Original article

Serum thyrotropin levels of medical and paramedical students of Gauhati Medical College, Assam, India

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Abstract

Introduction: Thyroid Stimulating Hormone (TSH) or Thyrotropin is an anterior pituitary hormone that plays an important role in regulating the function of the thyroid gland. Serum levels of TSH is a reliable index of the functional status of the thyroid gland. At present, TSH levels in serum are estimated by Immunoradiometric assays, which are very sensitive.

Materials and methods: In the present study, serum TSH levels were measured in 100 clinically euthyroid subjects, consisting of 50 males and 50 females by immunoradiometric assay.

Results: The study found that 12% of the subjects (5 males and 7 females) had TSH values above the normal upper limit, the normal range of the TSH assay being 0.30-5.00m IU/ml.

Conclusion: This finding is significant in light of the recent focus on subclinical thyroid dysfunction, particularly the risk of development of overt thyroid dysfunction in persons with high normal values of serum thyrotropin. Further, the present study is the first study done in our institute as well as north-east region of India to measure serum levels of TSH in the general population, not presenting with any thyroid disorder.

Keywords: thyrotropin, immunoradiometric

Introduction

Thyroid Stimulating Hormone (TSH) is the major regulator of the morphologic and functional states of the thyroid[(1)]. In normal serum, TSH is present in concentrations between 0.2 – 4.2 μ U/L; the average plasma level is about 2μU/L. the biologic half-life of human TSH is about 60 minutes. Circulating TSH displays both pulsatile and circadian variations. The former are characterized by fluctuations at 1- to 2-hour intervals. The magnitude of TSH pulsations is decreased during fasting, illness or after surgery[(2)]. The circadian variation is characterized by a nocturnal surge that precedes the onset of sleep and appears to be independent of the cortisol rhythm and fluctuations in serum T4 and T3[(3,4)]. The mean output of TSH starts to rise at about 9PM, peaks at midnight and then declines during the day. The normal secretion rate is about 110μg/day. When the onset of sleep is delayed, the nocturnal TSH is enhanced and prolonged and the early onset of sleep results in a surge of lesser magnitude and shorter duration[(1,5)]. However, TSH excursions are modest in comparison to those of other pituitary hormones, in part because TSH has a relatively long plasma half-life. Consequently, single measurements of TSH are adequate for assessing its circulating level[(6)].

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The rate of TSH secretion is exquisitely sensitive to the plasma concentrations of free thyroid hormones thus providing a precise and specific barometer of the thyroid status of the patient [5]. Measurement of TSH by sensitive immunoradiometric assay is currently the most useful first-line test of thyroid function [7]. Extremely sensitive (fourth generation) assays can detect TSH levels ≤0.004m U/L, but for practical purposes, assays sensitive to ≤0.1m U/L are sufficient[6]. Immunometric assay technology now makes it possible to define the normal range for serum TSH and hence to ascertain both when thyroid function is inadequate or when hormone supply is excessive. This assay uses the TSH molecule as a link between a TSH antibody bound to an inert surface (e.g. particles, side of a test tube) and a second antibody directed against a different TSH epitope that is labeled with a detectable marker (I125, an enzyme or a chemiluminescent reagent). Thus, the signal generated is proportional to the concentration of TSH in the serum[5].

Plasma TSH concentration is very sensitive to alterations in the levels of free T3 and T4; a 50% decline in the free T4 levels can cause plasma TSH concentration to increase 50-100fold. Conversely, an excess of thyroid hormone leads to a decrease in plasma TSH concentration [8]. When the rate of thyroid hormone secretion rises to 1.75times normal, the rate of TSH secretion falls essentially to zero [9]. There is a linear inverse relationship between the serum free T4 concentration and the log of TSH, making the serum TSH concentration an exquisitely sensitive indicator of the thyroid state of patients with an intact hypothalamic-pituitary axis [1].

Aims and objectives

The aim of the present study was to measure the serum TSH levels in a healthy young adult population.

Materials and methods

The study was approved by the Institutional Ethics Committee, Gauhati Medical College and Hospital. The present study was conducted in the Department of Physiology, Gauhati Medical College, Guwahati in collaboration with the Department of Endocrinology, Gauhati Medical College, Guwahati . The period of study was from August 2010 to July 2011. The study was conducted among the medical and paramedical students attending classes in the Department of Physiology. The purpose of the study and the study procedure was explained to all participants. Detailed history was taken and general and systemic examination was done. Students with present or past history of any thyroid disorder, with family history of thyroid disorder, with history of intake of any medication that might affect the thyroid hormone profile or with history or clinical examination suggestive of any signs or symptoms related to thyroid disorder were excluded from the study. After taking history and conducting general and systemic examination, a total of 100 students, with no symptoms or signs suggestive of any thyroid disorder, were included in the study. Written informed consent was taken from all the subjects in the format prescribed by the Institution Ethics Committee, Gauhati Medical College, Guwahati. The subjects consisted of 50 males and 50 females. Serum TSH levels of the subjects was estimated by Immunoradiometric assay method.

Statistical methods:

The data collected was tabulated and subjected to statistical analysis. All data were expressed as Mean±SD. The data was analysed using MS Excel.

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Results

A total of 100 students aged 18-20 years were included in the study. The mean age of the subjects was 18.98±0.696 years.

The normal range of TSH assay was 0.30 – 5.00 m IU/ml. The mean TSH of the 100 subjects was 2.99±1.43 m IU/ml with 12 subjects (12%) having TSH value greater than 5.00 m IU/ml. The male subjects had a mean TSH value of 2.96±1.43 m IU/ml with 5 subjects (10%) having TSH value greater than 5.00 m IU/ml. The female subjects had a mean TSH value of 3.01±1.43 m IU/ml with 7 subjects (14%) having TSH value greater than 5.00 m IU/ml. None of the subjects had TSH value less than 0.30 m IU/ml. Although the mean TSH value in females was higher than that in males, the difference was not significant.

In the present study, the combined male and female range for TSH concentration was found to be 0.74-7.34m IU/ml. The TSH range in females was 0.79-5.89m IU/ml and that in males was 0.74-7.34m IU/ml. Figure 1 shows the distribution of TSH values in the study population. Most (86%) of the students were from Assam and neighbouring North-Eastern states while the remaining 14% were from states in Northern India. The mean TSH of the students from North-East India was 3.01±1.43m IU/ml and that of the students of Northern India was 2.83±1.42m IU/ml. The difference was not statistically significant.The present study found that 12 subjects had TSH values greater than 5 m IU/ml. On further endocrinological follow-up, they were found to be cases of subclinical hypothyroidism. In the present study, the prevalence of subclinical hypothyroidism was found to be 12% with a male:female ratio of 1:1.5. The mean TSH among the subclinical hypothyroid subjects was 5.77±0.65m IU/ml (6.13±0.85m IU/ml among the males and 5.52±0.32m IU/ml among the females). The remaining 88 subjects, who were euthyroid , had a mean TSH value of 2.61±1.02m IU/ml (2.61±0.98m IU/ml in males and 2.60±1.08m IU/ml in females)

Discussion

In the following paragraphs, we recount the findings of some studies carried out to determine the reference intervals for serum TSH levels in various population groups. The study of Dika H et al [(10)]was one of the first attempts to determine thyroid hormones profile in healthy Ugandans. The main objective of this study was to determine the thyroid hormones profile of students of the Makerere College of Health Sciences in Kampala, Uganda. A cross sectional descriptive study was done involving 72 students, with the mean age of 24.17 ±4.48 years. Subjects who volunteered to participate in the study were interviewed; their height and body weight measured, 5 ml of blood withdrawn, and sera harvested. FT4 and T3 Radioimmuno Assay (RIA) were done and TSH was assayed using Immunoradiometric Assay (IRMA) technique. Mean serum TSH level was 2.412 ±2.284 µIU/ml. Mean serum TSH in the 19-20 years age-group was 2.71±2.404µIU/ml. Jang YY et al [(11)] reported that the mean TSH values for male subjects was 1.28±1.84 µIU/ml and 1.49±2.08 µIU/ml in females among healthy Korean adults.. Hubl W et al [(12)] reported that the reference interval for the healthy adults for TSH was 0.17-4.23 mIU/l.

González-Sagrado M and Martín-Gil FJ [(13)] in their study among 304 healthy subjects (male, n = 151; female, n = 153; age 12-94 years) excluding individuals taking any medications, with a history of thyroid disorder, or severe non-thyroidal illness, found that the reference interval for TSH was 0.51-5.95 mlU/l. Dhatt GS, Griffin G and Agarwal MM

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[14] reported that the 95% reference interval for TSH was 0.30-4.32 mU/l in an ambulatory adult (16-75 y) Arab population.. Taimela E et el [15] in their study conducted in Wallace, Finland found that the reference interval for thyrotropin was 0.6-4.3 mIU/l. Holowell J G et at (NHANES III) [16] found that for the disease-free population, mean serum TSH was 1.50 (95% confidence interval, 1.46-1.54) mIU/liter. Hershman JM et al [17] reported that the mean TSH in women, 1.37m U/L (0.34-5.5m U/L), was similar to that of the men, 1.30m U/L (0.48-3.5m U/L). Coiffi M et al [18] found that in the age range 2-7 yr, TSH values were 0.10-5.9 microU/ml (mean 2.2 microU/ml). In the age range 9-16 yr, TSH values were 0.20-6.1 microU/ml (mean 2.3 pU/ml). Gomez JM et al [19] in their study found basal TSH concentrations were 1.49 ± 0.8 mU/l in males and 1.67 ± 0.83 mU/l in females. Bjoro T et al [20] in their study conducted at Nord-Trondeleg, Norway found that in individuals without a history of thyroid disease the median, 2.5 and 97.5 percentiles for TSH (mU/l) were 1.80 and 0.49-5.70 for females and 1. 50 and 0.56-4.60 for males. Alqahatani M et al [21] carried out their study on young Saudi adults. The combined male and female range for TSH was found to be 0.48 – 6.30 m IU/L. TSH range in females was 0.48 - 6.30 m IU/L and in males was 0.52 – 4.89 m IU/L. Angel OK Chan et al [22] in their study found that the reference interval of TSH in Hong Kong Chinese was 0.68 – 3.70 m IU/L. Rosita Fontes et al [23] reported a TSH range of 0.3-5.8m U/L in the 20-49 years age-group.

In the present study, 12% of the subjects had TSH value greater than 5.00m IU/ml but with serum T4 and T3 within normal range. They were considered to be cases of subclinical hypothyroidism. Vaishali Deshmukh et al [24] reported that the prevalence of subclinical hypothyroidism in their study population was 11.3% which is comparable to the present study. They also found a M:F ratio of 1:3.7 whereas the present study found a ratio of 1:1.5. The euthyroid subjects had a mean TSH value of 2.22±1.06µIu/ml, which is comparable with the present study, with a range of 0.3-4.6µIu/ml. The mean TSH value among the subclinical hypothyroid subjects was 9.8±7.22µIu/ml which is higher than the value reported in the present study. N Karthick et al [25] reported a mean TSH value of 1.7±0.8m U/L among euthyroid females which is lower than the mean value reported in the present study. The TSH mean among subclinical hypothyroid females, 5.6±1.5m U/L, is comparable to the present study.

Conclusion

The present study found that even among healthy young adults, whose history and clinical examination is not suggestive of the presence of any thyroid disorder and who have no family history of thyroid disease and no history of any medication in the past which might interfere with thyroid function, there were a number of adults whose TSH levels were above normal. On further endocrinological evaluation, they were all found to be cases of Subclinical Hypothyroidism, defined as an elevated serum TSH but with serum free thyroxine levels within the normal range. In recent years, there has been an increasing focus on subclinical thyroid dysfunction, which may have an impact on morbidity and mortality. Detrimental effects on the cardiovascular system have been reported for suppressed and particularly, elevated serum levels of TSH and follow-up studies have shown an increase in the risk of development of overt thyroid dysfunction in subjects with high normal serum TSH levels [26,27,28,29]. Subclinical hyperthyroidism, defined as a

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combination of low serum TSH but with free thyroxine levels within the reference range, is a risk factor for atrial fibrillation [30,31]. Subclinical hypothyroidism, on the other hand, is associated with dyslipidemia [32] and is a risk factor for ischaemic heart disease and all-cause mortality [26,33].

The early identification and follow-up of such cases of subclinical hypothyroidism among young adults will aid in early diagnosis of overt hypothyroidism and prompt institution of appropriate treatment measures.

Limitations of the study:

The present study is self-funded, a time-bound study and a small sample size was taken due to high cost of the IRMA kit for TSH estimation. Only TSH levels were estimated. A further study with a large sample size that is representative of the population of the region and estimation of serum levels of Thyroxine, Tri-iodothyronine and TSH shall be helpful in establishing population-specific reference values for the north-eastern region of India.

TABLE 1: COMPARISION OF THE TSH RANGE AMONG DIFFERENT STUDIES

STUDY	TSH RANGE (COMBINED MALE + FEMALE)	
Present Study	0.74-7.34	
Hubl W et al	0.17-4.23	
Gonzalez-Sagrado M & Martin-Gil FJ	0.51-5.95	
Dhatt GS et al	0.32-4.32	
Taimela E et al	0.6-4.3	
Alqahatani M et al	0.48-6.30	
Angel OK Chan et al	0.68-3.70	
	TSH RANGE (MALES)	TSH RANGE (FEMALES)
Present Study	0.74-7.34	0.79-5.89
Alqahatani M et al	0.52-4.89	0.48-6.30

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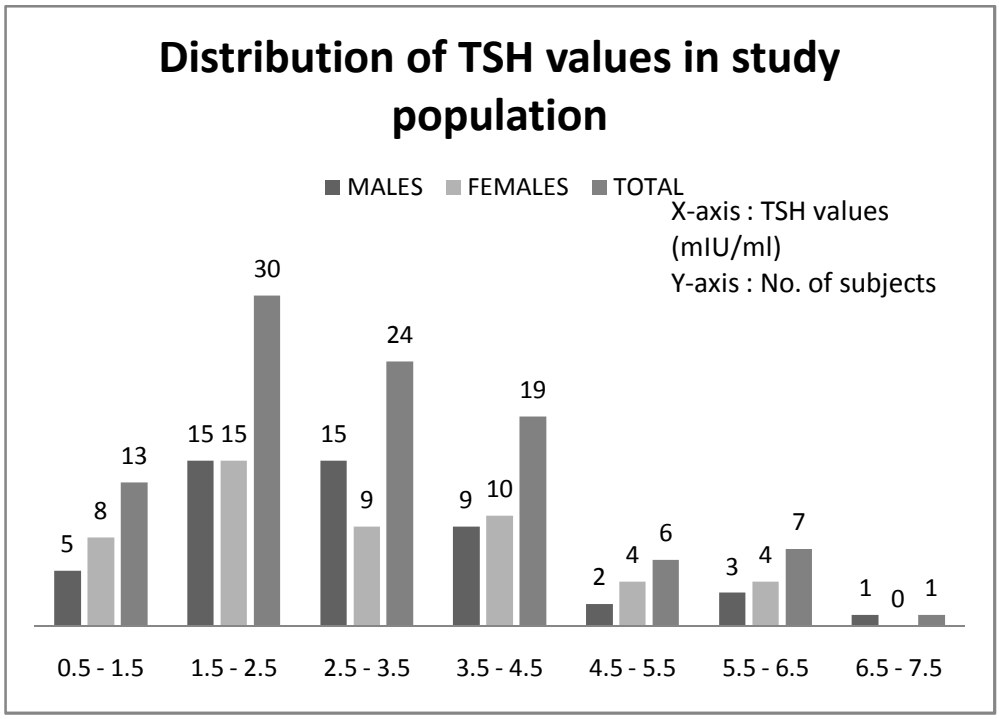

Figure 1

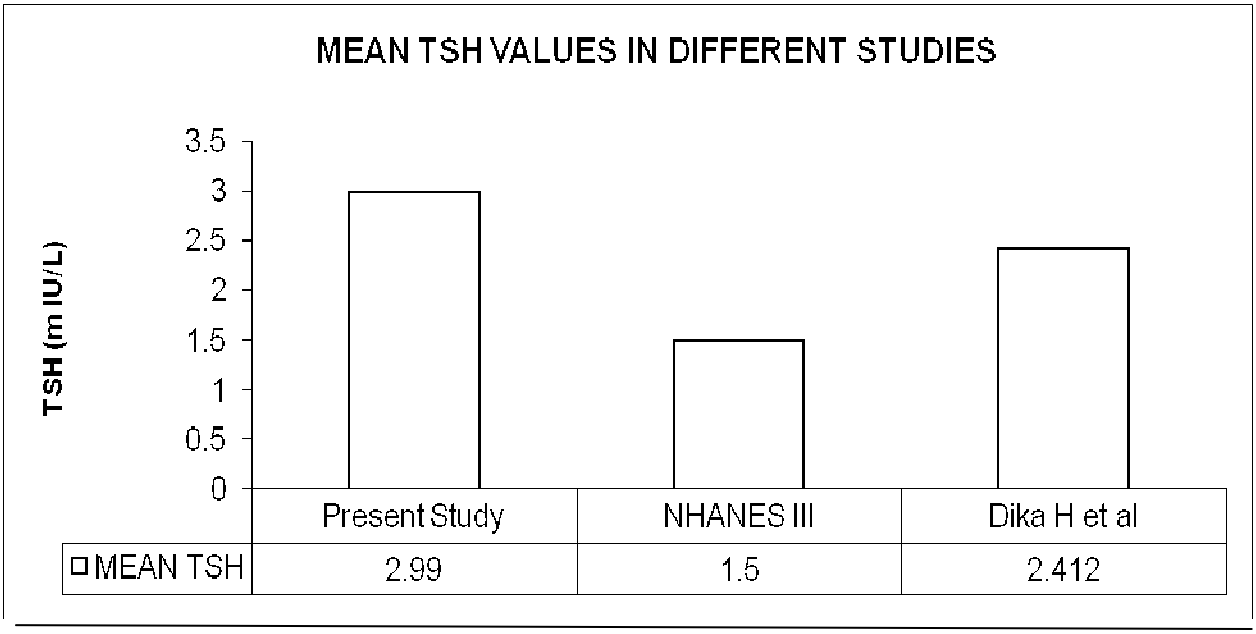

Figure 2

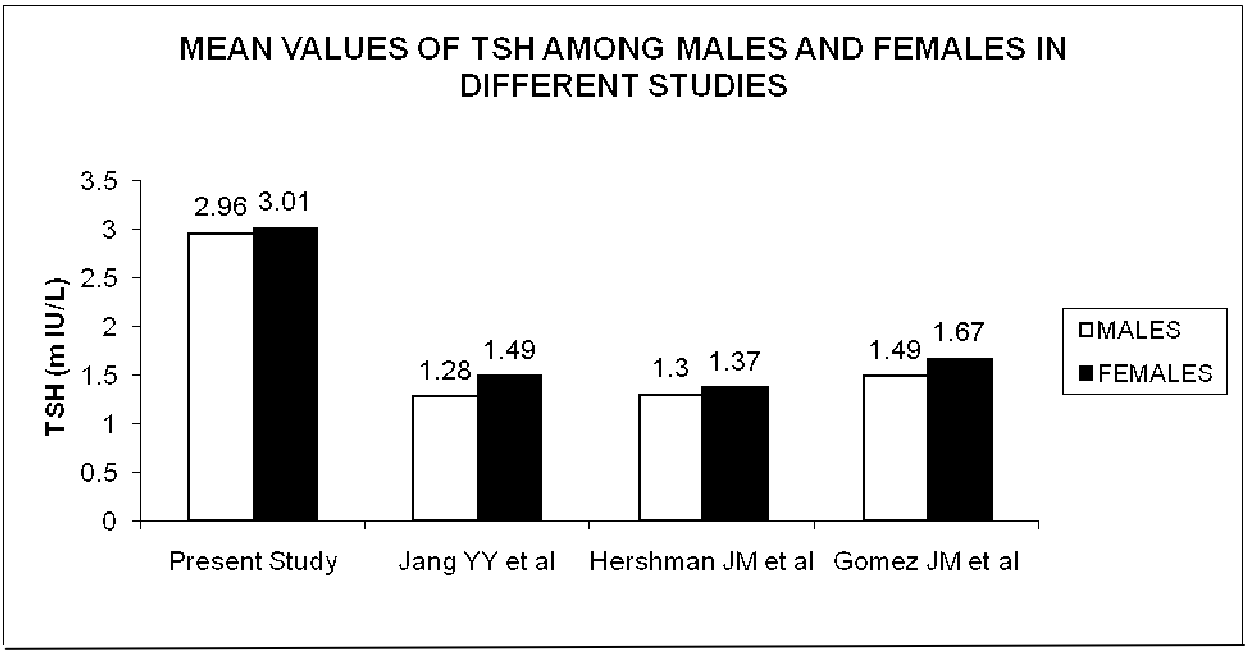

Figure 3

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