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Original Research Article

Evaluation of Thyroid Functions in Severely Malnourished Children

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ABSTRACT

Background: Protein energy malnutrition (SAM) continues to be a major public health problem in the tropical and subtropical region of the world. It affects several aspects of secretion and metabolism of thyroid hormones. The present study has been conducted to study the effect of SAM on thyroid hormone.
Objective: To study the level of T3 , T4, TSH in severely malnourished children and healthy control.
Design: Case control study.
Setting: Nutritional rehabilitation centre in M.L.B medical college Jhansi.
Methods: The sample size consists of severely malnourished children between the age group of 6 months to 60 months. There were total 40 cases. Details were collected in predesigned proforma. Triiodothyronine (T3), thyroxine (T4), thyroid stimulating hormone (TSH) levels was estimated. The parameters were compared among cases and controls using appropriate statistical tool.
Results: T3 and T4 levels were significantly low in SAM children as compared to controls. TSH levels were similar in both groups.
Conclusions: Severe acute malnutrition (SAM) is associated with reduction in T3 and T4 levels without any alteration in TSH levels. The altered thyroid hormone status in children with PEM is perhaps a protective phenomenon to limit protein catabolism and lower energy requirements.

Keywords: Severe Acute Malnutrition, Thyroxine, Triiodothyronine, Thyroid stimulating hormone.

INTRODUCTION

Protein Energy Malnutrition (PEM) is one of the most common nutritional problem of developing countries and an important cause of childhood mortality and morbidity leading to permanent impairment of physical and mental growth. [(1,2)] According to estimates in the world there are about 162 million children suffering from various forms of PEM. It is estimated that PEM is the primary or associated cause of nearly half of approximately 3 million deaths in children under the age of 5 years. Three-quarters of the world's stunted children live in South Asia and Sub-Saharan Africa; India is home to nearly one-third of world's malnourished children. [(3)] The World Health Organization (WHO) defines malnutrition as "The cellular imbalance between the supply of nutrients and energy, and the body's demand for them to ensure growth, maintenance, and specific functions". In PEM as the supply of protein and energy is limited, the body tries to use them more economically by decreasing the basal caloric expenditure. [(2)] A variety of endocrine abnormalities have been reported in PEM, like changes in growth hormone, insulin, glucocorticoids and thyroid hormones. The changes in thyroid homeostasis have not been given enough focus. [(4,5)] In PEM, there are marked

changes in secretion and metabolism of thyroid hormones and in the structure of thyroid gland (Abroe et al). [(6)] This results in reduction of the activity of the gland, [(7)] as the body tries to adapt to low calorie intake.

MATERIALS AND METHODS

The present study was conducted in nutritional rehabilitation centre of MLB Medical College Jhansi. It consisted of 40 children in age group 6months to 60 months. These children were included on basis of WHO's criteria for severe acute malnutrition, which included children with weight for height (W/H) or length (W/L) with Z score less than 3 standard deviation, and /or W/H or W/L with Z score less than 2 SD with mid upper arm circumference (MUAC)<11.5 cm and/ or presence of bilateral pitting edema.

Subjects were included in the present study after obtaining informed written consent from parents/ guardian. Details were entered in predesigned proforma. Detailed anthropometric measurements and systemic examination was done. Weight was recorded to the nearest 100g, length/height of the child was measured to the nearest cm, mid arm circumference (MAC) was measured to the nearest mm.

There were 40 controls who matched for age and sex were taken from children of normal weight for height/age attending hospital for either checkup for minor ailments or brother and sister of patients admitted to pediatric ward.

All children with maternal history of thyroid dysfunction, children with clinical evidence of endocrinal abnormality, especially thyroid and infants with clinical goitre were excluded from the study.

Taking aseptic precaution, 3ml of venous blood was collected and was kept in EDTA (Ethylene Diamine Tetra acetic Acid) vacutainer and test tube. The blood sample collected in test tube was centrifuged at 5000 rpm (rotation per minute) for 5 minutes; serum thus obtained was used to estimate T3, T4, thyroid stimulating hormone (TSH) T3, T4 and TSH were estimated by chemiluminescence method .The data obtained was entered in MS Excel spread sheet; the results were expressed in mean ± standard deviation (SD) for continuous variables and as percent (%) for categorical data. Observations were statistically analyzed using Epi Info software version 3.5.1. Descriptive statistics was applied for categorical data. Independent sample-t test and One-way ANOVA were used. P value of <0.05 was considered statistically significant.

RESULTS

A total of 40 children in age group 6 months to 60 months were included in the study. 25 children included in the study were male and 15 were female (sex ratio M: F:1.6:1). Mean T3, T4 and TSH levels of cases and controls is depicted in[Table 1,2,3].Mean T3, T4 and TSH levels in SAM group was 106.4ng/dL, 7.04 µg/dL and 2.28 mIU/L respectively and that of controls were 143.2 ng/dL, 8.12 µg/dL and 2.66mIU/L respectively. Mean T3 and T4 levels were significantly lower in cases as compared to controls (p <0.05 for both parameters). Mean TSH levels of cases and controls were nearly identical.

Table 1. Mean value of serum T3 in severely malnourished children and control group.

	Range(ng/dl)	Number	T3 mean(ng/dl)	t-value	p-value
Control	110-192	40	142.3		
Cases	69-172	40	106.40	2.79	<.01

Table 2. Mean value of serum T4 in severely malnourished children and control group.

	Range(µg/dL)	Number	T4 mean(µg/dL)	t-value	p-value
Control	7.28-9.1	40	8.12		
Cases	5.01-8.92	40	7.04	2.53	<.02

Table 3. Mean value of serum TSH in severely malnourished children and control group.

	Range(mIU/L)	Number	TSHmean(mIU/L)	t-value	p-value
Control	1.36-4.81	40	2.66		
Cases	1.77-4.12	40	2.28	1.64	>0.1

DISCUSSION

Protein energy malnutrition results in various alterations in thyroid gland structure and functions. [8] As already stated effects of PEM on the body are protean involving almost all the organ systems. [3] SAM is associated with reduction in synthesis of plasma protein. [9] Hormones play important role in energy and protein metabolism in PEM. [10] This study was conducted to know about thyroid hormones level in children with SAM and their comparison with age matched controls. In the present study mean T3 and T4 levels (Table 1, 2) (were significantly lower in cases as compared to controls ($p < 0.05$). Studies conducted by Graham et al (1973), [11] Ingenbleek (1986). [4] Turkay'at al [15] and Abrol et al [16] also showed similar inference. Similar results are reported by study done by Kumar S et al, [12] Orbak Z et al [13] and study conducted by Das BK et al, [14] found that mean T3 levels was significantly lower in malnourished children as compared to controls, however in their study they found no significant difference in mean T4 levels of cases and controls. Low T3 levels in children with PEM is probably due to low binding proteins, impaired thyroxine monodeiodination in liver which leads to decreased peripheral conversion of T4 to T3 and elevated corticosteroids which is often seen in children with malnutrition (acts by inhibiting 5' deiodinase system) and low T4 levels in children with PEM can be due to fall in thyroid secretion rate, depletion of reserves and failure of the adaptive mechanism. In the present study mean TSH levels in cases and controls were similar. In contrast to present study, study conducted by Orbak Z et al, found that mean TSH levels of children with PEM were higher as compared to controls. Normal TSH levels in children with PEM is possibly due to T4 undergoing intracellular monodeiodination to form T3 at pituitary level causing negative feedback inhibition

CONCLUSION

To conclude, protein energy malnutrition is associated with reduction in T3 and T4 levels without any alteration in TSH levels. The altered thyroid hormone status in children with PEM is perhaps a defense mechanism against excessive metabolic stimulation and energy consumption and protects the malnourished child with low calorie reserve from an early death. Normal TSH level is explained on the basis as T4 undergoes intracellular monodeiodination to T3 at pituitary level, so central feedback mechanism are apparently preserved, allowing appropriate adaptation of thyroid.

What this study adds?
Alteration in thyroid hormone status in severe acute malnutrition is an adaption of thyroid to low energy and protein reserve and perhaps a defense mechanism against excessive metabolic stimulation and energy consumption in such children.

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