VITAMIN E STATUS IN PROTEIN ENERGY MALNUTRITION

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ABSTRACT

Serum vitamin E and cholesterol concentrations were measured in 50 children with protein energy malnutrition (PEM) and results were compared with a group of 50 normal controls. Mean serum vitamin E concentration as well as vitamin E/cholesterol ratio were found to be reduced in children with PEM while their mean serum cholesterol level was not significantly different from the control group. Data suggest that the reduced levels of serum vitamin E in PEM may be a result of malnutrition per se.

KEY WORDS: Vitamin E, Cholesterol, PEM

INTRODUCTION

Protein energy malnutrition (PEM) continues to be a major health problem in infants and younger children, particularly in developing countries, where in addition to deficiency of proteins and energy, deficiency of the regulatory nutrients viz. vitamins, minerals and trace elements is also common and adds to morbidity and mortality of the underlying disease.

Vitamin E deficiency has been suggested to be a causative factor in the anaemia of Kwashiorkor (1). It is generally accepted that plasma vitamin E levels above 500 µg/dl are indicative of adequate vitamin E nutrition, since lower levels are associated with increased fragility of red cells (2). The concentration of tocopherol circulating in plasma however, do not accurately reflect intracellular stores, as it is subjected to changes in dietary intake and plasma lipid concentrations (3). Several workers have proposed that tocopherol/total lipids ratio is a better index of vitamin E status of an individual in humans (4,5). While plasma vitamin E levels have been shown to be decreased in a majority of the malnourished children (6,7,8,9) low tocopherol/total lipids ratio is not a constant feature (6,7,8). Thumham

et al (10) have studied vitamin E, total lipids as well as individual lipids concentrations and suggested that tocopherol/cholesterol ratio has greatest sensitivity of those ratios based on total or individual lipids. Though plasma α -tocopherol concentration has been shown to be reduced in children with severe oedematous malnutrition, tocopherol/cholesterol ratio remains unaltered (11). The present study was therefore planned to assess vitamin E status of children with PEM. Their serum vitamin E and cholesterol concentrations were measured and vitamin E/cholesterol ratio was determined.

MATERIALS AND METHODS

Fifty (37 males and 13 females) severely malnourished children (PEM grade III and IV as per IAP classification) in the age group of 1 to 4 years were studied. Those with infection, diarrhoea or dehydration were excluded from the study. The results were compared with a group of 50 normal controls (33 males and 17 females). Blood haemoglobin was determined by cyanmethaemoglobin (12), serum albumin by dye binding using bromocresol green (12), total proteins by biuret method (13), serum cholesterol by enzymatic method (14) and serum vitamin E (as α -tocopherol) by spectrofluorometry (15).

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OBSERVATIONS

Mean percentage of weight for age, as compared to 50th centile of the Harvard standard, was 51.2 ± 1.17 for the PEM group and 92.8 ± 1.05 for the controls. All the PEM cases had wasting while 18 per cent of them were also stunted. Their mean serum total proteins concentration (5.67 ± 0.12 g/dl) was found to be significantly reduced ($p < 0.001$) when compared with the control group (Table 1). Mean serum cholesterol concentrations however, was not different for the two groups ($p > 0.05$).

Serum vitamin E concentration for the PEM group (572.8 ± 26.21 µg/dl) was significantly lower ($p < 0.001$) than that of the control children (808.8 ± 24.05 µg/dl). Eighty four per cent of the PEM cases had serum vitamin E levels below the normal threshold value (500 µg/dl), as suggested by Sauberlich et al (16). When their serum vitamin E values were expressed relative to serum cholesterol concentrations, 50 per cent of the PEM patients were found to be deficient in vitamin E on the basis of the cut-off value (2.22 µmol tocopherol/mmol cholesterol) suggested by Thurnham et al (10).

DISCUSSION

Results of the present study demonstrate that children with PEM have poor vitamin E status since

their mean serum vitamin E as well as vitamin E/cholesterol ratio were significantly lower than the controls. Majority of the PEM (84 per cent) cases had serum vitamin E concentration below the normal threshold (500 µg/dl). Adelekan et al (11) reported that 88 per cent of the malnourished children have plasma tocopherol concentrations below the normal threshold. However, contrary to the observations of the present study they found a significant decrease in mean serum cholesterol concentration for the malnourished group. Plasma cholesterol levels are known to fall in infections as a result of an increased permeability of the vasculature (17) which is a part of acute phase response. Adelekan et al (11) further observed that tocopherol/cholesterol ratios were not significantly different in the malnourished and the control children (indicating adequate vitamin E for the level of cholesterol present in plasma) and concluded that low circulating vitamin E levels in malnourished children were the consequence of infections rather than of malnutrition *per se*.

In the present study since infections were one of the exclusion criteria, serum cholesterol levels were not found to be significantly different in the two groups. Poor vitamin E status observed in PEM may therefore be due to the disturbed low density-lipoprotein (LDL) metabolism since vitamin E is known to be delivered to cells via the high affinity receptors for LDL (18).

Table 1. Serum total proteins, cholesterol and vitamin E levels in children with PEM (values are mean $\pm$ SEM for 50 children in each group).

Concentration in serum	Normal children	Children with PEM
Total proteins (g/dl)	6.70 ± 0.05 (6.0-7.5)	$5.67 \pm 0.12^*$ (3.0-7.2)
Cholesterol (mg/dl)	169.7 ± 2.22 (145-200)	155.2 ± 2.13 (130-185)
Vitamin E (µg/dl)	808.8 ± 24.05 (500-1243)	$572.8 \pm 26.21^*$ (258-1072)
Vitamin E/cholesterol	4.82 ± 0.14 (3.07-6.99)	$3.68 \pm 0.15^{**}$ (1.98-5.86)

* $p < 0.001$

** $p < 0.01$

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