e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(8); 1990-1996

Original Research Article

# Assessment of Protein-Energy Malnutrition Among Hospitalized Children

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**Received: 09-06-2024 / Revised: 18-07-2024 / Accepted: 23-08-2024**

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**Conflict of interest: Nil**

**Abstract:**

**Background:** Protein-energy malnutrition (PEM) is still a serious public health problem faced by children, especially in the developing world. Hospitalisation causes an increase in the metabolic needs of children, poor feeding practices, multiple infections and socioeconomic factors all increase the risk of malnutrition. Pediatric inpatients who are malnourished have a delayed recovery, have longer hospital stays and have greater morbidity and mortality.

**Aim:** The present study was designed to find out the prevalence of protein-energy malnutrition (PEM) in the hospitalized children and to assess the demographic, socioeconomic and clinical factors associated with it.

**Methodology:** An observational cross-sectional study was done in the Department of pediatrics Gouri Devi Institute of Medical Sciences and Hospital, Durgapur, West Bengal, India for one year . The children hospitalized were 400 children aged 6 months to 12 years, and they were sampled consecutively. Anthropometric measurements (weight, height/length and MUAC) were taken based on WHO Growth standards. A structured case-record form had been administered for data on demographic profile, socioeconomic status and clinical manifestations. The SPSS version 25.0 software was employed for the statistical analysis.

**Results:** The study revealed that 61.0% of hospitalized children were suffering from protein-energy malnutrition, including 38.5% with moderate malnutrition and 22.5% with severe malnutrition. There was a higher prevalence of malnutrition among children aged 1–5 years, and among those in lower socioeconomic groups. The most frequent clinical features noted in malnourished children were reduced appetite (77.0%), muscle wasting (72.1%), pallor (66.4%) and recurrent infections (58.2%). Hospital stay was also significantly related to severe malnutrition.

**Conclusion:** The study findings indicated that protein-energy malnutrition was a major problem in the hospital-cared children and was significantly linked to the poor socio-economic status, younger age and poor clinical outcome of the children. Nutritional screening early and timely interventions are key elements for better health outcomes in children.

**Keywords:** Protein-energy malnutrition, Hospitalized children, Pediatric nutrition, Nutritional status, Socioeconomic factors, Clinical manifestations.



## Introduction

Protein Energy Malnutrition (PEM) is one of the most serious public health issues in children, especially in developing countries [1]. It is caused by a failure to obtain sufficient proteins and calories necessary for normal growth, development and maintenance of body function. Protein-energy malnutrition increases the risk of infection, poor growth and cognitive development, low immunity, and high morbidity and mortality in children [2]. Children admitted to hospital are particularly vulnerable to malnutrition, as a disease may raise the need for certain nutrients and at the same time decrease their appetite and the amount taken [3]. The burden of malnutrition among children is influenced by environmental factors like poverty, feeding practices, low education of parents, repeated infections and poor access to health services [4].

Despite the improvement in health services, protein-energy malnutrition is still very common in hospitalised children and has an impact on the health outcomes of children and on the time of hospitalisation [5]. Therefore, early identification and appropriate nutritional assessment of children who are hospitalized becomes very important to

help them recover from the hospital, to minimize complications and to improve child health [6]. The present study was conducted to estimate the prevalence of protein-energy malnutrition among children who were hospitalized and to look at the demographic, socioeconomic and clinical factors affecting the nutritional status of these children [7].

**Background of the Study:** Protein-energy malnutrition is a significant nutritional and clinical problem affecting children, especially in countries with low and middle-income where poverty and lack of adequate nutritional intakes and high prevalence of recurrent infectious diseases are prevalent. Malnutrition in childhood is a major cause of stunted growth, compromised immune systems, suboptimal cognitive functioning and hospitalization and death rates [8]. Ill children attending the hospital are particularly vulnerable since acute and chronic diseases can exacerbate underlying nutritional deficiencies and raise the metabolic requirements [9]. Malnutrition is often underdiagnosed and undertreated in hospitalized children but it has been linked to poor health outcomes, such as prolonged hospital stay, delayed recovery and higher health care burden [10]. The issue is further exacerbated by socioeconomic inequalities, lack of nutrition awareness, poor sanitation and limited access to balanced nutrition among the pediatric population [11]. Thus, having information on the prevalence and risk factors of protein energy malnutrition in hospitalized children is important for planning for appropriate nutritional interventions and better health care outcomes for children [12].

**Protein-Energy Malnutrition Among Hospitalized Children:** PEM in hospitalized children is a situation in which children admitted to a hospital have a protein/energy intake or utilization below the amount they need for normal growth, function and recovery from illness [13]. Malnutrition is especially risky for children that are hospitalized due to the high nutritional demands of illness and infection coupled with a diminished appetite and food uptake [14]. Children's immunity is lowered and muscle wasting is observed due to the occurrence of various kinds of ailments including diarrhea, respiratory infections, fever and gastrointestinal disorders frequently causing weight loss. In addition to delaying recovery, it extends hospital stay, and increases the risk of complications, recurrent infections and death in hospitalised children who are malnourished. Protein-energy malnutrition is a serious public health problem that is compounded by poverty, poor feeding practices, lack of awareness among parents, frequent illness, and lack of access to health care among children [15].

**Objectives of the Study**

1. To determine the prevalence of protein-energy malnutrition among hospitalized children admitted to the pediatric department.
2. To assess the nutritional status of hospitalized children using anthropometric measurements and WHO growth classification criteria.
3. To evaluate the association between demographic and socioeconomic factors such as age, gender, residence, and socioeconomic status with protein-energy malnutrition among hospitalized children.
4. To identify the common clinical manifestations associated with protein-energy malnutrition among hospitalized pediatric patients.

**Methodology:** The present study had been undertaken to determine the extent of protein-energy malnutrition among hospitalized children and to find out the various demographic and clinical factors affecting the nutritional status. A methodologically organized research approach had been used to guarantee the authenticity and science of results.

**Study Design:** Overall, the study had been designed as a hospital-based cross-sectional observational study. This design was deemed suitable for estimating the prevalence of protein-energy malnutrition among admitted children in the hospital during the study period. The participants were assessed for nutritional status at the time of hospital admission anthropometrically and clinically.

**Study Area:** The study had been carried out in the Department of pediatrics Gouri Devi Institute of Medical Sciences and Hospital, Durgapur, West Bengal, India

**Study Duration:** This study had been ongoing for one year.

**Study Participants**

**Inclusion Criteria**

The research that had been conducted included:

- Children from 6 months to 12 years of age.
- Children who were taken to the pediatric wards during the month of the study.
- Children of parents/carers who had given informed consent to take part.
- Children that had been in hospital for over 24 hours.

**Exclusion Criteria**

The following were not included in the study:

- Intensivist admissions for critically unstable children to intensive care units.
- Children who are born with growth abnormalities or genetic disorders.

- Children with long-term conditions like malignant disease, chronic renal disease or congenital heart disease.
- Children that had received a 'no' consent from parents or guardians.
- Children whose medical and anthropometric data is not complete.

**Sample Size:** In previous studies, the prevalence of children suffering from protein-energy malnutrition in hospital had been estimated and the sample size had been calculated accordingly. With a prevalence rate of 35%, a confidence level of 95% and a margin of error of 5%, the sample size of about 350 participants had been calculated. A consecutive sampling technique was used to select a total of 400 hospitalized children for the study, in order to improve the reliability of the study, and to compensate for the incompleteness of data.

**Procedure:** The data was collected by a pre-designed and structured case record form. Demographic profile, socioeconomic status, dietary history, immunization status, birth history, presenting illness, and duration of hospitalization data was obtained via parent/guardian interviews and hospital records.

Standardised techniques and calibrated instruments had been used to measure anthropometric data, such as weight, height/length and mid-upper arm circumference (MUAC). Weight had been measured by means of the digital weighing scale, and the height or length by means of the stadiometer or infantometer depending on the age of the child. Nutritional assessment was done using the World Health Organization (WHO) growth standards. The degree of malnutrition had been categorized by using indicators like weight-for-age (W/A), height-for-age (H/A) and weight-for-height (W/H) Z-scores.

The children were classified as having normal nutrition, moderate malnutrition, and severe malnutrition according to the WHO classification. Pediatricians had also evaluated clinical signs that might be related to protein-energy malnutrition (PEM) such as edema, muscle wasting, changes in the hair, and changes in the skin.

**Statistical Analysis:** All the collected data have been entered into Microsoft Excel, and analyzed with the software of Statistical Package for the Social Sciences (SPSS) version 25.0. Demographic and clinical data of the study participants had been summarized using descriptive statistics including mean, standard deviation, frequency and percentage.

Prevalence of protein-energy malnutrition had been calculated as percentages, with confidence intervals. The association between malnutrition and selected demographic or clinical variables was determined using inferential statistical tests (Chi-square test and Student's t-test). A p value of $< 0.05$ was considered statistically significant.

## Results

The aim of the present study was to assess prevalence of protein-energy malnutrition in hospitalised children admitted to the paediatric department during the period of study. A total of 400 children was included in the analysis. The results showed that there were substantial differences in nutritional status among different age, sex, socioeconomic and clinical groups.

Table 1 showed that the age group of 1-5 years had the highest proportion of hospitalised children at 45.0% (180) of children. The male children accounted for a higher proportion of admissions than females, with 57.5% (230) of male admitted while 42.5% (170) females were admitted. More children (62.0%, 248) lived in rural areas than in urban areas, suggesting a higher rate of hospitalisation in rural children. Families in the lower socioeconomic group accounted for a significant proportion of admissions to a pediatric hospital (54.5%, 218) for the children. The results emphasized the effect of demographic and socioeconomic issues on the health and nutritional risks of children.

**Table 1: Demographic Characteristics of Study Participants**

| Variables | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age Group** | | |
| 6 months – 1 year | 72 | 18.0 |
| 1 – 5 years | 180 | 45.0 |
| 6 – 9 years | 88 | 22.0 |
| 10 – 12 years | 60 | 15.0 |
| **Gender** | | |
| Male | 230 | 57.5 |
| Female | 170 | 42.5 |
| **Residence** | | |
| Rural | 248 | 62.0 |
| Urban | 152 | 38.0 |
| **Socioeconomic Status** | | |
| Lower | 218 | 54.5 |
| Middle | 134 | 33.5 |
| Upper | 48 | 12.0 |

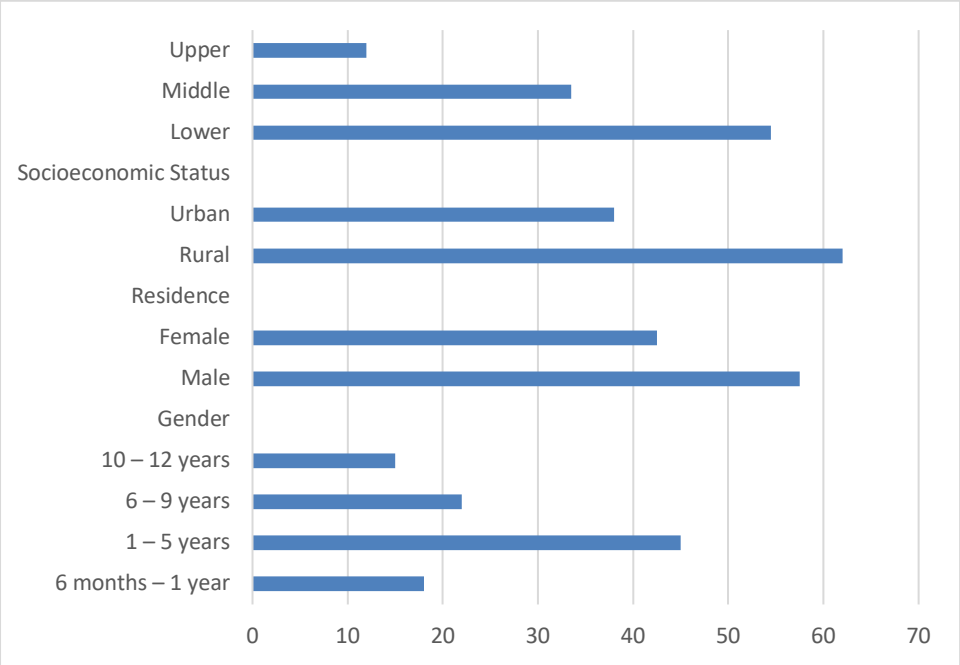


**Figure 1: Graphical Representation of Demographic Characteristics of Study Participants**

Table 2 showed that 39.0% (156) of children admitted to hospital had a normal nutritional status while 61.0% (244) of children had differing degrees of protein-energy malnutrition. The prevalence of moderate malnutrition (154 children) was 38.5% and children with severe malnutrition (90) were 22.5%. The findings showed that almost 65% of children in hospital had nutritional deficiencies. Poor nutrition status was indicated by the high prevalence of malnutrition among children hospitalized in the pediatric wards, which made them more vulnerable to diseases. From these findings, it was evident that protein-energy malnutrition was a major public health problem in pediatric hospitalized patients.

**Table 2: Distribution of Nutritional Status Among Hospitalized Children**

| Nutritional Status | Frequency (n) | Percentage (%) |
|---|---|---|
| Normal Nutritional Status | 156 | 39.0 |
| Moderate Malnutrition | 154 | 38.5 |
| Severe Malnutrition | 90 | 22.5 |
| **Total** | **400** | **100** |

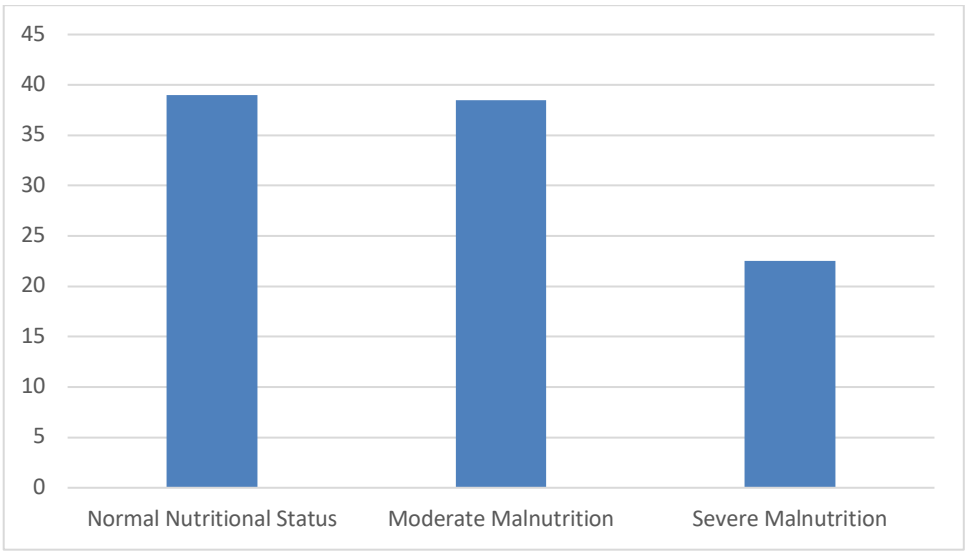


**Figure 2: Graphical Representation of Distribution of Nutritional Status Among Hospitalized Children**

Table 3 indicated that children aged 1-5 years experienced the highest level of severe malnutrition with 26.7% (48) children suffering from severe malnutrition and 43.3% (78) with moderate malnutrition. Children between the ages of 10 - 12 years on the other hand had relatively better nutritional status, and 53.3% (32) were classified as normal. Of the infants (6 months-1 year), 41.7% (30) were moderately malnourished, a sign of nutritional vulnerability during early childhood. The results indicated that young children were more vulnerable to protein-energy malnutrition, because of their fast growth rates and feeding problems. The statistically significant association ($p<0.05$) indicated that age was significantly related to the nutritional status.

**Table 3: Association Between Age Group and Nutritional Status**

| Age Group | Normal n (%) | Moderate n (%) | Severe n (%) | Total |
|---|---|---|---|---|
| 6 months – 1 year | 28 (38.9) | 30 (41.7) | 14 (19.4) | 72 |
| 1 – 5 years | 54 (30.0) | 78 (43.3) | 48 (26.7) | 180 |
| 6 – 9 years | 42 (47.7) | 30 (34.1) | 16 (18.2) | 88 |
| 10 – 12 years | 32 (53.3) | 16 (26.7) | 12 (20.0) | 60 |
| **Total** | **156** | **154** | **90** | **400** |

As shown in Table 4, the children from the lower socioeconomic group had the highest burden of malnutrition. In 218 children from lower socio-economic status, 45.0% (98) were moderately malnourished and 28.4% (62) severely malnourished. On the other hand, over 50% of children belonging to middle and upper socioeconomic middle and upper groups had normal nutritional status. Only 16.6% (8) children from upper socioeconomic families were severely malnourished. Researchers found a strong link between the level of poverty and malnutrition occurring among hospitalized children. A statistically significant association was found ($p < 0.01$), indicating that socioeconomic factors were significant in determining child nutritional health.

**Table 4: Association Between Socioeconomic Status and Nutritional Status**

| Socioeconomic Status | Normal n (%) | Moderate n (%) | Severe n (%) | Total |
|---|---|---|---|---|
| Lower | 58 (26.6) | 98 (45.0) | 62 (28.4) | 218 |
| Middle | 72 (53.7) | 42 (31.3) | 20 (15.0) | 134 |
| Upper | 26 (54.2) | 14 (29.2) | 8 (16.6) | 48 |
| **Total** | **156** | **154** | **90** | **400** |

Table 5 revealed that reduced appetite was the highest clinical manifestation recorded among malnourished children (188, 77.0%) participants. Nutritional deficiencies and anemia were seen in most children as muscle wasting was seen in 72.1% (176) children and pallor in 66.4% (162). Weakened immunity due to malnutrition was indicated by recurrent infections, seen in 58.2% (142) children. Changes in hair (48.4%, 118 children) and skin (39.3%, 96 children) were reported in children. The results showed that protein-energy malnutrition resulted in several clinical systemic effects which severely influenced the status of health of hospitalized children.

**Table 5: Clinical Manifestations Among Malnourished Children (n = 244)**

| Clinical Manifestations | Frequency (n) | Percentage (%) |
|---|---|---|
| Muscle wasting | 176 | 72.1 |
| Pallor | 162 | 66.4 |
| Hair changes | 118 | 48.4 |
| Skin changes | 96 | 39.3 |
| Edema | 54 | 22.1 |
| Reduced appetite | 188 | 77.0 |
| Recurrent infections | 142 | 58.2 |

The analysis also found that the excessively malnourished children had a longer stay in the hospital. The mean length of hospitalization was 8.6 ± 2.4 days for the severely malnourished children, and 4.2 ± 1.8 days for the normally nourished children.

## Discussion

In the present study, PEN was found to be prevalent in the hospitalized children with the rate of moderate or severe PEN being 61.0% of all children. Among the affected children, 38.5% had moderate malnutrition while 22.5% were severely malnourished. These results showed that malnutrition was still a significant health problem affecting children inpatients and associated with

malnutrition-related disease burden and hospitalisation (Ubesie & Ibeziakor, 2012) [16]. The high prevalence seen in the present study may be linked with poor nutritional practices, frequent infections, feeding and nutrition practices, and access to health care that was delayed. Earlier hospital-based studies have reported that malnutrition was prevalent among children admitted to the hospital because of poor immunity and susceptibility to diseases. Moreover, the study showed that the hospitalisation period was longer for children with severe malnutrition than for those with normal nutritional status, highlighting the detrimental effects of malnutrition on hospitalisation duration and health outcomes (Meyer et al., 2012) [17].

The demographic and socio-economic study showed that younger children, among which 1-5 years old, were more vulnerable to protein energy malnutrition. 43.3% of children in this age group were moderately malnourished and 26.7% were severely malnourished (Satyanarayana, 2015) [18]. Younger children's susceptibility to nutrition may be related to the fast growth needs, poor complementary feeding, frequent infections, and lack of nutritional awareness of caregivers. Moreover, there was a significant correlation between the nutritional status and the socioeconomic status (Huisman et al., 2011) [19]. Children in the lower socioeconomic backgrounds had the highest burden of malnutrition as 45.0% were moderately malnourished while 28.4% were severely malnourished. Poor social conditions, such as poverty, food insecurity, crowded living conditions, unclean water and sanitation facilities, and reduced access to health care may have been responsible for the elevated rate of malnutrition among low-income families. The results confirmed that there was a strong link between socioeconomic inequalities and nutritional health of children.

The clinical evaluation of malnourished children showed that decreased appetite, wasting of muscles, pallor and frequent infections were the most common clinical characteristics related to PEM. Loss of appetite was noted in 77.0 % of malnourished children, muscle wasting in 72.1 % and pallor in 66.4 % of the malnourished children (Srikanth et al., 2014) [20]. Pallor was observed in a high proportion of children in the hospital, indicating that there may be a concurrence of anaemia and micronutrient deficiencies among these children. Among 58.2% of those who had recurrent infections, poor nutritional status showed to be a sign of weak immune function. These results highlighted that protein-energy malnutrition not only had a negative impact on physical growth, it also had an impact on immunity and overall physiological functioning. Thus, the study highlighted the importance of nutritional screening during early hospitalization, regular anthropometrical monitoring, giving nutrition education and early therapeutic interventions to decrease morbidity and to reach better clinical results in hospitalized children.

## Conclusion

Based on results of the present study, it was concluded that the prevalence of protein-energy malnutrition (PEM) was high among the hospitalized children where more than half presented moderate and severe PEM. It was observed that nutritional deficiencies were more prevalent for younger children, especially those aged 1–5 years, and children of lower socioeconomic status. The study also showed that children with malnutrition suffered from decreased appetite, muscle wasting, pallor, and recurrent infections, highlighting the gravity of poor nutrition on the health and immunity of children. Also, there was a link between severe malnutrition and the length of hospitalisation, which indicated greater disease burden and slower recovery. The positive outcomes highlight the necessity of regular nutrition checks, timely identification of malnutrition, dietary changes, nutrition education for parents, and early nutrition interventions in hospital environments in order to decrease morbidity and enhance children's health outcomes.

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