:** The study included children of age group 1-5 years. Two hundred fifty children with PEM were included as cases and 250 healthy children were enrolled as controls. Details were collected in predesigned proforma. Serum total protein by biuret method, serum albumin by bromocresol green dye method and hemoglobin was estimated using auto analyzer. The parameters were compared among cases and controls.

**Results:** Mean hemoglobin, serum total protein, serum albumin levels and A/ G ratio were significantly low in PEM children (cases) as compared to controls.

**Conclusion:** PEM children have low serum total protein and albumin levels as compared to healthy controls. This is probably due to decreased intake of proteins and reduced biosynthesis. PEM children have lower hemoglobin levels as compared to healthy controls; this is probably due to deficiency of iron and other micronutrients, which is often found in a child with malnutrition.

**Keywords:** Protein energy malnutrition, serum total protein, serum albumin

### Introduction

Protein Energy Malnutrition is a range of pathological conditions arising from concurrent lack in varying proportions of proteins and calories, occurring most frequently in infants and young children and commonly associated with infection. Malnutrition is defined as an imbalance between nutrient requirements and intake resulting in cumulative deficits of energy, protein or micronutrients that may negatively affect growth, development and other relevant outcomes<sup>[1, 2]</sup>.

Child malnutrition is a widespread public health problem having international consequences. Protein Energy Malnutrition (PEM) is one of the most common nutritional problems of developing countries of the world and an important cause of childhood mortality and morbidity leading to permanent impairment of physical and mental growth<sup>[3, 4]</sup>.

Malnutrition is more common in India (47%) than in Sub-Saharan Africa (29%). One of every three malnourished children in the world lives in India. The National Family Health Survey (NHFS) shows that PEM is most commonly seen in preschool children between the age of 6 months to 2 years, and around 50- 60% of children are malnourished by the age of 2<sup>[5, 6]</sup>.

In cases of severely malnourished wasted children, serum total protein and albumin are reduced. Studies have also shown that PEM is associated with iodine, vitamin A and iron deficiencies leading to anemia, increasing the risk of death and disability from diarrhea, acute respiratory infection and vaccine preventable diseases particularly measles. Conversely diarrhea, parasitic infections and other childhood ailments diminish a child's ability to utilize those nutrients available in diet.

Several studies have been done to estimate the individual biochemical parameters in PEM. However, few studies have been conducted to see if there is any correlation between serum total proteins, albumin levels in children with PEM. In this study, an attempt has been made to study the concentration of serum total protein and albumin levels in PEM children.

### Materials & Method

The present study consists of children with age group of 1 to 5 years.

The study was done in the paediatric department of medical college and research institute. A total of 500 children were included in the study. All the children included were divided into two groups. Group 1 consists of 250 children diagnosed with PEM where as control group children with good health were included in group 2.

**Inclusion criteria:** Children with protein energy malnutrition as per IAP classification of PEM i.e. whose weight for age was less than 80% of expected for age constituted cases (PEM group) they were further subdivided into Grade I-IV as per IAP classification of PEM. Children whose weight was more than 80% of expected weight formed control group. **Exclusion criteria:** Children with a) Chronic infection like tuberculosis, HIV b) Malabsorption syndrome, protein losing nephropathy c) Endocrine disorders d) History of preterm or low birth weight delivery e) Congenital anomalies A total of 500 children in age group of 1 to 5 years were included in the study. Informed consent were obtained from the parents of the included children. Thorough history in particularly history of previous hospitalization for illness like acute diarrheal disease, lower respiratory tract infection, measles and the nutritional history of child was taken, following which detailed anthropometric measurements and systemic examination was done.

Taking aseptic precaution, 3ml of venous blood was collected and was kept in EDTA vacutainer and test tube. EDTA blood was used for Hb and total WBC count estimation. The blood sample collected in test tube was centrifuged at 5000 rpm for 5 minutes; serum thus obtained was used to estimate serum total protein and albumin. Serum total protein was estimated by Biuret method, serum albumin was estimated by Bromocresol green dye method (BCG dye). Hemoglobin and total WBC count was estimated by using auto analyzer. All the statistical methods were performed through SPSS for windows version 16, p value of < 0.05 was considered statistically significant.

## Result

The present study was a hospital based case control study. The following results were made from the study. The study group consisted of 250 cases (PEM group) and 250 controls. The study results were analyzed using appropriate statistical methods. In the present study 42% of cases and 35% of controls were in the age group 12-18 months. The lowest aged patient included was 12 months in both cases and controls, and oldest aged being 59 months in cases and 60 months in controls.

Majority of the children were males. Results showed that there was no statistically significant difference in the gender distribution among cases and controls. Majority of cases in present study belonged to Grade II PEM (36%), followed by Grade III PEM (30%). fever was predominant symptom in both cases and controls, followed by loose stools. Most of children in cases were admitted with gastroenteritis, respiratory tract infection.

**Table 1:** Grades of PEM distribution in the study

Grade of PEM	Cases (n = 250) %
Grade I	21
Grade II	36
Grade III	24
Grade IV	19
Total	100

Mean serum total protein and albumin levels is significantly lower in cases compared to controls. When the mean value of these parameters of different grades of PEM was compared with controls, it was observed that these parameters were significantly lower in each group as compared to controls.

**Table 2:** Mean serum total protein, albumin levels

Variables	Total protein	Albumin
Grade I	6.61 ± 0.43	3.21 ± 0.33
Grade II	6.24 ± 0.30	3.23 ± 0.41
Grade III	5.47 ± 0.23	3.30 ± 0.35
Grade IV	5.10 ± 0.34	2.57 ± 0.45
Control	7.45 ± 0.70	4.65 ± 0.34

## Discussion

A comparison of total protein and serum albumin between cases and controls has shown significantly lower values for cases than controls. Protein energy malnutrition continues to be a major problem throughout the developing world. In India almost half of children under the age of 5 years are suffering from various grades of PEM. As already stated effects of PEM on the body are protean involving almost all the organ systems, PEM leads to failure in homeostatic mechanism of the body leading to increased susceptibility of an individual to infections.

The study conducted by Abrol P *et al.* [7] had enrolled 80 malnourished children, each group (Grade I- IV PEM) had 20 children. Study conducted by Turkey *et al.* [8] had enrolled 107 malnourished children of which majority of them had Grade I PEM (53) followed by Grade II PEM (37) and only 10 children had Grade III PEM, 7 children had Grade IV PEM.

In the present study mean serum total protein, albumin levels and A/ G ratio were all significantly lower in cases as compared to controls with a p value of <0.001. When serum total protein, albumin levels and A/G ratio of each Grade of PEM was compared to controls it was observed that in all Grades the parameters were significantly lower in comparison with controls. On comparison of these parameters in different grades of PEM among each other it was observed that the reduction in total protein, albumin and A/G ratio were correlating well with severity of malnutrition with maximal decrease been noted in Grade IV PEM. Study conducted by Adegbusi HS *et al.* [26] also found that mean serum total protein and albumin levels were significantly lower in under-nourished children as compared to well-nourished children.

## Conclusion

PEM children have low serum total protein and albumin levels as compared to healthy controls this is probably due to decreased intake of proteins and reduced biosynthesis. PEM children have lower hemoglobin levels as compared to healthy controls; this is probably due to deficiency of iron and other micronutrients, which is often found in a child with malnutrition. Early diagnosis and prompt management of PEM and its complications can prevent development of permanent physical and mental retardation.

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