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A comparative study on outcomes of preprandial versus postprandial thyroid function test

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ABSTRACT

Background: The thyroid is an endocrine gland. It secretes two hormones thyroxine (T_4), triiodothyronine (T_3). Hypothyroidism is a common condition encountered by a clinician. Subclinical hypothyroidism (SCH) defined as normal free thyroxine (T4) and elevated thyroid stimulating hormone (TSH), is primarily a biochemical diagnosis with or without clinical symptoms. Studies have observed that TSH levels vary at different times in a day. In practice not much importance is given to the timing of the sample collection (pre-prandial or post-prandial sate). SCH is diagnosed depending on TSH value. So the condition may be under or over diagnosed based on a single value. So we conducted this study to determine whether timing of sample collection had any significant relationship in the determination of levels of thyroid hormones.
Methods: The study was carried on 114 patients who visited ENT department, NMCH between July 2018 and June 2019. Group-1 consisted of 38 normal patients. Group-2 consisted of 36 hypothyroidism patients GROUP-3 consisted of 40 subclinical hypothyroidism patients. Thyroid function tests (TSH and free T4) were done in fasting state and 2 hours postprandially.
Results: TSH values were found to be significantly lowered after food in all the three groups. Free T4 values did not show any statistically significant alteration after food.
Conclusions: There was a significant decline in TSH values postprandially. This might lead to inappropriate diagnosis and management of patients as cases of hypothyroidism, especially in cases of sub clinical hypothyroidism.

Keywords: Thyroid function test, Subclinical hypothyroidism, Thyroid stimulating hormone, Postprandial thyroid function test

INTRODUCTION

Thyroid hormones regulate metabolism, brain development, breathing, heart and nervous system functions, body temperature, muscle strength, skin dryness, menstrual cycles, weight, and cholesterol levels.[1] Subclinical hypothyroidism (SCH) defined as normal free thyroxine (T4) and elevated thyroid stimulating hormone (TSH) is a biochemical diagnosis with or without clinical symptoms. Subclinical hypothyroidism is associated with hypertension, dyslipidaemia, infertility and cardiovascular comorbidities.[2] TSH shows a normal circadian rhythm with a peak between 11 pm-5 am.[3] Secretory TSH pulses occur every 2-3 hours and are interspersed with periods of tonic non-pulsatile secretion.[3] It is generally observed that TSH in early morning fasting states were higher than TSH levels measured later in the same day.[4] Subclinical hypothyroidism is mainly diagnosed by biochemical diagnosis and a condition like this is often underdiagnosed in routine clinical practice. So this study aims to evaluate whether TSH and free T4 measured in

fasting state or postprandial state would show any statistical difference.

METHODS

This was a prospective study conducted at Navodaya Medical College and Hospital, Raichur, Karnataka. It included 114 patients who visited ENT OPD between July 2018 to June 2019 and underwent serum TSH, free T4 at our hospital.

Inclusion criteria

Patients aged between 15-60 years of both sexes.

Exclusion criteria

Patient less than 15 or more than 60 years of age, patients with liver dysfunction, patients with renal dysfunction, patients on thyroxine therapy, and patients on steroid therapy were excluded from the study.

A total of 114 patients were divided into 3 groups. Group-1 consisted of 38 normal patients. Group-2 consisted of 36 hypothyroidism patients. Group-3 consisted of 40 subclinical hypothyroidism patients. The study was approved by the institutional ethical committee and informed consent was obtained from patients. Serum TSH and free T4 were analysed after a 12 hour overnight fast. Venous blood sample was collected between 9:00 am -10:00 am in the morning and the patients returned 2 hours after breakfast for their samples to be rechecked between 11:00 am -12:00 pm on the same day. Samples were analysed by the electro chemiluminesence immunoassay method. The methodology had an analytical sensitivity of 0.005 µIU/ml and a functional sensitivity of 0.014 µIU/ml. Normal values for TSH were 0.27-4.2 µIU/ml and normal values for free T4 was 0.80-1.8 ng/ml. The results were statistically analysed.

Statistical methods

Differences in free T4 and TSH levels between fasting and non-fasting state were analysed by paired student t-test. P value below 0.05 was considered statistically significant.

RESULTS

In our study there were 114 patients in between age of 15-60 years (7- males and 107- females). Group-1 had 38 patients (4- males and 34- females), Group-2 had 36 patients (2- males and 34- females), Group-3 (1- male and 39- females) [Table 1]. TSH values in: Group-1 (euthyroid pts) was 2.44±1.50 preprandially and 1.79 ±1.11 postprandially, Group-2 (SCH pts) was 66.93±17.83 preprandially and 61.27±16.43 postprandially, Group-3 (hypothyroid pts) was 7.54±1.50 preprandially and 5.37±1.40 postprandially TSH values were found to be significantly lowered after food when compared to fasting in all the three groups [Table 2] and this result was found to be stastically significant. Free T4 values did not show any statistically significant alteration after food in all the three groups.

Table 1: Demographic data of study population.

	Male	Female	Age (Mean±S.D.)
Group 1 (n=38)	4	34	29±12
Group 2 (n=36)	2	34	30±13
Group 3 (n=40)	1	39	25±10
Total	7	107	28±5

Table 2: Fasting and post-prandial values (mean±S.D.) of TSH and free T4 among the three groups.

	Fasting values	Postprandial values	P value
Group 1 (n=38)			
Free T4 (ng/ml)	1.06±0.10	1.06±0.13	0.08
TSH (mIU/l)	2.44±1.50	1.79±1.11	0.00
Group 2 (n=36)			
Free T4 (ng/ml)	0.57±0.21	66.94±17.84	0.76
TSH (mIU/l)	66.93±17.83	61.27±16.43	0.01
Group 3 (n=40)			
Free T4 (ng/ml)	0.90±0.21	0.90±0.20	0.38
TSH (mIU/l)	7.54±1.50	5.37±1.40	0.02

Group 1 (euthyroid patients), Group 2 (hypothyroidism patients), Group 3 (subclinical hypothyroidism patients).

DISCUSSION

TSH is a glycoprotein hormone secreted in a pulsatile fashion. It's long half-life and low pulse amplitude result in very minimal changes in the circulating level of the hormone.[5] TSH secretion is dependent on two factors namely thyrotropin releasing hormone (TRH) which stimulates it and somatostatin which inhibits its

secretion.[6] In our study we observed that TSH is lowered when estimated postprandially irrespective of the fasting levels. Many previous studies by Kamat et al, Bandhopadhyay et al and Scobbo et al have shown results similar to our study.[7-9] Studies have shown that there is elevation of circulating somatostatin after food consumption, this might account for the decline of TSH circulating levels postprandially as TSH secretion is inhibited by somatostatin.[7]

The TSH variation is unlikely to have been due to method of assay used, as there are studies which have used different assay techniques for TSH viz., immunofluorescence assay, radioimmunoassay, micro particle enzyme immuno assay but have observed results similar to our study.[7-9] In a study conducted by Nair et al in 57 patients they observed similar results as of our study.[10] There are no proper guidelines for thyroid function testing or laboratory guidelines for free T4 and TSH estimation, which emphasize the time of sample collection (fasting or postprandial). In our study, 20 out of 40 subjects were reclassified as euthyroid based on postprandial decrease in TSH levels, who would have otherwise been labelled as SCH based on fasting TSH alone. This confers that the timing of sample collection made a significant alteration in the diagnosis and further management of the patients. From the observations made from our study, we propose that a fasting TSH sample should be preferred to random or postprandial estimations.

CONCLUSION

There was a statistically significant decline in TSH values postprandially in comparison to fasting values. This might lead to inappropriate diagnosis and management of patients, especially in cases of sub clinical hypothyroidism.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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