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Efficacy of serum transferrin & serum pseudocholinesterase as biochemical markers in assessing protein energy malnutrition in children

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Abstract

Background: This study was done to assess the efficacy of serum transferrin & serum pseudocholinesterase as biochemical markers for assessing Protein Energy Malnutrition (PEM) in children.

Materials and Methods: This analytical case control study was done in the Narayana Medical College and Hospital from September 2007 to September 2009. The material for the study consisted of 50 cases of PEM and 20 normal healthy children. A detailed clinical history was taken and the serum analysis of transferrin and pseudocholinesterase was done.

Result: In PEM cases, serum transferrin & serum pseudocholinesterase were found to be significantly lower in comparison to normal healthy controls. Thus serum transferrin & serum pseudocholinesterase may become useful indicators of the nutritional status of the malnourished children and have been proposed as good markers of PEM.

Keywords: PEM, Biochemical markers, Serum transferrin & serum pseudocholinesterase.

Introduction

World Health Organisation (WHO) has defined, "Protein Energy Malnutrition"(PEM) as a range of pathological conditions arising from coincidental lack in varying proportion of protein and calories, occurring most frequently in infants and young children and commonly associated with infection.[(1)]

PEM has been recognized as a major health & nutrition problem in India.

For every one case of severe malnutrition, there are probably 10- 30 children with mild to moderate degrees of PEM. The situation is like an iceberg; there is more malnutrition below the surface than is recognized on clinical inspection.[(2,3)]

Physical findings generally help in the diagnosis of advanced malnutrition, but are not frequently positive in children with mild and moderate degrees of malnutrition. Early diagnosis of these cases is very useful, as they are amenable to early rehabilitation, have better prognosis and form the major bulk of the problem of malnutrition.[(4)]

Recently serum transferrin has been described as a reliable and sensitive indicator of the nutritional status in children with various degree of malnutrition.

In malnourished children, the reduction in transferrin may be the direct result of a reduced rate of synthesis of the protein per unit time mediated either due to changes in iron status or due to deficiency of protein the diet, the latter being the main factor.[(5)]

Potential mediator of the changes in transferrin kinetics in PEM is infection. As concurrent infection is a common feature of severe PEM. The reduction in plasma transferrin is due to a higher rate of catabolism, possibly mediated by infection. In injury & infection, there are marked losses of plasma proteins from the intravascular space as a result of increased transcapillary escape or excretion in the urine. It also includes loss through the gut in children with intestinal infection. This may impede recovery because transferrin has an important role in host defense against infection.[(6,7)]

Pseudocholinesterase (CHE) is found in liver, pancreas, heart, serum & white matter of the brain. It catalyses conversion of Acetylcholine bromide to acetate & choline bromide.

The other enzyme is acetylcholinesterase (true cholinesterase), also related to cholinesterase. It is present in erythrocytes, the lungs, spleen, nerve endings & the gray matter of the brain. Both true & pseudocholinesterase catalyse the following reaction.

CHE

Acetylcholine bromide----------Acetate + Choline Bromide

Activity of CHE is decreased in case of liver diseases & protein energy malnutrition.[(8,9)]

Aims and Objectives

This study was designed to assess the efficacy of biochemical markers like serum transferrin & serum pseudocholinesterase for assessing PEM in children.

Materials and Methods

Study Design: Analytic epidemiology case control Study. The study extended for a period of 2 years from September 2007 to September 2009. The material for the study consisted of 50 cases of PEM and 20 normal healthy children. The study was approved by Institutional Ethics Committee and informed consent was taken from the parents of cases and controls.

Inclusion Criteria:

Cases: All children below 5 yrs. who either came to the outpatient department or were admitted in the pediatrics ward of Narayana Medical College and Hospital and satisfied the case definition criteria of PEM (as per IAP Classification) were included in the study.

Controls: Age and sex matched normal healthy children who visited the immunization Clinic of Narayana Medical College and Hospital, Nellore.

Exclusion Criteria

Children with lesion like lymphoma, tuberculosis, leukemia, dehydration, clinical evidence of infections or septicemia, nephrosis, liver cirrhosis, cardiac failure and severe anemia or any other systemic disease leading to weight loss were excluded from the study.

Methods

A detailed history and thorough clinical examination including auxiologic (Height, Weight, Mid-arm circumference) measurements and relevant laboratory investigations were done as per proforma. Data analysis was done using SPSS version 12.0.Study variables were expressed in terms of Mean ± Standard Deviation (S.D.).

The "p value" <0.05 was considered significant and <0.001 was considered highly significant. Within a study group relation between 2 variables was assessed using Pearson's correlation test with "p value" less than 0.05 as significant limit. The mean and Standard deviation of all the parameters were calculated.

Serum sample: About 5 ml of blood sample was collected from selected children under aseptic conditions from a vein. Then the sample was transferred to plain tubes to get serum. Samples were centrifuged and the serum thus obtained was either analysed or stored at 2-8ºC.

Parameters	Method
1. Serum Transferrin	Immunoturbidimetric Method.[10]
2. Serum Pseudocholinesterase	- Butyryl thiocholine potassium hexacyanoferrate III (Kinetic Method).[11]

Serum transferrin was assayed by immunoturbidimetry method (Reagents provided by Abbott and Architect) and the readings were taken on a fully automated analyzer.(Beckman Coulter).**[10]**

Serum pseudocholinesterase was assayed by kinetic method (Reagents provided by Labcare diagnostics: Accucare Cholinesterase) and the readings were taken on spectrophotometer.(Labomed).[11]

Result

The comparison of serum transferrin level between malnourished cases and normal healthy children had shown a significantly lower value for cases than the controls.

Table 1 shows the comparison of serum transferrin between cases & controls. The serum transferrin was significantly lowered in the cases than the controls as "p value" = 0.000.

Table 1: Comparison of serum transferrin between cases & controls

Parameter	Cases	Controls	t value	p value
Serum Transferrin (mg/dl)	164.19 ± 19.06	274.8 ± 37.7	16.287	0.000

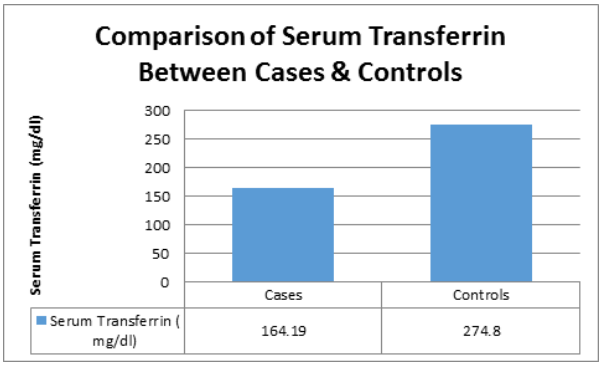
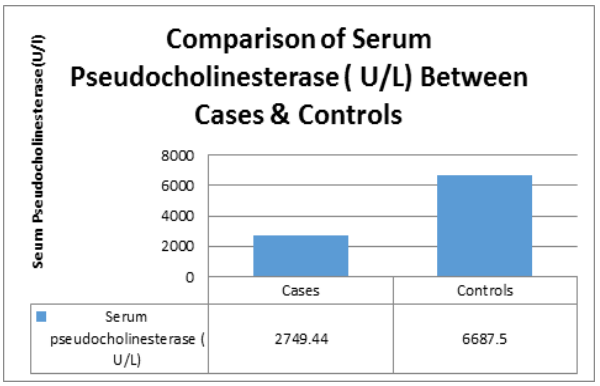


Table 2 shows the comparison of serum pseudocholinesterase between cases & controls. The value of serum pseudocholinesterase was significantly lower in cases than in controls as "p value" = 0.000.

Table 2: Comparison of serum pseudocholinesterse between cases & controls

Parameter	Cases	Controls	t value	p value
Serum Pseudocholinesterase (U/L)	2749 ± 856.56	6687.5 ± 1437.1	14.155	0.000



Discussion

Serum transferrin: The comparison of serum transferrin level between malnourished case and normal healthy children had shown a significantly lower value for cases than the controls.(Table 1). The mean serum transferrin value for malnourished children was 164.19 ± 19.06 mg/dl, while that for controls was 274.8 ± 37.7

mg/dl. The difference was highly significant statistically, as p value was 0.000.

The level of serum transferrin has been described as a reliable protein marker in malnourished children.[12]

In this study serum transferrin concentration was found to be significantly lower in malnourished children than in normal healthy children. The findings of this study are in accordance with those of other studies which state that serum transferrin concentration is markedly lowered in malnourished children.[13,14]

Finally it was proposed that serum transferrin concentration is a good indicator of protein intake and nutritional status as serum transferrin concentration is lowered in severe protein- energy malnutrition.[15]

Few workers had advocated the use of serum transferrin as a most sensitive index of protein energy malnutrition because of its rapid response to refeeding in malnourished children, and sensitivity to reduced protein intake.[14]

Often, there are associated decreases in the albumin and transferrin levels in Protein energy malnutrition.[16,17]

The findings of this study are not in line with the findings of other studies which proposed that serum transferrin concentration is not a sensitive marker of protein energy malnutrition as its importance in malnutrition is limited by its relatively long half-life of 8 days which minimizes the change in its levels. Its use is further limited by the induction of transferrin synthesis in iron deficiency.[18]

Serum Pseudocholinesterase: A study of serum pseudocholinesterase (Table 2) in malnourished children and healthy children had shown significantly lower values in malnourished children than in controls. The mean value of serum pseudocholinesterase in malnourished children was 2749.44 ± 856.66 U/l, whereas in controls it was 6687. 5 ± 1437.1 U/l. So the difference is highly significant statistically as, "p value" is 0.000

The findings of this study suggest that serum pseudocholinesterase is significantly lowered in malnourished children in comparison to normal healthy children.

The findings are in line with those of other studies which suggest that serum pseudocholinesterase is reduced in malnutrition.[8,9]

Conclusions

In this study it was found that serum transferrin and serum pseudocholinesterase concentrations were significantly lowered in malnourished children in comparison to. So serum transferrin and serum pseudocholinesterase concentrations are good indicators of protein nutritional status and thus have been proposed as good markers of protein energy malnutrition.

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Limitations

The limitation of this study was small sample size. A better conclusion can be made if the study is done on a big sample size.

Conflict of Interest: None.

Role of Funding Source: None.

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