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A STUDY OF THYROID HORMONE STATUS, SERUM TOTAL PROTEIN AND SERUM ALBUMIN LEVELS IN CHILDREN AGED 1 TO 5 YEARS WITH PROTEIN ENERGY MALNUTRITION

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ABSTRACT

Introduction: Protein Energy Malnutrition (PEM) is one of the most common nutritional problem of developing countries of the world and an important cause of childhood mortality and morbidity leading to permanent impairment of physical and mental growth. Hence, an attempt has been made to study the concentration of serum thyroid hormone levels in PEM children and its correlation with serum total protein and albumin levels. **Objectives:** To assess thyroid hormone (T3, T4 and TSH), serum total protein and serum albumin levels, to correlate the levels with anthropometric parameters and find correlation between T3, T4, TSH and serum total protein and albumin. **Materials and Methods:** The present study was a hospital based case control study, consisted of 162 children aged 1-5 years having PEM as per WHO Classification of PEM (weight for height) evaluated at Department of Paediatrics, NMCH & RC, Raichur during the term January 2021 to July 2022 equally divided into case and controls group. **Results:** Majority of the children in all grades of PEM were males. Among cases majority belonged to Grade II PEM (29.6%). Prevalence of vitamin deficiency was significantly higher in cases as compared to controls and the difference was statistically significant. Mean serum total protein, albumin levels and A/G ratio is significantly lower in cases compared to controls. The mean T3 and T4 levels are significantly lower in cases as compared to controls. Mean TSH level was similar in both cases and controls. T3, T4 levels showed a significant positive correlation with hemoglobin, serum total protein and albumin levels. TSH levels had no correlation with hemoglobin, serum total protein and albumin levels. **Conclusion:** PEM was positively correlated with serum total protein and albumin levels. Degree of reduction in T3, T4 levels is related to severity of malnutrition, with highest reduction been noticed in Grade IV PEM. The T3, T4 levels of cases had a significant positive correlation with hemoglobin, serum total protein, albumin levels and A/G ratio. TSH levels had no correlation with these parameters

KEYWORDS: Protein Energy Malnutrition; Thyroid hormone levels; Serum total protein; Albumin levels; malnourished; T3; T4; TSH.

INTRODUCTION

Child malnutrition is a widespread public health problem having international consequences. WHO estimates that about half of all deaths, occurring among children aged less than five years in the developing countries, can be attributed to malnutrition[1] and it is an important cause of childhood mortality and morbidity leading to permanent impairment of physical and mental growth. PEM initially leads to failure in maintaining adequate weight gain and growth rate in early stages, as the condition progresses there is loss of weight associated with loss of subcutaneous tissue and muscle mass. PEM affects every organ system, as PEM progresses organ dysfunction develops and leads to variety of clinical features; several metabolic derangements are expected. Hepatic synthesis of serum proteins decreases and depressed levels of circulating proteins are observed. With increasing severity there is increasing failure in the homeostatic mechanism of the body and it damages the immune defense, which may result in infection and death.[2,3] Thyroid hormone plays an important role in regulation of lipid and carbohydrate metabolism and necessary for normal growth and maturation. There is reduced synthesis of plasma proteins that affects secretion and metabolism of thyroid hormone. The manifestations of PEM include retarded growth rate and limited weight gain with delayed skeletal maturation which may be mediated by alterations in thyroid hormone status in these children.[1] Absence of thyroid hormone causes mental and physical slowing, mental retardation and dwarfism.[4]

Several studies have been done to estimate the individual biochemical parameters in PEM. However, few studies have been conducted to see if there is any correlation between serum thyroid hormone levels and serum total protein, albumin levels in children with PEM. Hence, an attempt has been made to study the concentration of serum thyroid hormone levels in PEM children and its correlation with serum total protein and albumin levels.

OBJECTIVES

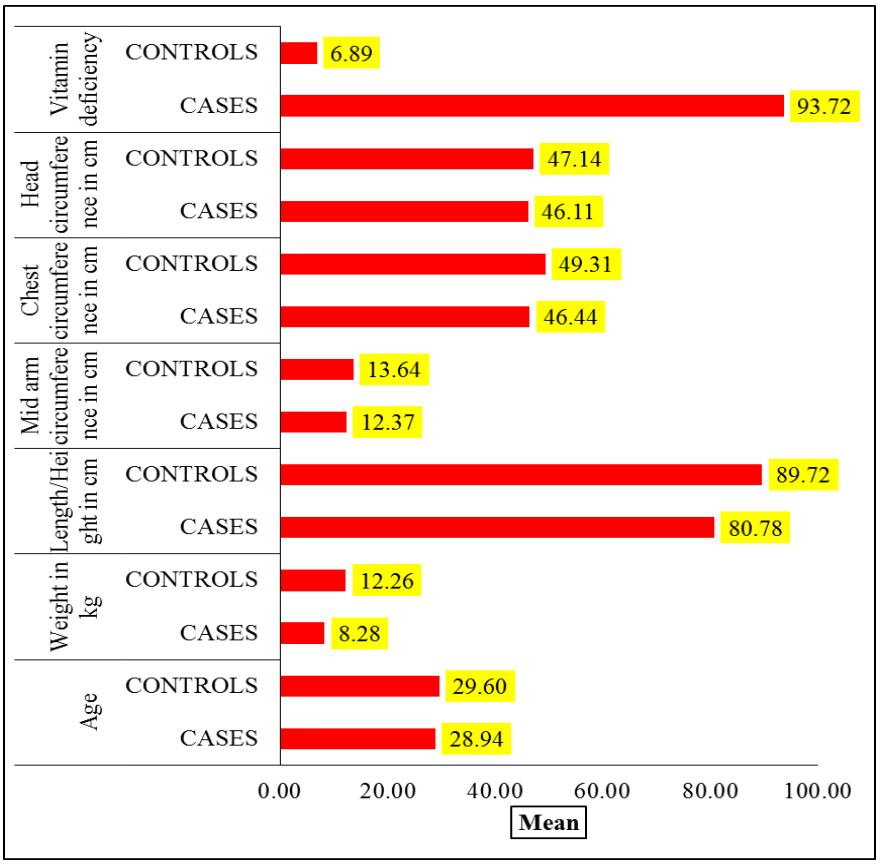
To assess thyroid hormone (T3, T4 and TSH), serum total protein and serum albumin levels, to correlate the levels with anthropometric parameters and find correlation between T3, T4, TSH and serum total protein and albumin.

MATERIALS AND METHODS

The present study was a hospital based case control study, consisted of 162 children of age group 1- 5 years evaluated at Department of Paediatrics, Navodaya Medical College Hospital and Research Centre, Raichur during the term January 2021 to July 2022. Using simple random sampling children aged 1-5 years having PEM as per WHO Classification of PEM (weight for height) were included in the study. Children with chronic infection like tuberculosis, HIV, malabsorption syndrome, protein losing nephropathy, endocrine disorders, history of preterm or low birth weight delivery and congenital anomalies were excluded. Weight was recorded to the nearest 100gm, length/height of the child was measured to the nearest cm, MAC was measured to the nearest mm, head circumference and chest circumference was measured to the nearest 0.5cm. IAP weight for age classification will be used to grade PEM among cases. The blood sample collected was used to estimate T3, T4, TSH, serum total protein and albumin. T3, T4 and TSH was estimated by chemiluminescence method. The comparison of categorical data was done using chi-square test and the continuous data was analyzed by student 't' test and ANOVA, Fisher exact test.

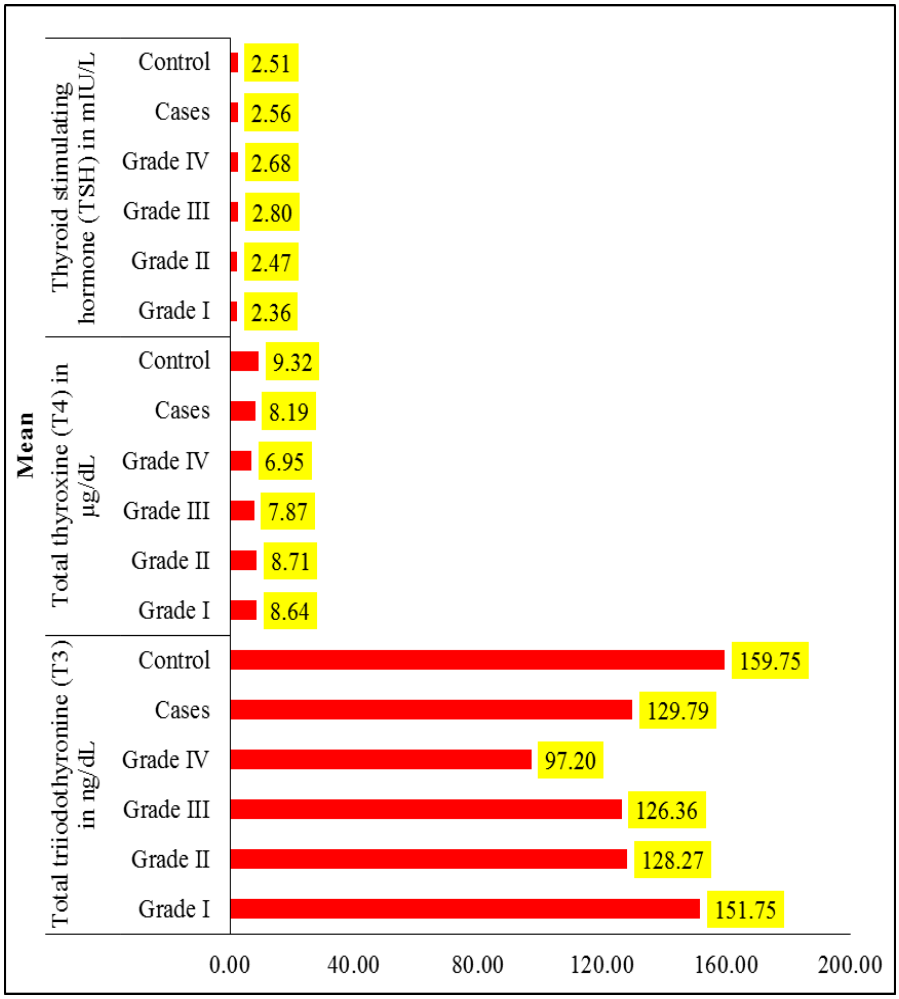
RESULTS

Majority of children in cases and controls (33.3% and 30.9% respectively) were of the age group 12-18 months. Majority of the children (58% in cases, 57% in controls) were males. Majority of the children in all grades of PEM were males. Majority of the children (53.09% in cases, 50.62% in controls) were from urban area. Majority of the children (75.31% in cases and 67.90% in controls) were Hindus. Among cases majority 28.4% belonged to Grade II PEM, Grade III & Grade I. In the study, 53% in cases and 42% in controls belonged to class IV Socio Economic status as per modified Kuppuswamy classification. Cases had significantly lower weight, length/ height, MAC, chest circumference, head circumference compared to controls.



Graph 1: Comparison of age, gender, anthropometric measurements, prevalence of pallor and vitamin deficiency among cases and controls.

Prevalence of vitamin deficiency was significantly higher in cases as compared to controls and the difference was statistically significant. Pallor was the most common presenting complaint in cases (PEM group) followed by fever. The mean hemoglobin levels in cases is significantly lower as compared to controls (p<0.001). Mean serum total protein and albumin levels is significantly lower in cases compared to controls(p<0.000). A/G ratio is significantly lower in cases as compared to controls(p<0.000). The mean T3 and T4 levels were significantly lower in cases as compared to controls(p<0.000). Mean TSH levels in cases was similar to that of controls with no statistically significant difference. Decrease in these parameters was correlating with severity of malnutrition. Mean TSH level was similar in both cases and controls.



Graph 2: Mean T3, T4 and TSH levels in various grades of PEM and controls.

All biochemical parameters in the present study except for TSH showed a good correlation with age, weight, length/height, Mid arm circumference, Chest circumference parameter. T3, T4 levels showed a significant positive correlation with hemoglobin, serum total protein and albumin levels. TSH levels had no correlation with hemoglobin, serum total protein and albumin levels.

DISCUSSION

PEM is a multisystem disease and involves almost all organs of the body. PEM is associated with a decrease in the synthesis of serum proteins which has an indirect or direct effect on secretion and metabolism of thyroid hormones levels in our body.[5] Protein energy malnutrition continues to be a major problem throughout the developing world. In India almost half of children under the age of 5 years are suffering from various grades of PEM.[6]

In the present study we enrolled children with Grade I to Grade IV PEM (according to IAP classification of PEM) as cases; majority of children had Grade II PEM 23(28.4%) followed by Grade III PEM 23(28.4%) and Grade III PEM 23(28.4%). In a study conducted by Dr. Helie R et al[7], majority of children had Grade II PEM (36) followed by Grade III PEM (24). In another study conducted by Gupta SS et al[8] had enrolled 250 malnourished children of which majority of them had Grade III PEM (82) followed by Grade II PEM (68).

In the present study cases had significantly lower weight, length/ height as compared to controls with a p value of <0.000. Study conducted by Sandeep et al[9] also found

that mean weight in cases was significantly lower than controls (p<0.001). Study conducted by Dhanjal GS et al[1] found that mean weight and height were lower in cases as compared to controls similar to our study.

In the present study, we found significantly decreased levels of serum total protein, albumin and A/G ratio in children with PEM as compared to controls. The reduction in serum total protein, albumin and A/G ratio were positively correlated with the severity of malnutrition. It may be due to decreased protein intake and reduced biosynthesis. So there was progressive decrease in serum protein, serum albumin levels and A/G ratio as the severity of malnutrition increased. The alterations in serum total protein, albumin and A/ G ration in PEM could be explained on the basis of decreased protein intake and reduced biosynthesis. In a study conducted by Sandeep et al[9] and Dhanjal GS et al[1] also found that mean serum total protein and albumin levels were significantly lower in under-nourished children as compared to well-nourished children (p<0.001). In a study by Dehariya el at[10], serum protein and albumin levels were also measured in all cases and control, the serum levels of protein and albumin were found to be decreased in PEM children.

In the present study mean T3 levels was significantly lower in cases as compared to controls (p<0.000). Mean T3 levels of Grade I PEM was similar to that of controls, and that of Grade II –IV was significantly lower as compared to controls (p<0.000). Decreased T3 levels in PEM children is probably due to low binding proteins, impaired thyroxin monodeiodination in liver which leads to decreased peripheral conversion of T4 to T3 and elevated corticosteroids which is often seen in children with malnutrition. Study conducted by Sandeep et al9 also found that mean serum T3 levels were lower in Grade II- IV PEM as compared to controls (p>1.195 in grade I, p<0.001 in grade II, III,IV). Study conducted by Sah SP et al[11] found that mean T3 levels was significantly lower in malnourished children as compared to controls (p<0.001), it was found that with increase in severity of PEM there was progressive decrease in T3 levels.

In the present study mean T4 levels was significantly lower in cases as compared to controls with a p value of <0.000. When mean T4 levels of different grades of PEM was compared to controls significant difference was observed in grade I–IV PEM with a p value of <0.0000 in comparison to controls. When mean T4 levels of different grades of PEM was compared to each other it was observed that mean T4 value showed a significant correlation to severity of malnutrition, with maximal decrease in T4 value been observed in grade IV PEM (One-way ANOVA; p<0.000). 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. The cause for decreased levels of TT3, TT4 in a malnourished child is probably due to a reduction in circulating plasma proteins. In a study conducted by Sandeep M et al[9], showed that mean T4 levels were significantly lower in cases as compared to controls (p <0.001 for both parameters). Study conducted by Dhanjal GS et al[1], showed that the mean value fT4 of the cases were significantly lower than the control group and was statistically significant (p<0.001). In a study by Sandeep et al[9], the mean TSH levels value was similar in all grades of PEM with no significant difference. The mean TSH levels in cases and controls were within normal limits, though it was low normal in cases and high normal in controls. The levels decreases as the severity of malnutrition increases and the difference between the TSH levels among cases with moderate and severe malnutrition was statistically significant. Study conducted by Dhanjal GS et al[1], showed that the mean TSH levels in cases and controls were within normal limits, though it was low normal in cases and high normal in controls.

In the present study it was observed that the mean T3, T4 levels of cases had a significant positive correlation with hemoglobin, serum total protein, albumin levels and A/G ratio. TSH levels had no correlation with these parameters. In a study conducted by Sandeep M et al[9], it was observed that mean T3, T4 levels of cases had a significant positive correlation with hemoglobin levels, serum total protein and albumin levels. Similarly Dhanjal GS et al[1] in their study, observed that mean i.e. fT3, fT4 and TSH had a statistically significant positive correlation with serum total protein and albumin

CONCLUSION

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. PEM is associated with decrease level of thyroid hormone levels and were positively correlated with serum total protein and albumin levels. The decrease level of thyroid hormone may have a contributory role in retarded growth and development. Degree of reduction in T3, T4 levels is related to severity of malnutrition, with highest reduction been noticed in Grade IV PEM. The T3, T4 levels of cases had a significant positive correlation with hemoglobin, serum total protein, albumin levels and A/G ratio. TSH levels had no correlation with these parameters.

The altered thyroid hormone status in children with PEM protects the malnourished child with low calorie reserve from an early death. Early diagnosis and prompt management of PEM and its complications can prevent development of permanent physical and mental retardation.

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