

Original Article

ASSESSMENT OF THYROID HORMONE STATUS OF UNDERNOURISHED CHILDREN OF DISTRICT OKARA, PUNJAB

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Objective: To assess thyroid hormone status of undernourished children and compare with that of adequately nourished children.

Methods: Seventy one subjects with required weight, height and age were recruited for this study and were divided into two groups: Malnourished group and adequately nourished group. After taking informed consent, relevant data was collected on the proforma, blood sample was taken for estimation of thyroid function test which includes serum thyroid stimulating hormone (TSH), total thyroxine (T4) and total triiodothyronine (T3). Data was analysed by IBM SPSS version 21. p value < 0.05 was considered statistically significant.

Results: Levels of thyroid stimulating hormone (TSH) were higher in undernourished children ($2.36 \pm 0.30 \mu\text{IU/ml}$) as compared to normal ($1.3 \mu\text{IU/ml}$) whereas levels of total triiodothyronine and total thyroxine, were lower in undernourished children as compared to normal.

Conclusions: These results strongly predict that in protein and energy malnutrition thyroid gland has to do extra effort to combat this condition as depicted by higher TSH levels and lower levels of T3 and T4.

Keywords: thyroid function test, malnutrition in children.

Introduction

Protein energy malnutrition (PEM) is surprisingly common in children and has a significant impact on physical and mental growth of a child.¹ According to WHO estimates, worldwide prevalence of malnutrition is 17.6% with 113.4 million children of less than 5 years of age are affected by low weight for age.² The WHO estimates that nearly half of all deaths, occurring among children aged less than five years in the developing countries, can be attributed to malnutrition.³ Malnutrition is still a challenge for Pakistan as 14% of children less than 5 years of age were found to be wasted, 31% were reported underweight and 42% were found to be stunted.⁴ Nutrition and endocrinology are linked from time ancient with the premise that adequate nutrition is required for statural growth. Nutritional endocrine disorders are characterized by alteration in the function or structure of the endocrine glands with resulting clinical consequences due to the deficiency or excess of a dietary compound.⁴ Thyroid hormone plays an important role in regulation of lipid and carbohydrate metabolism and is necessary for normal growth and maturation.⁵ Absence of thyroid hormone causes mental and physical slowing, mental retardation and dwarfism.⁶ Alterations in nutritional state, whether short term or chronic, affect physiology of the thyroid hormone, especially peripheral hormone metabolism. The changes in thyroid

homeostasis have not been enough focused.⁷ In PEM, there are marked changes in secretion and metabolism of thyroid hormones and in the structure of thyroid gland. This results in reduction of the activity of the gland, as the body tries to adapt to low calorie intake.⁸ In cases of severely malnourished wasted children, serum total protein and albumin are reduced whereas increased globulin level is expected since malnutrition is commonly associated with infections.^{19,20}

Thyroid hormone is very important for normal growth and development as it help in cell differentiation and maturation. It plays important role in all stage of aging including pregnancy, infancy, childhood and even post-menopause. Fall in thyroxine level in first trimester of pregnancy cause psychomotor and mental derangements in affected children.⁹ Thus thyroid studies are of greater importance in malnutrition because inadequate functioning of thyroid serious negative implications not only on the individual but also on the family and society. This study will help us to assess the thyroid hormone status of malnourished children so that we can plan out the strategies to maintain thyroid level within normal functioning state in the affected population.

Methods

This cross-sectional study was carried out in lowest social status population locality in the outer fringes of

Okara, Punjab. Children were approached at their homes and primary education centre. Total 71 children were included in the study and divided into two groups. Out of which 40 children were undernourished and belong to undernourished group and 31 were adequately nourished and belong to adequately nourished group. After taking informed consent from children parents or guardians, following measurements were done. Each child's weight, height and MUAC were measured and compared with Z measurements score chart (CMAM protocol) for grading of their nutritional status. The weight was recorded on an electronic weighing scale to the nearest of 5 g. Four ml venous blood sample was drawn from antecubital vein of each subject and added in serum tube i.e. red top vacutainer Blood in red vacutainer was centrifuged (1600rpm for 15 minutes), serum was separated, divided into aliquots and frozen at -80 °C to be used later for analysis. Serum Thyroid stimulating hormone (TSH), total triiodothyronine (T₃) and total thyroxine (T₄) was measured by AccuBind ELISA microwells (product code 1225-300) of Monobind Inc. CA, USA. Data was analysed through IBM SPSS version 23. Groups are compared by measuring means and standard of means. Significance of difference was determined

with two sample test and ANOVA. p-value<0.05 was considered statistically significant.

Results

To assess thyroid hormone status, serum TSH, T₃ and T₄ levels were estimated in both groups. Levels of serum TSH were found to be significantly higher ($2.36 \pm 0.30 \mu\text{IU/ml}$) in undernourished group as compare to ($1.588 \pm 0.17 \mu\text{IU/ml}$) in adequately nourished group (p-value=0.288) as shown in (**Table-1**). The mean concentration of T₄ in undernourished children group was $1.963 \pm 0.087 \mu\text{g/dl}$ and it was significantly lower (p-value = 0.05) than its value in adequately nourished children group ($2.69 \pm 0.36 \mu\text{g/dl}$) as shown in (**Table-2**).

The mean concentration of T₃ in undernourished children group was $8.78 \pm 0.66 \text{ng/dl}$ and it was significantly lower (p-value=0.01) than its value in adequately nourished children group ($13.37 \pm 0.74 \text{ng/dl}$) as shown in (**Table-3**).

Discussion

Protein energy malnutrition is an important health problem for under developing country like Pakistan. In this study, we researched the effect of malnutrition on thyroid hormone of undernourished children of

Table-1: Comparison of serum thyroid stimulating hormone between undernourished (group1) and adequately nourished children (group-2).

Marker	Groups	N	Mean±SEM $\mu\text{g/dl}$	P-value
Serum TSH	Group-1 Undernourished children	36	2.36 ± 0.30	0.028
	Group-2 Adequately nourished children	27	1.588 ± 0.17	

Table-2: Comparison of serum total thyroxine between undernourished (group1) and adequately nourished children (group 2).

Marker	Groups	N	Mean±SEM $\mu\text{g/dl}$	P-value
Serum total Thyroxine	Group-1 Undernourished children	36	1.963 ± 0.087	0.05
	Group-2 Adequately nourished children	30	2.69 ± 0.36	

Table-3: Comparison of serum total triiodothyronine between undernourished (group1) and adequately nourished children (group 2).

Marker	Groups	N	Mean±SEM $\mu\text{g/dl}$	P-value
Serum total Triiodothyronine	Group-1 Undernourished children	36	8.87 ± 0.66	0.01
	Group-2 Adequately nourished children	30	13.37 ± 0.74	

Pakistan. For this purpose, we compared thyroid function test among undernourished and adequately nourished children.

Nutrition is defined as the replacement of consumed chemistry of the metabolizing body. Therefore adequate nutrition maintains the health of the individual and inadequate nutrition failing to replenish chemicals adversely affects physiological mechanism of the body.

When we compared levels of thyroid stimulating hormone (TSH) in between undernourished and adequately nourished group. It was found to be significantly higher in undernourished group (p-value = 0.028) as compare to adequately nourished group. These results were similar with research conducted by Dhanjal and Singh, 2017 in Haryana,⁶ India where they found higher levels of serum TSH in malnourished controls (p-value < 0.001). But in contrary to our study, Abrol et al.⁴ and Turkey S et al.¹⁰ in their study found no significant difference in TSH when PEM children were compared to healthy controls.

This elevated level of serum TSH in undernourished children is due to the decreased secretory capacity of thyroid hormone specifically T4 which inhibits negative feedback mechanism.¹¹ Shahjadi et al, 2011 reported that in chronic severe PEM, the reserves are depleted which causes decrease secretion of thyroid and adaptation of thyroid may fail thus raising TSH level.¹²

Serum T3 and serum T4 levels were found to significantly lower in the malnourished group as compare to the adequately nourished group (p value < 0.001). The result of our study were similar to that seen in other studies. In the study done by

Shaheen B et al. the mean fT3 value in cases was 1.5 pg /ml±0.3 and in controls was 2.3 pg /ml±0.5 (p <0.0001)¹³ while there was a significant decrease in the mean T3 and T4 values in PEM patients in the study done by Shahjadi S et al.¹² when compared to control group but there was no statistically significant difference within subgroups of cases. These result are attributed to the fact of decrease protein uptake and reduced biosynthesis.¹⁸ Lazarus et al have also reported decreased T4 levels in the malnourished children in India.¹⁴ Studies from Turkey and Bangladesh reported that mean T3 and T4 levels were extremely low in PEM cases as compared to controls.¹⁶ It is found in animal studies that during starvation, the activity of enzyme 5-deiodinase, uptake of T4 by liver are decreased. This probability is also considered above in argument of marked lower levels of T3 in undernourished group than controls. Similarly, Valinjkar et al compared the levels between children of severe and moderate malnourished children and reported results comparable to ours.¹⁷

The present study strongly suggests that the state in particular and society in general must address PEM to avoid the increasing population of subjects with deficient intellectual and cognitive abilities.

Conclusion

These results strongly predict that in protein and energy malnutrition thyroid gland has to do extra effort to combat this condition as depicted by higher TSH levels and lower levels of T3 and T4.

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