SERUM ENZYME ABNORMALITIES IN PROTEIN ENERGY MALNUTRITION

R. Kumari
Y.N. Rao
B. Talukdar
S. Agarwal
R.K. Puri

ABSTRACT

Six serum enzymes, alkaline phosphatase, cholinesterase, lactate dehydrogenase, aspartate aminotransferase, alanine aminotransferase and gamma-glutamyl transpeptidase were studied in 30 cases of protein energy malnutrition (PEM). The mean serum values of alkaline phosphatase, cholinesterase and lactate dehydrogenase in cases of PEM were significantly lower than the controls, lowering being maximum in PEM Grade IV. The mean serum values of aspartate aminotransferase and alanine aminotransferase in patients with PEM were significantly higher than the controls. The mean serum values of gamma-glutamyl transpeptidase showed similar significant rise in all but PEM Grade IV. The degree of increase in the serum values of these three enzymes were maximum in cases with PEM Grade I. These findings suggest that abnormalities in blood levels of these enzymes occur in any form of PEM and these are related to the severity of the disease.

Key words: *Protein energy malnutrition, Enzymes, Alkaline phosphatase, Cholinesterase, Lactate dehydrogenase, Aspartate aminotransferase, Alanine aminotransferase, Gamma-glutamyl transpeptidase.*

Protein energy malnutrition (PEM) is known to be associated with many biochemical disturbances in the body. Enzymes being proteins, disturbances in their functions and levels in the body are expected to occur in PEM of any severity. We studied some serum enzymes in PEM and report the findings.

Material and Methods

Thirty cases of PEM admitted to the pediatric wards of Maulana Azad Medical College and Associated LNJPN Hospital, New Delhi, were studied. The cases of PEM were graded according to the classification of the Indian Academy of Pediatrics(1). Twenty age and sex matched group controls were drawn from children of normal weight for age attending the hospital for check up or for minor ailments. The blood levels of six enzymes, alkaline phosphatase (ALP), cholinesterase (ChE), lactate dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma glutamyl transpeptidase (GGTP) were estimated.

The methods used for the estimations were as described by King and Armstrong(2) for serum alkaline phosphatase; Rappaport, Fischel and Pinto(3) for serum cholinesterase; Reitman and Frankel(2) for aspartate aminotransferase and alanine aminotransferase; Naftatin, Sexton Whitaker and Tracy(4) for gamma glutamyl transpeptidase; and Bergmeyer and

From the Departments of Biochemistry and Pediatrics, Maulana Azad Medical College and Associated LNJPN Hospital, New Delhi 110 002.

Reprint requests: Dr. B. Talukdar, Department of Pediatrics, Maulana Azad Medical College, New Delhi 110 002.

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Bernt(5) for lactate dehydrogenase.

Statistical analysis was done using Student 't' test, and Fisher Behren's test(6).

Results

Out of the 30 cases of PEM, 5 (16.6%) were below 1 year, 22 (73.3%) were between 1-3 years and 3 (10%) were between 3-5 years of age. There were 17 males and 13 females. The number of cases in different grades of PEM were 7 (23.3%) in Grade I, 5 (16.6%) in Grade II, 8 (26.6%) in Grade III and 10 (33.3%) in Grade IV. Three cases had Grade III malnutrition and kwashiorkor.

Twenty three cases (76.6%) had some infective complications including pneumonia, diarrhea and ascariasis; one child had rickets. Seven cases (23.3%) did not have any obvious infection. Except for a single child with febrile seizure, none had any illness related to nervous, cardiovascular, hepatobiliary or urinary systems.

The values of the serum enzymes in controls and cases with PEM are shown in *Table I.* The values of enzymes in different grades of PEM are shown in *Table II.*

The mean values of serum ALP, ChE and LDH in PEM cases were significantly lower than the mean values in the controls (*Table I*). The values were lowest in cases with Grade IV PEM (*Table II*).

The mean values of AST, ALT and GGTP were significantly higher in the PEM cases than controls (*Table I*). The increase in the levels of AST and ALT were significant in all the grades of PEM, while that of GGTP was insignificant in Grade IV PEM cases (*Table II*). Patients with Grade I PEM had higher levels of

TABLE I–*Levels (mean ± SD and range) of Serum Enzymes in PEM*

Enzyme (units)	Control (n=20)	PEM (n=30)	p
ALP (KAU*/dl)	11.1 ± 1.5 (8.2 – 13.3)	5.8 ± 2.5 (1.7 – 15.4)	<0.001
ChE (RU**/ml)	44.2 ± 5.7 (36 – 55)	19.5 ± 9.5 (1.5 – 34.5)	<0.001
LDH (U/L)	105.7 ± 42.3 (48.1 –189.9)	40.3 ± 24.9 (10.1 – 95.8)	<0.001
AST (IU/L)	31.8 ± 5.2 (23.9 – 39.8)	71.3 ± 17.5 (49.9 –116.6)	<0.001
ALT (IU/L)	28.7 ± 3.7 (22.9 – 34.5)	85.9 ± 16.9 (53.3 –120.1)	<0.001
GGTP (U/ml)	8 ± 5.2 (1.2 – 16.3)	16.5 ± 7.2 (6.1 – 30.3)	<0.001

*KAU = King Armstrong Units; **RU = Rappaport units.

which is usually seen in hepatobiliary disorders, is also known to occur with tissue breakdown(22). In order to metabolize the aminoacids released from exaggerated tissue breakdown, the process of transamination is enhanced leading to increased activity of the related enzymes AST and ALT. In the absence of clinical liver disease in our cases, we feel that the increase in serum levels of AST and ALT is primarily due to tissue breakdown. Previous studies also have highlighted this fact(9,17,18,21). A similar mechanism may be responsible for the increased GGTP levels as well.

The pattern of reduction of serum ALP, ChE and LDH levels in different grades of PEM (*Table II*) shows that impairment of protein synthesis is maximum in severe PEM (Grade IV) and also it is a progressive process corresponding to the loss of body weight. On the other hand the increase in levels of serum AST, ALT and GGTP, which is maximum in PEM Grade I cases, probably indicate maximum tissue breakdown in early stage of PEM. This may reflect an effort on the part of the body to maintain homeostasis through protein synthesis from tissue breakdown and amino acid mobilization. This process probably slows down later with diminishing muscle mass as the serum values of these enzymes gradually fall from Grade I to Grade IV PEM.

The present study shows that any type of PEM can be associated with alteration in levels of serum enzymes. Many of these abnormalities are probably due to metabolic readjustment resulting from protein deficiency.

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NOTES AND NEWS

SEX AND HEALTH EDUCATION FOR SCHOOL CHILDREN

It is proposed to introduce a nationwide programme to impart health education to school children in the fields of sex education and HIV, mother craft, nutrition, physical fitness and promotion of cardiovascular health, personal hygiene, vaccines and prevention of diseases and substance abuse, *etc.* The Academy would like to establish a Task Force and organize a workshop to develop appropriate tools and teaching material to meet this objective. Those members of the Academy who have special interest and expertise in this field and can spare their time are requested to send their names along with brief synopsis of their contribution already made in this area to the undersigned within the next two weeks.

Dr. Meharban Singh,
President, IAP,
Professor and Head,
Department of Pediatrics,
All India Institute of Medical Sciences,
Ansari Nagar, New Delhi 110 029.