# Seasonal Variation in Level of Thyroid Hormones in Surat, Gujarat

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### Abstract :

Introduction : The principal hormones of thyroid gland are Triiodothyronine (T3) and Thyroxine (T4). Several changes in thyroid function and thyroid function tests occur with advancing age as well as during various seasons. Objective: To investigate the impact of age, gender and seasons on the level of Thyroxine (T4), Triiodothyronine (T3) and Thyroid Stimulating Hormone in individuals free of thyroid diseases. **Method:** Present record based cross sectional study was done in patients of a multispecialty Hospital of Surat, Gujarat. Records of patients attending the hospital during April 2012 to March 2013 were form the study population. Written consent of the patients was taken and ethical approval was obtained from IEC. The serum levels of T3, T4 and TSH in 112 individuals attending the Hospital in different seasons were examined. Hormonal assay was done by using AIA 360 immunoassay. Data were entered in Microsoft excel and were analysed using Epi info software. Results: The Mean ± SD for T3, T4 & TSH was 2.78 ± 0.50ng/dl, 1.54 ± 0.78 mg/dl&  $1.78 \pm 1.22 \mu$ IU/L. The mean value of TSH is elevated in females than males while T4 is slightly higher in males and T3 remained almost same in both genders. The mean T3 level was highest in age group of 30-40 years and minimum in patients of <20 years age. Mean T4 level was highest in age group of 41-50 years and minimum in patients of >50 years age. Mean TSH level was highest in age group of 20-30 years and minimum in patients of >50 years age. There is significant change in thyroid hormone levels in both genders of different age group in different seasons. Conclusion: It is concluded that the age and seasons have an appreciable effects on the levels T3, T4 and TSH.

Keyword: Thyroxine, Triiodothyronine, Thyroid Stimulating Hormones

## Introduction:

The principal hormones of thyroid gland are Triiodothyronine (T3) and Thyroxine (T4) and their concentrations are 93% and 7% respectively. The normal total plasma T4 level is approximately 8  $\mu$ g/dL (103 nmol/L), and the plasma T3 level is 0.15  $\mu$ g/dL (2.30 nmol/L). Several changes in thyroid function and thyroid function tests occur with advancing age, as reviewed by Mariotti et al <sup>[1]</sup> and Adler et al <sup>[2]</sup>.

Studies on the natural course of thyroid function tests in the elderly are often complicated by confounding factors such as the increased prevalence of autoimmune subclinical hypothyroidism, of chronic (non-thyroidal) illness and of medication induced changes in thyroid function tests.<sup>[1,3-5]</sup> After exclusion of these confounders, most studies show similar results: A clear, age-dependent decline in serum Thyroid Stimulating Hormone (TSH) and (free) T3, whereas serum (free) T4 levels remain unchanged. The inactive metaboliter T3 (Reverse T3) seems to increase with age.

In normal individuals the range of thyroid hormones and TSH in the blood is as follows  $^{[6]}$ :

Free Thyroxine (T4) - 0.89–1.76ng/dl

Free Tri-iodothyronine (T3) - 2.3-4.2ng/dl

Thyroid Stimulating Hormone (TSH) – 0.5-5.0  $\mu IU/mL$ 

Age has an effect on the concentration of T3, T4 and TSH. It is studied that gradual increase in autonomous tissue with age makes individual more

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susceptible to thyroid problems. Higher frequencies of thyroid problems are noted in people above 40 yrs of age.<sup>[7]</sup>

Fasting state along with acute and chronic illness are associated with a decreased serum T3 and increased rT3, without any evidence of thyroid disease. <sup>[8-13]</sup> This is often referred to as non-thyroidal illness. The high prevalence of non-thyroidal illness, due to malnutrition and the presence of chronic illness, is an important confounder in the assessment of thyroid function in the elderly. <sup>[1,3]</sup>

This is illustrated by a recent study in 403 healthy ambulatory men (aged 73-94 years), in which subjects with systemic infectious, inflammatory, and malignant disorders were excluded. In this study, 63 men met the criteria for non-thyroidal illness, which was defined as a low serum T3 and a high serum rT3.

There is a paucity of literature on effect of age, sex and seasons on the levels of thyroid hormones had been scarcely researched in western part of India. So, this study was done to investigate the impact of age, gender and seasons on the level of Thyroxine (T4), Triiodothyronine (T3) and Thyroid Stimulating Hormone in individuals free of thyroid diseases.

## Method:

Present study was a record based cross sectional study done in patients of a multispecialty hospital of Surat, Gujarat. Records of patients attending the hospital during April 2012 to March 2013 formed the study population. Total 112 patients had attended the hospital for thyroid hormone test were included in the study. Secondary data on age, gender, TSH, T3 and T4 level were analyzed. Permission from hospital authorities was taken to conduct the study. The confidentiality of individual patients was maintained throughout the study.

Collection of blood sample: Blood samples were obtained from anti-cubital vein of subjects who attended hospital for various problems other than the thyroid or related diseases. Serum was separated by centrifugation at 2000 rpm for 5 mins. Determination of hormones: The samples were analysed for T3, T4 and TSH by AIA-360 FLOUREMETRIC ENZYMATIC IMMUNOASSAY by using ST AIA pack T3, ST AIA pack T4 and ST AIA pack TSH supplied by TOSOH manufactures in central laboratory of hospital itself. Data were entered in Microsoft excel and were analysed using Epi info software.

## **Results:**

The present study was done among total 112 patients of a multispecialty Hospital of Surat. The Mean  $\pm$  SD for T3, T4 & TSH was 2.78 $\pm$ 0.50ng/dl, 1.54 $\pm$ 0.78ng/dl & 1.78 $\pm$ 1.22 µIU/L. There were total 64 females and 48 males in study participants. In Males, Mean  $\pm$  SD for T3, T4 & TSH was 2.63  $\pm$ 0.79 ng/dl, 1.54  $\pm$  0.68 ng/dl and 1.55  $\pm$  1.22 µIU/L. In Females, Mean  $\pm$  SD for T3, T4 & TSH was 2.48  $\pm$ 0.51ng/dl, 1.33  $\pm$  0.48 ng/dl& 2.09  $\pm$  1.31 µIU/L. The mean value of TSH is elevated in females than males while T4 is slightly higher in males and T3 remained almost same in both genders.

# Table 1: Mean T3, T4 & TSH levels in different age groups

Age	T3 (ng/dl)	T4 (ng/dl)	TSH (μU/L)
<20 years	1.79±0.51	1.53±0.45	1.24±0.45
20-30 years	2.94±0.87	1.45±0.53	2.44±1.04
30-40 years	3.00±0.94	1.48±0.55	2.22±0.96
41-50 years	2.16±0.74	1.49±0.48	1.68±1.39
>50 years	2.83±1.35	1.35±0.88	0.51±0.49

Table 1 shows variation inmean level of T3, T4 and TSH in different age group. It was observed that mean T3 level was highest in age group of 30-40 years and minimum in patients of <20 years age. Mean T4 level was highest in age group of 41-50 years and minimum in patients of >50 years age. Mean TSH level was highest in age group of 20-30 years and minimum in patients of >50 years age.

Table 2 shows the effect of seasons on the concentration of T3, T4 and TSH. The data indicated that serum TSH level is lowest in monsoon while

Seasons	Winter	Summer	Monsoon	F value	P value
T3 (ng/dl)	2.54±0.70	2.34±0.47	2.47±0.69	2.91	0.055
T4 (ng/dl)	1.26±0.30	1.51±0.68	1.42±0.45	7.13	0.0009
TSH μU/L	3.01±1.41	2.22±2.00	1.76±1.15	18.37	0.000000001

Table 2: Season wise variation in Mean T3, T4 & TSH levels

highest in winter. The concentration of serum T3 is stable in all the seasons, but highest in winter and lowest in summer. The serum T4 level is also nearly equal in all seasons, slightly lower in winter while highest in summer.

### **Discussion**:

The present study was done to check the seasonal and age group wise variation in the level of thyroid hormones. The Mean  $\pm$  SD for T3, T4 & TSH was 2.78  $\pm$  0.50 ng/dl, 1.54  $\pm$  0.78 ng/dl& 1.78  $\pm$  1.22  $\mu$ IU/L. The mean value of TSH is elevated in females than males while T4 is slightly higher in males and T3 remained almost same in both genders. This observation is in accordance with previous work by Razzak et al <sup>[14]</sup> and Franklyn et al, <sup>[15]</sup> that in males the value of sex hormones increases the circulating level of Thyroxine Binding Globulin (TBG), which directly leads to increase in circulating level of T4.

The levels of thyroid hormones and TSH in different age groups are depicted in table 1. It was observed that mean T3 level was highest in age group of 30-40 years and minimum in patients of <20 years age. Mean T4 level was highest in age group of 41-50 years and minimum in patients of >50 years age. Mean TSH level was highest in age group of 20-30 years and minimum in patients of >50 years age. But previous studies by Razzak et al,<sup>[14]</sup> Muslim and Khalil et al <sup>[16]</sup> shows decreased value of TSH in last decade. While in males, TSH is lowest in fourth decade and highest in second group. This is in accordance with studies of Razzak et al $^{[14]}$  and Muslim and Khalil et al $^{[9]}$ While in previous work by Muslim and Khalil et al<sup>[9]</sup>, Franklyn et al <sup>[16]</sup> and Westgern et al <sup>[17]</sup> revealed lower level of T4 in first decade and increased T4 level as age advances.

The effect of seasons on concentration of T3, T4 and TSH is given in table 2, which shows that

serum TSH level is lowest in monsoon while highest in winter. The concentration of serum T3 is stable in all the seasons, but highest in winter and lowest in summer. The serum T4 level is also nearly equal in all seasons, slightly lower in winter while highest in summer. Seasons also have effect on T3, T4 and TSH which is in accordance with study done by khan et al.<sup>[18]</sup>

## Conclusion

From the present study it can be concluded that the age and seasons have appreciable effects on the level of T3, T4 and TSH.

### **Declaration:**

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Conflict of Interest: Nil

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