

Thyroid Hormone Status of School Going Children in An Urban Area of Chattogram, Bangladesh

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ABSTRACT

Background: Thyroid gland is the endocrine organ that secretes hormones namely, Triiodothyronine (T3) and Thyroxine hormone (T4). T3 and T4 are released in relation to the message of tropic hormone TSH, by the anterior pituitary. Absences as well as excess of thyroid hormones have harmful impacts on the overall health condition like physical and mental impediment. Poor intelligence leading to poor academic performance is frequently observed in hypothyroid children. The study was aimed to estimate serum T3, T4 and TSH levels of a group of school going children in urban area of Chattogram, Bangladesh.

Materials and methods: This cross-sectional observational study was conducted among school going children (Age: 7-12 years) of Chattogram city between January, 2022 and June 2022. Chattogram based three schools were selected by convenient sampling. A total of 500 blood samples of children were collected and serum T3, T4 and TSH levels were measured. Estimation of T3 and T4 were done by Radioimmunoassay (RIA) and estimation of TSH was done by Immunoradiometric assay (IRMA) in the in Vitro laboratory.

Results: Among 500 children, the estimated mean \pm SD serum T3 hormone level was 2.46 ± 0.79 (Range: 1.27-5.51) nmol/L, mean \pm SD serum T4 hormone level was 141.99 ± 32.77 (Range: 86.21-239.05) nmol/L and mean \pm SD serum TSH hormone level was 1.58 ± 1.04 (Range: 0.30-3.02) mIU/L.

Conclusion: Thyroid hormone status of the study group children was found within normal limits. However, regular screening of children is suggested to identify the subclinical and unreported clinical cases, so that their optimum growth and development are ensured.

Key words: School going Children; Thyroid hormone status; Urban area.

Introduction

The thyroid gland is a butterfly-shaped organ located in the base of neck. It releases hormones that control metabolism depending on body requirements. The thyroid's hormones regulate vital body functions, including breathing, heart rate, central and peripheral nervous systems, body weight, muscle strength, menstrual cycles, body temperature, cholesterol levels and much more.¹ The thyroid gland, though not essential, is responsible for maintaining the level of metabolism in the tissue through stimulation of oxygen

consumption. It also helps to regulate lipid and carbohydrate metabolism and is necessary for normal growth, maturation and reducing mental retardation and dwarfism.^{2,3}

The thyroid is a part of endocrine system, which is made up of glands that produce, store and release hormones into the bloodstream. So, the hormones can reach the body's cells. The thyroid gland uses iodine from the foods to make two main hormones: Triiodothyronine (T3) and Thyroxine (T4). The thyroid gland is the sole source of thyroxine (T4) but most of the Triiodothyronine (T3) in blood is derived from the peripheral conversion of T4 by 5'-deiodinase.⁴ It is important that T3 and T4 levels are neither too high nor too low. The hypothalamus of brain and the pituitary, communicate to maintain T3 and T4 balance. The hypothalamus produces TSH Releasing Hormone (TRH) that signals the pituitary to tell the thyroid gland to produce more or less of T3 and T4 by either increasing or decreasing the release of a hormone called Thyroid Stimulating Hormone (TSH).¹

The significant role of thyroid hormones is exemplified in cases of hormones absence and excess. Its absences causes physical and mental slowing, poor resistance to cold and in children, mental retardation and dwarfism.² Poor school achievement and cognition in hypothyroid

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children have also been reported.⁵ Thyroid hormones physiology show relation with the growth and development, especially brain.⁶ The role of TSH in the development of goiter is obvious in cases with elevated serum TSH levels. However, in many studies, normal levels of serum TSH have been reported, despite iodine deficiency.^{7,8} Children with hyperthyroidism feel nervous, moody, weak and tired. Delay of normal development and growth can lead to intellectual impairment. Some children exhibit laziness, mental collapse while giving any response and avoid participation in exercise related sessions in institution which could be due to abnormality in thyroid hormones production.⁹ Aim of this study was to estimate serum T3, T4 and TSH levels of a group of school children in urban area.

Materials and methods

This cross-sectional observational study was conducted among school going children (Age: 7-12 years) during the period of January, 2022 and June, 2022. A total of 500 children of Chattogram city based 3 schools were selected as sample from 3 schools by convenient sampling. With the help of school authority, the guardians of class three to eight students were informed in details about the study in a parent meeting. After getting such voluntary written consent from the parents, blood samples of the children were collected in a prefixed date during the school hours. Samples were transported to the laboratory immediately and refrigerated at a temperature of 4°C. The serum was analyzed for T3, T4 and TSH levels. Estimation of T3 and T4 were done by Radioimmunoassay (RIA) and estimation of TSH was done by Immunoradiometric Assay (IRMA) in the in Vitro laboratory. Normal range of Thyroid hormone levels in different age groups has described as T3 (nmol/L) (1-15 years: 1.57 to 3.30; >15 years: 1.23 to 3.10), T4 (nmol/L) (1-7 years: 77.2 to 173.7, 8-11 years: 70.8 to 160.9, >12 years: 58.0 to 154.4) and TSH (mIU/L) (For all ages: 0.6 to 4.8).¹⁰ Statistical analysis was performed using SPSS version 26. Data were measured by performing Student's t test.

Results

In this study, total 500 children were observed. Mean \pm SD age of the children was 11.2 \pm 2.53 years (Table I). Among the respondents, 266 (53.2%) were male and 234 (46.8%) were female (Figure 1). Mean \pm SD serum T3 hormone level was 2.46 \pm 0.79 (Range: 0.77-7.03) nmol/L, mean \pm SD serum T4 hormone level was 141.99 \pm 32.77 (Range: 64.60-285.80) nmol/L and mean \pm SD serum TSH hormone level was 1.58 \pm 1.04 (Range: 0.17-4.83) mIU/L (Table II). There was significant difference in serum T3 level between male and female students. But no significant difference was found in serum T4 and TSH levels between them (Table III).

Table I Age of the children (n=500)

	Level	Frequency (Percentage)
Age (Years)	7-8	80 (16%)
	9-10	108 (21.6%)
	11-12	312 (62.4%)
	Mean \pm SD	11.2 \pm 2.53

Data are expressed as frequency (Percentage) and mean (\pm SD)

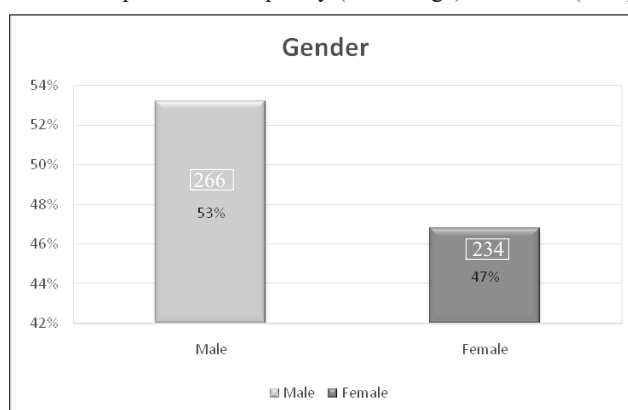


Figure 1 Gender distribution the children (n= 500)

Table II Thyroid hormones and TSH level of the children (n=500)

	Mean \pm SD	Range
T3 (nmol/L)	2.46 \pm 0.79	1.27-5.51
T4 (nmol/L)	141.99 \pm 32.77	86.21-239.05
TSH (mlu/L)	1.58 \pm 1.04	0.30-3.02

Data are expressed as mean (\pm SD) and range.

Table III Thyroid hormones and TSH levels in both male and female children (n=500)

	Male	Female	p-value
T3 (nmol/L)			
Mean \pm SD	2.38 \pm 0.83	2.55 \pm 0.76	0.038 ^s
T4 (nmol/L)			
Mean \pm SD	140.88 \pm 34.67	143.26 \pm 30.48	0.229 ^{ns}
TSH (mlu/L)			
Mean \pm SD	1.60 \pm 1.07	1.47 \pm 0.84	0.096 ^{ns}

Data are expressed as mean (\pm SD) and range.

s=significant, ns=non-significant, p value was derived from student t-test.

Discussion

The relative frequency of thyroid disorders varies with age, sex and geographical area. The pattern of disease varies in different parts of the world and also in different regions of the same country. About 1.6 billion people in the world are at risk of iodine deficiency disorders who may also develop thyroid hormone deficiencies.¹¹

Present attempt was made to observe the thyroid hormones and TSH levels in children of 7-12 years of both sexes by which reliable reference values of the same can be predicted. This study showed, the estimated serum T3 hormone ranges from 0.77-7.03 nmol/L and reference intervals of the same is 1.27-5.51 nmol/L. Estimated serum T4 hormone ranges from 64.60-285.80 nmol/L, reference intervals of which is 86.21-239.05 nmol/L. Estimated serum TSH hormone ranges from 0.17-4.83 mIU/L and reference intervals is 0.30-3.02 mIU/L. In their study, Channa et al. similarly found normal thyroid hormone level in urban boys. In contrast, urban females showed elevated T3, T4 and TSH levels, 17%, 05% and 17%, respectively.⁹ Suchitra et al. reported mean TSH value as 3.98 mIU/mL in their study. Abnormally high TSH values were found in 30 (11.5%) students. Only 6 (Six) students had low T3 level. One had a TSH value of 150 with no symptom. TSH value of another student was found 0.15 despite having normal T3 and T4 profile. All students were asymptomatic. None of the students had goiter.¹² Another recent published study among children with Severe Acute Malnutrition (SAM) showed that the mean T3 (ng/dl) T4 (mcg/l) and TSH (mIU/L) were 109.8 ± 50.6 , 8.36 ± 3.7 and 2.5 ± 1.8 respectively. Low serum T3 and T4 levels were found in 11 (22%) and 14 (28%), respectively and elevated TSH in 4 (8%) children.⁴ Mean T3 and T4 levels were significantly low in children with protein energy malnutrition as compared to normal healthy children in their study by Sandeep et al.³

In the current study, statistically significant difference was observed in serum T3 concentration between male and female students. But serum T3 and TSH levels of them showed no such difference. Pediatric reference intervals for serum T3, T4 and TSH levels in this study were based on a very large number of children and that might be considered accurate and reliable.

Limitations

In this study, samples were taken from the children of Chattogram city-based 3 schools. A study involving children of same age group of both sexes from different districts including rural and urban areas may further standardize the T3, T4 and TSH levels of Bangladeshi children.

Conclusion

The mean serum T3, T4 and TSH levels were within the normal limits among the school going children. Still regular and routine screening of such children is recommended for their optimum growth and development which will eventually give us a healthy, energetic and industrious generation of manpower to contribute in the progress and prosperity of our nation.

Disclosure

All the authors declared no competing interest.

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