

Serum thyroid hormone and thyrotropin levels in school children from goiter endemic sub-Himalayan tarai region of Eastern Uttar Pradesh, India.

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Abstract

In the present study serum concentrations of T3, T4, TSH were measured in 140 goitrous school children, aged 6-12 yrs of both sexes from Siddharthnagar, located in sub-Himalayan tarai region of Eastern Uttar Pradesh where endemic goiter and iodine deficiency are prevalent. The results show that overall 10.0% studied population (12.9% boys and 7.7% girls) has TSH level above 6.1 μ IU/ml indicating that they had biochemical hypothyroidism and all the hypothyroid children are subclinically hypothyroid and none of them are overt hypothyroid as their T4 level is within normal range. The serum levels of T4, T3 were in the normal range in children with different grades of goiter. The findings of present study suggest that serum thyroid hormone and thyrotropin levels are relatively less sensitive marker for iodine deficiency.

Keywords: Thyroid hormones, Hypothyroidism, Endemic goiter, Iodine deficiency, Eastern Uttar Pradesh.

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Introduction

Iodine deficiency lowers circulating T4 and raises the serum TSH, so that iodine deficient populations generally have higher serum TSH concentration than do iodine sufficient groups. Therefore, elevated serum TSH constitutes an indicator of the potential risk of iodine deficiency. However the difference is not great and much overlap occurs between individual TSH values. Therefore, the blood TSH concentration in school age children is not a practical marker for iodine deficiency [1].

A base line study in certain selected CD Blocks of Siddharthnagar district in Eastern Uttar Pradesh, located in the foot-hills of the Himalayas suggests that endemic goiter and associated iodine deficiency disorders (IDD) are still prevalent causing a major threat of public health. Overall total goiter prevalence rate of 26.3% (grade 1: 23.2%; grade 2: 3.1%) indicating that IDD is a moderate public health problem in this region and median urinary iodine level of 6.0 μ g/dl, suggests the biochemical iodine deficiency in the studied region [2].

In the post salt iodization phase reports on thyroid hormone profile of the population are not available from this sub-Himalayan tarai region. Therefore, the present study has been undertaken to evaluate the functional status of thyroid gland of the population of the studied region by estimating serum level of thyroxine (T₄), tri-iodothyronine (T₃) and thyroid stimulating hormone (TSH) in representative blood samples.

Material and Methods

Geographically Siddharthnagar in Eastern Uttar Pradesh of India is located in the foot-hills of the Himalayas and made up of tarai (flat lands). There are 14 Community Development Blocks (CD Blocks) in the district of which 10 are rural and 4 are urban CD Blocks. The present study was conducted in 14 representative localities taking one from each of the CD Blocks covering the entire Siddharthnagar district by purposive sampling method [3]. The study has been conducted from January to August 2010.

A total of one hundred forty (140) venous blood samples were collected from goitrous school children of both sexes taking ten (10) samples from each study area. Necessary consent was taken from the subjects and their parents to participate in the study. Samples were collected in marked centrifuge tube with necessary precautions required for collection of blood including the ethical procedure. The serum was separated from each blood samples after centrifugation and clear serum samples were transferred to the marked ependrop tubes and transported on dry ice to reference laboratory. The samples were stored at -20°C until analysis.

Serum level of thyroid stimulating hormone (TSH) was measured by ELISA using Monobind, Inc. TSH kit (kit no. MBI 42918/088151). The estimation of serum levels of the thyroid hormones (T4 and T3) was done by ELISA using Monobind, Inc total T4 Kit (kit no. MBI 32718/083001) and Monobind, Inc total T3 Kit (Monobind Inc. Lake Forest, CA 92630, USA.) respectively.

Results

The thyroid hormone profile (T4 and T3) and TSH was investigated in 140 goitrous school children living in sub-Himalayan tarai region, an area with moderate iodine deficiency. Table 1. depicts the distribution of TSH level among boys, girls and overall population dividing into four groups i.e., <0.3 µIU/ml -below normal, 0.3 to 3.1 µIU/ml -normal having tendency towards below normal, 3.2 to 6.1 µIU/ml -normal having tendency towards above normal and >6.1 µIU/ml-above normal. The results show that overall 10.0% population (12.9% boys and 7.7% girls) has TSH level above 6.1µIU/ml indicating that they had biochemical hypothyroidism. In 56.4% population (51.6 % boys and 60.2 % girls) TSH level was 3.2 to 6.1µIU/ml, showing the tendency to be biochemically

hypothyroid, while rest of the children had TSH level within normal ranges.

The distribution of serum T4 level of the population is shown in Table 2. dividing into sub groups i.e., T4 level < 4.0 µg/dl - below normal, 4.0 to 7.4 µg/dl - normal having tendency towards subnormal), 7.5 to 11.0 µg/dl -normal having tendency towards above normal and >11 µg/dl - above normal. The overall results showed that none of the studied population had T4 level below normal (i.e., < 4.0 µg/dl) and in 59.3 % of the population (54.8% boys and 62.8% girls) T4 level was between 7.5 to 11.0 µg/dl i.e. within normal range but having tendency towards above normal and in 6.4 % of the studied population (9.7% boys and 3.8% girls) where T4 value was above normal i.e., >11 µg/dl, while rest of the 34.3 % (35.5 % boys and 33.3 girls) of the studied population T4 level was within normal range but having tendency towards subnormal.

The serum T3 level in school children of tarai region is shown in Table 3. diving into four subgroups i.e., <0.7 ng/ml - below normal, 0.7 to 1.35 ng/ml - normal having tendency towards subnormal, 1.36 to 2.0 ng/ml - normal having tendency towards above normal, and >2.0 ng/ml - above normal or elevated. In the present study the serum T3 level was found within normal ranges in all the studied population with 87.9% population having tendency towards subnormal and rest 12.1 % having tendency towards above normal.

Prevalence of thyroid dysfunction among goitrous school children is shown in Table 4. The results of the present study shows that none of the children is hyperthyroid whereas 12.9% boys, 7.7% girls and in overall 10.0% of the studied children have subclinical hypothyroidism. All the hypothyroid children was subclinically hypothyroid and none of them are overt hypothyroid as their T4 level is within normal range.

Table 1. Serum TSH level among the cases

	Serum TSH (µIU/ml)				
	Mean±SD	<0.3	0.3-3.1	3.2-6.1	>6.1
Boys (N=62)	4.27±1.85	0(0%)	22(35.5%)	32(51.6%)	8(12.9%)
Girls (N=78)	3.57±1.24	0(0%)	25(32.05%)	47(60.2%)	6(7.7%)
Total (N=140)	3.87±1.57	0(0%)	47(33.6%)	79(56.4%)	14(10.0%)

Table 2. Serum T4 level among cases

	Serum T4 (µg/dl)				
	Mean±SD	<4.0	4.0 - 7.4	7.5 – 11	>11
Boys (N=62)	8.35±2.97	0(0%)	22(35.5%)	34(54.8%)	6(9.7%)
Girls (N=78)	7.80±1.31	0(0%)	26(33.3%)	49(62.8%)	3(3.8%)
Total (N=140)	8.04±2.21	0(0%)	48(34.3%)	83(59.3%)	9(6.4%)

Table 3. Serum T3 level among cases

	Serum T3 (ng/ml)				
	Mean±SD	<0.7	0.7 - 1.35	1.36 - 2.0	>2.0
Boys (N=62)	1.26±0.17	0(0%)	45(72.6%)	17(27.4%)	0(0%)
Girls (N=78)	1.18±0.06	0(0%)	78(100.0%)	0(0%)	0(0%)
Total (N=140)	1.21±0.12	0(0%)	123(87.9%)	31(12.1%)	0(0%)

Table 4. Prevalence of thyroid dysfunction among goitrous school children

	HYPOTHYROIDISM		HYPERTHYROIDISM	
	Overt	Subclinical	Overt	Subclinical
Boys (N=62)	00	8 (12.9%)	00	00
Girls (N=78)	00	6 (7.7%)	00	00
Total (N=140)	00	14 (10.0%)	00	00

Discussion

The role of TSH in the development of goiter is obvious in cases with elevated serum TSH levels[4]. However, patients with normal serum levels of TSH may also have goiter[5]. High TSH levels have been found in iodine deficient subjects studied in China[6]. Similarly in Central African Republic 80% of the subjects studied had high TSH level[7]. In India the mean TSH level of the group with severe iodine deficiency was found to be higher than the mean TSH level of the group with mild iodine deficiency[8]. However in many studies normal levels of serum TSH have been reported, despite iodine deficiency[4,5,9-12]. Similarly in the present study only in 10.0% subject serum TSH had above the normal range and in rest of the children serum TSH levels were within the normal range in spite of mild iodine deficiency in the study region. With few exceptions the circulating T4 and T3 were also within normal range in all the studied children. This observation is similar with the earlier findings of Bourdoux[13].The explanation for the goitrogenesis in these subjects, having normal serum TSH levels, may be an increased sensitivity of the thyroid gland to the mitogenic effect of TSH due to iodine deficiency. Normal serum T4 and T3 level of the children with iodine deficiency may be due to wide normal range of these thyroid

hormones and proves that they are less sensitive indicators of iodine deficiency.

Sub-clinical hypothyroidism is diagnosed if serum T4 level is normal and serum TSH level above 6.1µIU/ml, while sub-clinical hyperthyroidism is diagnosed if TSH level less than 0.3µIU/ml is detected in presence of normal serum T4 concentration. Overt hypothyroidism is diagnosed when T4 is less than 4.0 µg/dl and TSH level above 6.1µIU/ml and overt hyperthyroidism where T4 level more than 11.0 µg/dl and TSH level is less than 0.3 µIU/ml[14].A detail study conducted by Marwaha *et al.*[14], in India during post salt iodization phase showed a goiter prevalence of 23% in school children of 6-18 years age. Among the goitrous subject the prevalence of overt and subclinically hypothyroidism were 0.89% and 4.3% respectively ; in the studied region, the population had no iodine deficiency, but they were exposed to thiocyanate load[14].Correspondingly, studies conducted on thyroid function in goitrous children from both endemic and iodine supplemented region showed the prevalence of sub-clinical and overt hypothyroidism from 0-40% residing in iodine deficient areas[15,16]. Similarly in the present study only 10% of the goitrous children were biochemically hypothyroid. None of the hypothyroid children had overt hypothyroidism.

Conclusion

Serum TSH levels were found within the normal range in 90% goitrous children however, rest 10.0% goitrous children had TSH levels above the normal range and were biochemically hypothyroid. The serum levels of T4, T3 and TSH are in the normal range in most of the children with different grades of goiter suggests that these are relatively less sensitive marker for iodine deficiency.

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