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SERUM PROTEINS, TRANSAMINASES AND PHOSPHATASES IN MALNUTRITION[1]

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ABSTRACT

The levels of serum total protein, albumin, transaminases and phosphatases were estimated in a group of children with severe (Marasmus) or mild malnutrition in order to identify some of the associated deficiencies in these syndromes. The biochemical pattern was similar in the normal and malnourished children.

INTRODUCTION

Protein-calorie malnutrition includes many different clinical syndromes, all of which are accompanied by retardation of growth and development. Severe cases show metabolic and clinical changes which may vary according to the severity and duration of the nutritional deficiency, whereas the more frequent, milder forms only manifest retardation of growth and development with few clinical symptoms. Two severe clinical forms are recognized : nutritional marasmus and Kwashiorkor. In Kwashiorkor, edema usually develops early as a result of severe lowering of the serum albumin concentration (1). Liver enlargement is common in this syndrome and biopsy usually reveals fatty infiltration (2). El Nabawy *et al.* (3), in a histologic study of the liver in kwashiorkor, found an association between liver necrosis and pronounced elevations of SGOT levels. Edozian (4), similarly, reported increases in serum trans-

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aminase in Nigerian patients with kwashiorkor and suggested that small increases were due to muscle break down and large increases were the result of liver necrosis.

The depressed alkaline phosphatase values seen in patients with kwashiorkor, according to Sandstead *et al.* (5), activity and bone growth.

However, there is not enough evidence to suggest that similar clinical and biochemical manifestations exist in marasmus, a clinical syndrome which results from general starvation, and in mild malnutrition. Therefore, to identify some of the associated deficiencies and to characterize some of the clinical manifestations in marasmus and mild malnutrition, the levels of serum total protein, albumin, transaminases and, finally, phophatases were estimated in marasmic and mildy malnourished children and in the normal controls.

PATIENTS AND METHODS

The forty-four Iranian children studied had recently been admitted to an orpahanage in Teheran. They were between the age of 4 and 37 months and the distribution of the two sexes was approximately equal. Along with anthropometric measurements (weight, height, measurements of arm and head circumference), physical examination was performed and medical history was obtained. To classify our subjects, we used the classification of protein-calorie malnutrition given by the FAO/WHO Expert Committee on Nutrition (6). In the absence of local standards, the Boston growth curve was used for calculating the weight and height deficit. Anthropometric measurements revealed that the weight measurements are more sensitive than height, arm or head circumference. Therefore children were considered severely malnourished or marasmic (weight of less than 60 per cent of the 50th percentile for age), mildly malnourished (weight of up to 80 per cent) and normal (weight of 81 per cent and above). None of the children had apparent infection and none were suffering from kwashiorkor.

Blood samples were obtained by femoral vein puncture for biochemical studies. Serum was collected and analyzed within 6 hours.

Biochemical studies included the determination of serum total protein, albumin, glutamic oxaloacetic transaminase (SGOT), glutamic pyruvic transaminase (SGPT), acid and alkaline phophatases.

Serum total protein was measured by the microbiuret method and serum albumin by cellulose acetate electrophoresis. Serum levels of transaminases and phosphatases were estimated using the spectrophotometric method (7,8).

RESULT :

Table 1 shows the relationship between clinical assessment and biochemical findings for 16 severely malnourished, 11 mildly malnourished and 17 normal children. The mean serum total protein levels were practically the same for all groups: 8.3 g/100 ml for the control and 7.1 and 7.4 g/100 ml for the mildly and severely malnourished children respectively. Similarly, there was no change in the levels of serum albumin (Table 1).

Only minimal change was observed in the levels of transaminases in marasmic and mildly malnourished children (Table 2). The range for the SGOT level of severely malnourished children was 32-82 Sigma Units/ml with a mean value of 54, and that of the normal children was 20-190 Sigma Units/ml with a mean value of 61. Only swo children had SGOT levels greater than 100 in the control group. The mean SGOT levels for mildly malnourished children were lower than those for normal children, but the difference is not statistically significant.

The levels of SGPT were normal in both malnourished groups. The mean values were 22, 24 and 28 Sigma Units/ml for the marasmic, mildly malnourished and normal controls respectively.

Similarly, no change was observed in the level of acid phosphatase. The alkaline phosphatase concentrations were also normal in the malnourished children.

DISCUSSION :

Biochemical studies on 27 children with marasmus and mild malnutrition showed a pattern distinctly different from that described for children with kwashiorkor. As in the case of serum protein, albumin concentrations in these marasmic and mildly malnourished children were normal that is, above 3.5 g/100 ml (9). However, it should be mentioned that Amirshahi *et al* (10) have found low levels of serum albumin in the marasmic children.

Similarly, no change was observed in the levels of transaminases and acid phosphatase in the sera of children with marasmus or mild malnutrition, suggesting the absence of liver necrosis. Previous studies on children with kwashiorkor have shown that sever protein-calorie deficiency can result in a pronounced elevation of serum transaminases (4) — this finding is considered an "ominous prognostic sign reflecting the hepatic leak". However, Sandstead and coworkers (5) have reported that, in Egyptian children with kwashiorkor, elevations in SGOT levels were within the normal range.

Finally, severe and mild malnutrition were not associated with any change in the level of alkaline phosphatase. Contrary to our findings, depressed alkaline phosphatase values have been reported in studies on children showing clinical signs of marasmus (11) and on patients with kwashiorkor (4,5).

The lack of change in the activity of these serum enzymes parallels that of serum albumin concentration. Major biochemical changes closely related to the pathological abnormalities of malnutrition begin only after the serum albumin concentration has decreased below 3.0 g/100 ml (1).

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TABLE 1

Serum proteins in severely and mildly malnourished children and controls

Group	Body weight (% of the reference)[b]	Height (% of the reference)[b]	Arm circumference (% of the reference)[b]	Total serum protein (g/100ml)	Serum albumin (g/100ml)
Severely malnourished (16)[a]	34-60	77-90	70-90	$7.4^{\pm}1.4$	$3.9^{\pm}0.7$
Mildly malnourished (11)	61-80	82-98	70-90	$7.1^{\pm}1.3$	$3.9^{\pm}1.0$
Normal (17)	81-97	86-100	80-100	$8.3^{\pm}2.0$	$4.2^{\pm}0.8$

[a] Number of cases studied

[b] Reference taken as the 50th percentile of the Boston Growth Standard.

TABLE 2

Transaminase and phosphatase levels in severely and mildly malnourished children

Group	SGOT (Sigma Units)	SGPT (Sigma Units)	Alkaline Phosphatase (Sigma Units)	Acid Phosphatase (Sigma Units)
Severely malnourished (16)[a]	54±17	22±13	5.8±2.7	1.0±0.4
Mildly malnourished (11)	37±17	24±21	6.2±1.8	0.8±0.6
Normal (17)	61±46	28±19	5.9±1.5	1.2±0.6

[a]Number of cases studied.