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THYROID FUNCTION IN PROTEIN-ENERGY MALNUTRITION*

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Protein-energy malnutrition (PEM) is a serious nutritional disorder known to alter various body functions. The survival of the patient can only be maintained by an adaptation of homeostatic mechanisms to this abnormal situation. Lack of adequate amounts of protein and calories in the diet necessitates a delicate equilibrium among catabolic and anabolic hormones. Although protein and energy needs for growth are greatly diminished, basal caloric requirements are to be met in one way or another to preserve life. As the supply of protein and energy is limited, it is of great importance for the body to use them in the most economical way. Our previous work has already shown a significant decrease of basal calorie expenditure in third degree PEM [1].

The aim of the present study is to investigate thyroid hormones in PEM before and approximately two months after treatment.

Material and Methods

20 cases of PEM and 10 healthy controls of the same age group are studied. In cases with PEM, serum samples were taken before and approximately two months after treatment. ^{125}I-labelled kits from Oxford Co. were used for analysis of T_4, FT_4 and T_3 uptake. Serum total protein was estimated by refractometry.

Findings

Table I shows the mean values ± SD for age, weight, height and total serum protein in controls and malnourished infants before and after treatment. Most of the infants were second and third degree malnourished according to the Gomez classification, and the mean weight loss was 41.7% compared to the 50th percentile. The mean weight gain following treatment was 1 kg.

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TABLE I

Body Measurements and Total Serum Protein Levels in Children Before and After Treatment for PEM*

	n	Age (mo)	Weight (kg)	Height (cm)	Total serum protein (gr/dl)
Controls	10	8	9.39 ± 1.46	67.8 ± 4.8	6.89 ± 1.24
Children with PEM					
Before treatment	20	9	4.90 ± 1.88	64.0 ± 11.0	5.64 ± 0.81
After treatment	20		5.90 ± 1.56	—	—

* Mean values ± SD.

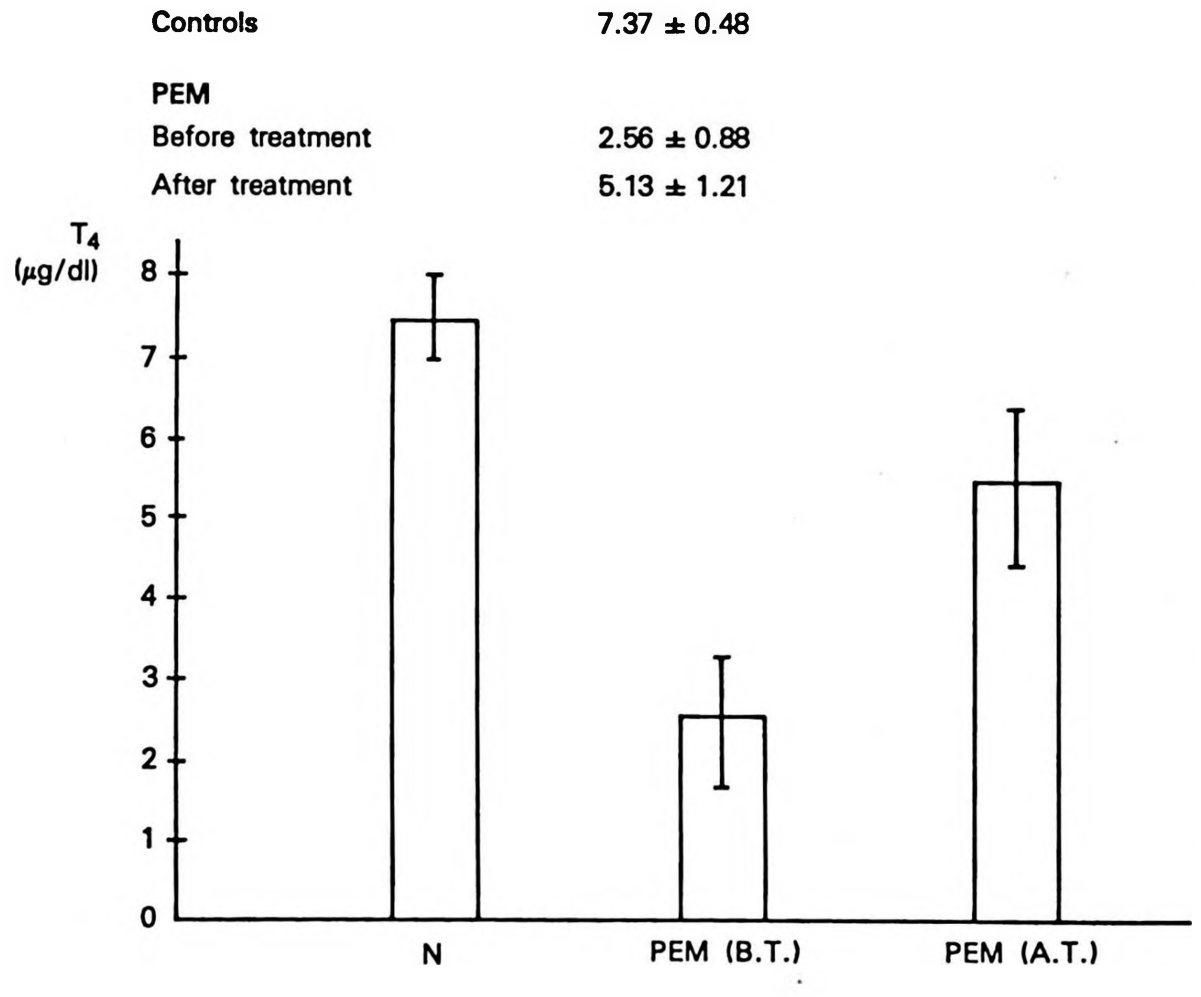

Figure 1

Serum T_4 levels (mean ± SD) in children before and after treatment for PEM

Figure 1 presents the mean ± SD of serum T_4 values. It is seen that before treatment serum T_4 values are significantly lower than in normal controls, and after treatment, although T_4 values increased significantly, they did not reach normal level.

FT_4 index values are shown in Figure 2. This index gives an indirect estimate of free thyroxine which is corrected for alterations and thyroxine binding globulin (TBG) capacity. FT_4 levels, like T_4 levels, are noticeably lower than normal in PEM children even after treatment.

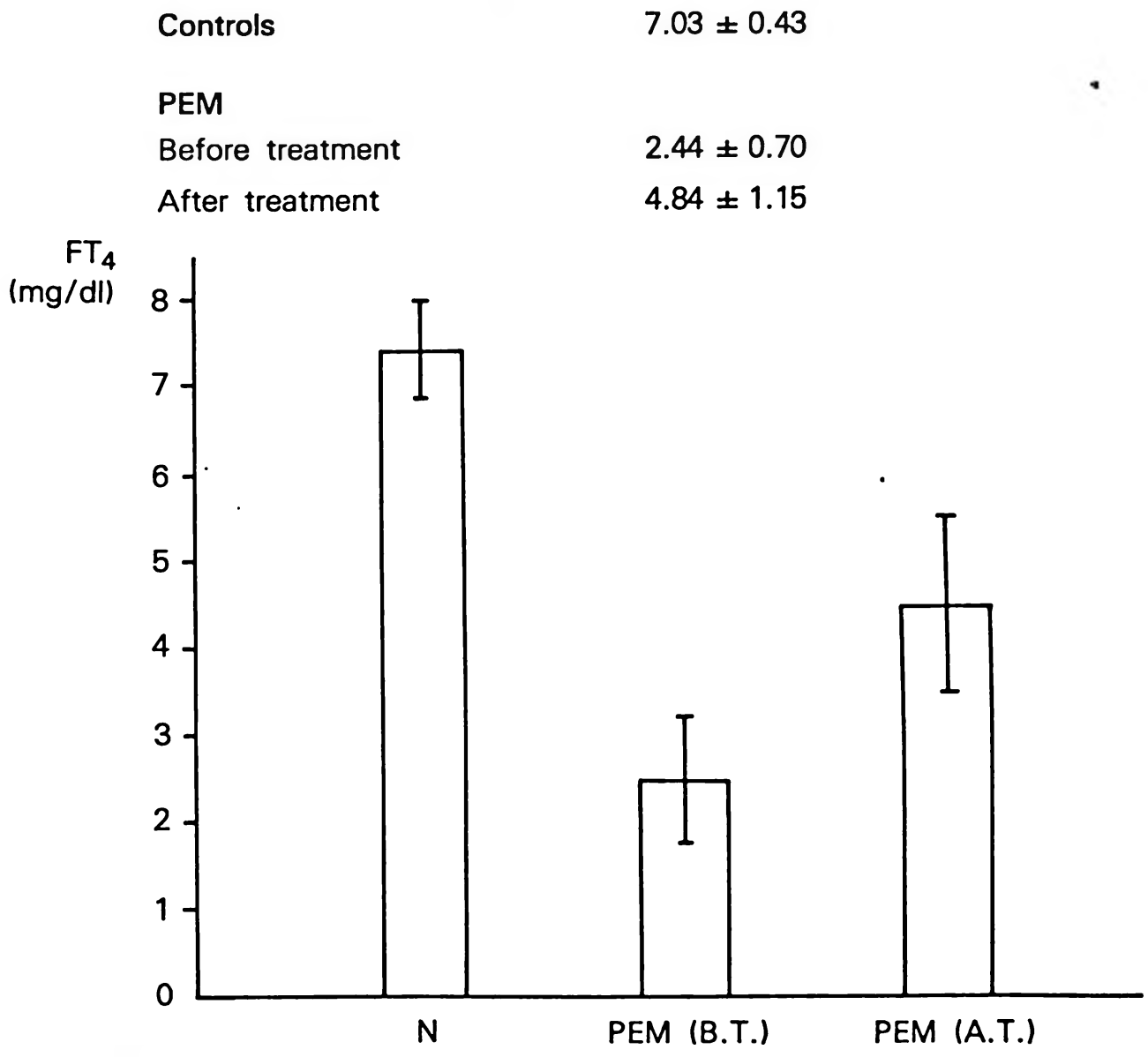

Figure 2

Serum FT_4 levels (mean ± SD) in children before and after treatment for PEM

Figure 3 shows serum T_3 values in normal controls and in PEM cases before and after treatment. Before treatment T_3 levels were significantly lower in the patients compared to normals, but after partial treatment the mean T_3 values had nearly reached the normal level, and the difference between T_3 values in patients and normal controls was no longer significant.

Controls	243.0 ± 24.9
PEM	
Before treatment	113.9 ± 36.5
After treatment	217.0 ± 32.1

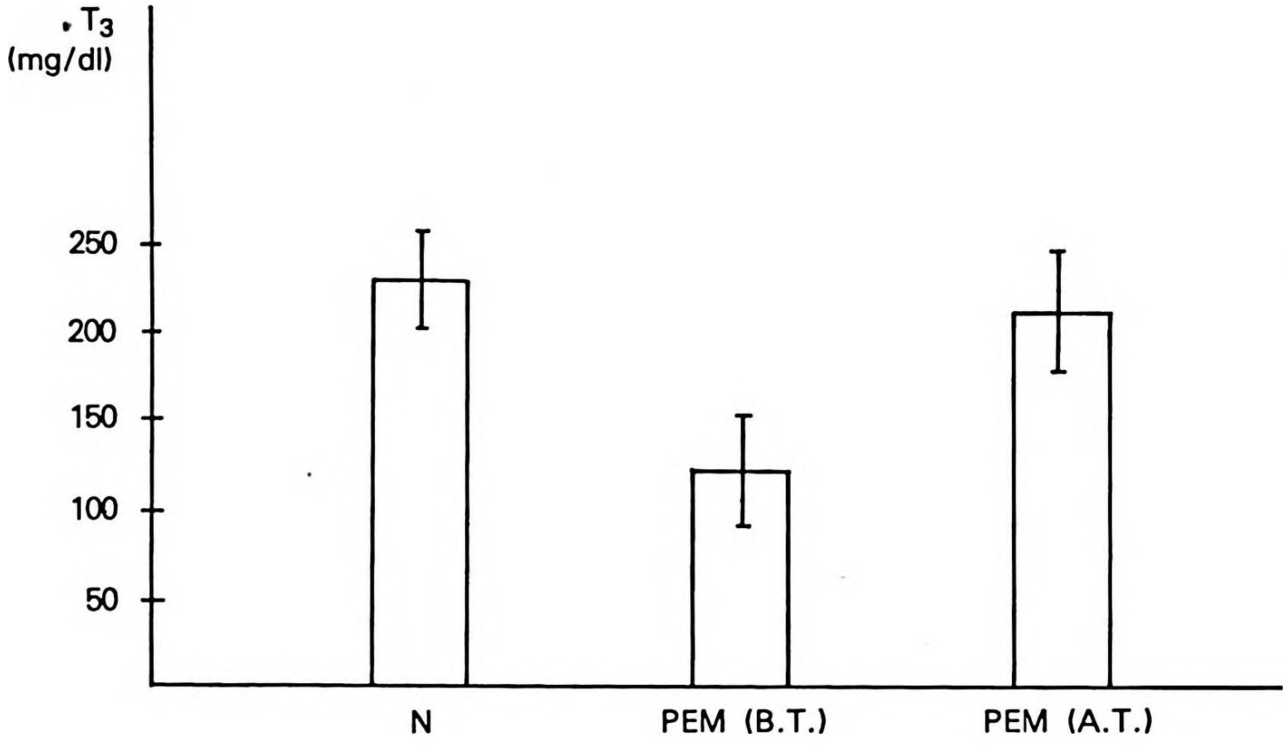

Figure 3

Serum T_3 levels (mean ± SD) in children before and after treatment for PEM

Discussion

Thyroid function in acute or chronic protein energy deprivation has been the subject of a great number of investigations. Previous work with estimations of protein-bound iodine (PBI), butanol-extractable iodine (BEI), or ^{131}I uptake has shown a decrease in these values during chronic protein energy malnutrition, suggesting some alteration in thyroid function[2-4]. Using modern techniques such as radioimmunoassay methods, Graham et al[5] have shown low T_4 and free thyroxine levels in

the marasmic type of protein-energy malnutrition. In our present work we have also observed that partial recovery from PEM fails to restore T_4 values to the level of normal controls. It will be of interest, therefore, to follow up these cases for a longer time in order to see whether there is an eventual return to normal T_4 levels.

Investigations in adults by Portnay et al[6] have revealed that total starvation decreases serum T_3 levels and increases T_4 levels. Animal studies have shown that during starvation hepatic T_4 uptake[7] and hepatic 5-deiodinase activity are decreased[8]. Starvation is also associated with a decrease in nuclear T_3 receptors, which could further decrease the efficiency of the thyroid hormones.

Studies on T_3 levels in infantile protein-calorie malnutrition are rare. Chopra and Smith[3] have demonstrated the decrease in T_3 levels in PEM, especially in kwashiorkor. This may be due to a more marked disturbance in liver function in this form of PEM. The results of our study agree with their observation. After partial treatment, T_3 levels of our marasmic cases showed a marked increase, so that the difference compared to normal controls was not significant.

It is concluded that the decrease in T_4, and especially in its calorigenically active metabolite T_3, may help to conserve energy stores and may also serve as an adaptive process to decrease muscle protein catabolism when sufficient intake of protein and energy is lacking.

Summary

Thyroid function is investigated in 20 malnourished and 10 normal infants.

Our findings indicate that there is a significant decrease in serum thyroid hormone levels in protein-energy malnutrition. After two months of treatment, serum T_4 and FT_4 levels were still significantly lower in the patients than in normal controls. T_3 levels were also significantly low in untreated malnourished infants. After treatment the mean T_3 value of malnourished babies was still lower than in normal controls, but the difference was not statistically significant.

It is concluded that decrease in thyroid gland activity in protein-energy malnutrition should be considered as an adaptation to low calorie intake.

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