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## ORIGINAL ARTICLE

# Correlation of Thyroid Hormone Levels with Plasma Protein Levels in Severely Malnourished Children

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### ABSTRACT

**Objective:** To determine the correlation of thyroid hormones with serum total protein and albumin levels in severely malnourished children.

**Study Design:** Cross sectional study.

**Place and Duration of Study:** This study was conducted at department of Diabetes and Endocrinology at National Institute of Child Health, Karachi between 28<sup>th</sup> May and 30<sup>th</sup> November 2018.

**Material and Methods:** A total of 115 malnourished children of age less than 5 years were enrolled in the study. Thyroid hormones (T3, T4 and TSH), serum albumin and total protein level were estimated. Pearson correlation test was applied to see the significant correlation between thyroid hormones (T3, T4 and TSH) with serum albumin and total protein level.

**Results:** Mean age of the children was  $2.57 \pm 0.96$  years with moderate positive significant relationship of T3 ( $r=0.561$ ,  $p$ -value  $<0.001$ ) and T4 ( $r=0.356$ ,  $p$ -value  $<0.001$ ) with serum total protein level. While TSH ( $0.031$ ,  $p$ -value  $0.744$ ) was weakly positive. Moderate positive significant relationship of T3 ( $0.510$ ,  $p$ -value  $<0.001$ ) with serum albumin level. While T4 ( $0.255$ ,  $p$ -value  $0.006$ ) and TSH ( $0.23$ ,  $p$ -value  $0.811$ ) was found to be weak positive.

**Conclusion:** This study has reported positive correlation of thyroid hormone with serum total protein and albumin levels in malnourished children, which could be due to decrease protein intake in malnourished children. Thyroid hormone levels should be interpreted with relation to serum protein and albumin.

**Key Words:** *Thyroid hormone, Serum total protein, Albumin, Protein energy malnutrition*

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### INTRODUCTION

Malnutrition has been known to cause noteworthy damage to child health and growth which can lead to childhood mortality and morbidity.<sup>1,2</sup> Protein malnutrition are of two types classical which is marasmus (wasting syndrome) and kwashiorkor. Protein malnutrition is a common nutritional

problem involving variable level of protein and calorie deficiency in children of developing countries.<sup>3</sup> Moreover, it is also associated with some micronutrients deficiencies including iodine, vitamin A and iron leading to anemia, diarrhea, acute respiratory infection and vaccine preventable diseases.<sup>4</sup> A large number of children

who die before five years of age are known to have severe protein malnutrition.<sup>5</sup>

UN agencies declared protein malnutrition as an alarming situation and announced as the global crises,<sup>6</sup> even though it is more commonly observed among children of Asian and African region.<sup>7-9</sup> Leading predisposing factor of PEM among children are low socioeconomic status, poverty, unavailability of quality food, restriction of food due to some cultural or religious reasons, compromised maternal health, improper breast feeding, and lack of maternal education.<sup>10-12</sup> Lots of children survive on food which is deprived source of essential protein such as cassava and maize.<sup>13-14</sup>

In children with PEM there is a lack of normal regulation of lipid and carbohydrate metabolism which is crucial for the normal regulation of thyroid hormone secretion and structure of thyroid gland.<sup>15</sup> Normal level of thyroid hormone is vital for the optimum growth of children, as the decreased production of T3 and T4 hormone in children along with PEM can affect and slows down the mental and physical development.<sup>16-17</sup>

The incidence of thyroid related disease which is one of the common endocrine disorders is high not only in northern areas of Pakistan but also in Karachi which is located by the side of Arabian Sea.<sup>18</sup>

In severely malnourished children, a noteworthy difference of thyroid hormone levels is observed with mild changes of thyroid gland structure, which consequently results in decreased production of T3 and T4 level. Moreover, binding proteins of all three thyroid hormones level are also extremely low, so serum concentration of these hormones also deteriorate.<sup>19</sup> This study was designed to evaluate thyroid hormones levels in severely malnourished children and to find out correlation of thyroid hormones with protein (albumin) levels in children with malnutrition.

## MATERIALS AND METHODS

This cross-sectional study was performed between 28<sup>th</sup> May and 30<sup>th</sup> November, 2018 in outpatient department of Diabetes and Endocrinology clinic after taking ethical approval from the institute. Informed consent was taken from parents. One hundred and fifteen children of

both genders under the age of 5 years were recruited on the basis of weight for age and SD was calculated. Secondary malnutrition due to infections were excluded from the study. Approximately three ml of whole blood samples were collected aseptically to estimate T3, T4, thyroid stimulating hormone through immunoassay and serum total protein and albumin levels through electrophoresis. Findings of the lab test were recorded and analyzed using SPSS version 20. Pearson correlation test was applied to analyze the correlation between thyroid hormone levels (T3, T4 and TSH) with serum albumin level and total protein level and P-value  $\leq 0.05$  was taken as significant. Effects of modifiers like age, gender and BMI was controlled by stratification. Post stratification Pearson correlation test was also applied.

## RESULTS

**Socio-demographic characteristics:** Among the participants, 47% were females and 53% were males and 56.5% were living in rural areas. The monthly household income showed that majority of the families had <15,000 rupees monthly income (n=59, 51.3%), followed by 15,000 to 30,000 rupees (n=37, 32.2%), and >20,000 rupees in 19 (16.5%) children (table 1).

**TABLE 1: Socio-demographic characteristics of the respondents (n = 115)**

Variable	Mean $\pm$ SD	Mini- mum	Maxi- mum
Age	2.57 $\pm$ 0.96	1	5
Weight	9.62 $\pm$ 2.21	6	14
Height	0.75 $\pm$ 0.11	0.56	1
BMI	15.52 $\pm$ 1.52	13	17.9
T3 level (ng/dl)	125.75 $\pm$ 53.19	11.7	215
T4 level (ng/dl)	11.37 $\pm$ 4.36	2.50	22.40
TSH level ( $\mu$ U/ml)	2.56 $\pm$ 2.01	0.50	8.10
Total protein level	5.24 $\pm$ 0.11	4.87	6.71
Albumin level (g/dl)	2.52 $\pm$ 0.43	3.02	5.21

The correlation of thyroid hormones (T3, T4 and TSH) with serum total protein level showed moderate positive significant relationship of T3 (r=0.561, p-value <0.001) and T4 (r=0.356, p-value <0.001) with serum total protein level, while TSH (r=0.031, p-value 0.744) was weak positive.

The correlation of thyroid hormones (T3, T4 and TSH) with serum albumin level showed moderate positive significant relationship of T3 ( $r=0.510$ ,  $p$ -value  $<0.001$ ) with serum albumin level. T4

( $r=0.255$ ,  $p$ -value  $0.006$ ) and TSH and T4 ( $r=0.23$ ,  $p$ -value  $0.811$ ) was found to be weak positive (table 2).

**TABLE 2: Correlation of thyroid hormones (T3, T4, TSH) and serum total protein and serum albumin level**

Parameters	Correlation between thyroid hormone and serum total protein levels		Correlation between thyroid hormones and serum albumin level	
	r	p value	r	p value
T3 (ng/dl)	0.561	$<0.001$	0.510	$<0.001$
T4 (ng/dl)	0.356	$<0.001$	0.255	0.006
TSH ( $\mu$ U/ml)	0.031	0.744	0.023	0.811

## DISCUSSION

Among the enrolled 115 children of severely malnourished children, majority were under 3 years of age, which indicate the importance of the breast feeding and the need of complementary feed during early period of life. Most of the children belonged to the low socioeconomic status, which has previously reported that the financial status is a key factor which contribute to PEM among children.<sup>18</sup>

According to a study finding, the reduction in serum total protein, albumin and A/G ratio were correlating well with severity of malnutrition.<sup>20</sup> Adegbusi et al, also found that mean serum total protein and albumin levels were significantly lower in undernourished children as compared to well-nourished children ( $p <0.05$ ).<sup>21</sup> The alterations in serum total protein, albumin and A/G ratio in severely malnourished children could be explained on the basis of decreased protein intake and reduced biosynthesis.

In the present study, we found a decreased level of thyroid hormones among severely malnourished children, similar to a study conducted by Sah SP et al in 2017.<sup>22</sup> However, the correlation of thyroid hormones (T3, T4 and TSH) with serum total protein level showed moderate positive relationship of T3 ( $0.561$ ,  $p$ -value  $<0.001$ ) and T4 ( $0.356$ ,  $p$ -value  $<0.001$ ) with serum total protein level. TSH ( $0.031$ ,  $p$ -value  $0.744$ ) was found to have a weak positive relation. Similarly, the correlation of thyroid hormones (T3, T4 and TSH) with serum albumin level showed moderate positive relationship of T3 ( $0.510$ ,  $p$ -value  $<0.001$ ) with serum albumin level. While T4 ( $0.255$ ,  $p$ -value  $0.006$ ) and TSH ( $0.023$ ,  $p$ -value  $0.811$ ) was found to have weak positive relation.

In a previous study, mean T3 and T4 levels were significantly lower in cases as compared to controls ( $p <0.001$ ). Mean T3 and T4 levels of Grade I PEM was similar to that of controls, and that of Grade II –IV was significantly lower as compared to controls. It was observed that the T3 and T4 levels decreased with increase in severity of malnutrition, with maximal decrease been noted in Grade IV PEM.<sup>22</sup> Study conducted by Abrol et al has showed similar results.<sup>23</sup> Kumar et al also found mean T3 levels significantly lower in malnourished children as compared to controls, however in their studies no significant difference in mean T4 levels of cases and controls were reported.<sup>24</sup>

## CONCLUSION

The finding of our study depicted a decrease in the thyroid hormone levels with low serum protein and albumin levels in severely malnourished children. This can be due to low intake of dietary protein and their biosynthesis in malnourished children. However, TSH levels remain unaffected in malnourished children. So, the thyroid hormone levels should be interpreted with serum proteins and albumin levels especially in children with malnutrition for better management.

**Conflict of interest:** Nil

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