

Original Research Article

# A comparative assessment of thyroid hormones and lipid profile among hypothyroid patients: A hospital based case control study

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## Abstract

**Background:** In India, thyroid disorders are the most common among all the endocrine disorders and hypothyroidism being more common than hyperthyroid state and carcinoma.

**Objectives:** The present study was undertaken to assess the association of dyslipidemia in hypothyroid patients.

**Materials and methods:** A total of 50 study subjects of both gender groups were selected from the medicine ward of Maheshwara Hospital during the period from January 2016 to April 2016. Fasting venous blood sample were analysed for Thyroid hormones like, T3, T4, TSH and lipid profile. Statistical analysis was done using student unpaired t test.

**Result:** The thyroid stimulating hormone (TSH) and total cholesterol, LDL, VLDL values were significantly higher, whereas T3, T4 and HDL values were in a decreasing order with that of control group.

**Conclusion:** The present study concludes that hypothyroidism is associated with dyslipidemia having raise in all lipid parameters, which may increase the risk of cardiovascular diseases. Finally regular assessment of thyroid hormones and lipid profile among hypothyroid patients can prevent progression of the disease to severity.

### Key words

Hypothyroidism, Thyroid Profile, Cardiovascular disease, Euthyroid, Dyslipidemia, Thyroid stimulating hormone (TSH), Triiodothyronine (T3), Tetraiodothyronine (T4).

### Introduction

Globally, thyroid gland diseases are the commonest endocrine disorder and most abundant public health problems. Worldwide, approximately 42 million people were suffering from thyroid dysfunction with a prevalence of 4-5%. In India, thyroid disorders are the most common among all the endocrine disorders and hypothyroidism being more common than hyperthyroid state and carcinoma [1, 2].

Hypothyroidism is a common disorder in which thyroid activity is reduced and does not produce enough thyroid hormones. It leads to hyper secretion of pituitary thyroid stimulating hormone (TSH) and an increased serum level of TSH is observed. This is a key biochemical finding, particularly in the early detection of thyroid dysfunction [3, 4, 5]. Hypothyroidism can cause a number of symptoms such as depression, weight gain, feeling tiredness, and affects the reproductive, nervous, renal, pulmonary, neuromuscular and cardiovascular system. Thyroid hormones regulate and show significant effects on the mobilization, synthesis, and metabolism of lipids [6, 7]. So derangement in lipid metabolism is associated with signs and symptoms of cardiovascular diseases.

So, the present study was undertaken to assess the association of dyslipidemia in hypothyroid patients as early detection and treatment will help to prevent progression of the disease to severity.

### Materials and methods

The present study was carried out at Maheshwara Medical College and Hospital situated in Patancheru, part of Medak District, Telangana state. A total of 50 study subjects of both gender groups were selected from the medicine ward of Maheshwara Hospital during the period from January 2016 to April 2016. This study was approved by institutional ethical committee and investigations were carried out in the biochemistry laboratory, Maheshwara Medical College and Hospital, Patancheru.

### Inclusion criteria

- A criterion of primary hypothyroidism was defined by clinical features of hypothyroidism.
- Hypothyroid patients of age group 30-70 years.

### Exclusion criteria

All the patients with past history of thyroid disease, drugs, malignancy, radiotherapy to chest and neck areas, pregnant, patients with chronic illness and familial lipid disorders, were excluded from the study.

### Collection of blood sample

Blood samples were collected, after 12 hours fast from the above study subjects. 5ml of blood from the cubital vein was collected in a plain bottle after explaining the procedure to the study subjects. Serum was separated from the blood samples by a centrifuged machine at 3000 rpm for 10 minutes in the biochemistry department. Following estimations are carried out on the serum samples by standard kit methods and analyses were performed on COBAS e411 auto analyzer.

### Parameters measured

In the present study following parameters were measured:

- Triiodothyronine (T3)
- Tetraiodothyronine (T4)
- Thyroid stimulating hormone (TSH)
- Total Cholesterol (TC)
- Triglycerides (TG)
- High Density Lipoprotein – Cholesterol (HDL-C)

The Serum total cholesterol was measured by CHOD – PAP method [8], Triglycerides were measured by GPO-Trinder method [9], HDL-Cholesterol measured by Phosphotungstic acid method [10] and the values of Low Density

Lipoprotein cholesterol (LDL-C) and Very-low-density lipoprotein cholesterol (VLDL-C) can be calculated by using Friedewald's equation [11, 12] as follows;

- $LDL - Cholesterol = total\ cholesterol - (HDL - cholesterol + triglycerides / 5)$
- $VLDL - C = Triglycerides / 5.$

### Reference range

The normal reference ranges according to the kits are: TSH (0.7-6.4  $\mu$ IU/ml), T3 (0.52-1.85 ng/ml), T4 (4.0-11.0  $\mu$ g/dl. Normal values for lipid profile parameters are total cholesterol (< 200 mg/dl), triglycerides (< 150mg/ dl), HDL-Cholesterol (30-60 mg/dl), LDL- Cholesterol (< 100 mg/ dl), and VLDL-Cholesterol (20-40 mg/dl).

### Statistical analysis

The collected data were analyzed by SPSS software version 16.0. All results were presented as mean  $\pm$  standard deviation (SD). A p-value of less than 0.0001 was considered significant.

### Results

In the present study, total 50 subjects were divided into two groups, 25 controls (Euthyroid subjects) and 25 cases (Hypothyroid patients) with the age range of 30 –70 years. Out of 25 controls, 12 were males and 13 females and in 25 hypothyroid patients, 09 were males and 16 females as per **Table - 1**. The mean  $\pm$  SD of age in years was  $49.12 \pm 15.26$  in cases and  $47.56 \pm 13.41$  in healthy controls as per **Table - 1**.

**Table - 1:** Age and Gender wise distribution of Cases and Controls.

Age (Years)	Controls (n=25)		Cases (n=25)	
	Males	Females	Males	Females
30- 40	02	09	02	05
41-50	02	03	02	04
51-60	03	01	03	04
61-70	05	00	02	03
<b>Total</b>	<b>12</b>	<b>13</b>	<b>09</b>	<b>16</b>
<b>Mean <math>\pm</math> SD</b>	<b>47.56 <math>\pm</math> 13.41</b>		<b>49.12 <math>\pm</math> 15.26</b>	

The mean  $\pm$  SDs of T3 (ng/ml), T4 ( $\mu$ g/dl), and TSH ( $\mu$ IU/ml), in controls were in the range of  $1.32 \pm 0.30$ ,  $9.26 \pm 1.82$ ,  $2.17 \pm 1.07$ , respectively. It was observed that the mean  $\pm$  SDs of T3 (ng/ml), T4 ( $\mu$ g/dl), and TSH ( $\mu$ IU/ml), in cases were in the range of  $0.77 \pm 0.33$ ,  $6.94 \pm 1.53$ , and  $10.61 \pm 3.20$ , respectively. It was evident that T3 and T4 levels were decreased in cases as compared to controls and TSH levels were increased in cases as compared to controls and the increase was statistically highly significant ( $p < 0.0001$ ) as per **Table - 2**.

The mean  $\pm$  SDs of TC, TG, HDL-C, LDL-C and VLDL-C, in controls were in the range of  $177.48 \pm 15.01$ ,  $126.92 \pm 20.16$ ,  $45.12 \pm 3.96$ ,  $106.9 \pm 13.41$ , and  $25.38 \pm 4.03$ , respectively. It is observed that the mean  $\pm$  SDs of TC, TG, HDL-C, LDL-C and VLDL-C, in cases were in the range of  $236 \pm 38.96$ ,  $229.96 \pm 56.69$ ,  $39.68 \pm 2.78$ ,  $150.3 \pm 34.97$ , and  $45.99 \pm 11.33$ , respectively. It was evident that TC, TG, LDL-C and VLDL-C levels were increased in cases as compared to controls. The mean  $\pm$  SD level of serum HDL was statistically significantly decreased in hypothyroid cases compared to healthy controls ( $P < 0.0001$ ) as per **Table - 2**.

**Table - 2:** Comparison of T3, T4, TSH and Lipid Profile between controls and hypothyroid patients

Parameters	Controls (n=25)	Cases (n=25)	t- value	p-value
	Mean $\pm$ SD	Mean $\pm$ SD		
<b>T3 (ng/ml)</b>	$1.32 \pm 0.30$	$0.77 \pm 0.33$	5.94	< 0.0001 *S
<b>T4 (<math>\mu</math>g/dl)</b>	$9.26 \pm 1.82$	$6.94 \pm 1.53$	4.87	< 0.0001 *S
<b>TSH (<math>\mu</math>IU/ml)</b>	$2.17 \pm 1.07$	$10.61 \pm 3.20$	12.50	< 0.0001 *S
<b>TC (mg/dl)</b>	$177.48 \pm 15.01$	$236 \pm 38.96$	7.00	< 0.0001 *S
<b>TG (mg/dl)</b>	$126.92 \pm 20.16$	$229.96 \pm 56.69$	8.56	< 0.0001 *S
<b>HDL-C (mg/dl)</b>	$45.12 \pm 3.96$	$39.68 \pm 2.78$	5.62	< 0.0001 *S
<b>LDL-C (mg/dl)</b>	$106.9 \pm 13.41$	$150.3 \pm 34.97$	5.78	< 0.0001 *S
<b>VLDL-C (mg/dl)</b>	$25.38 \pm 4.03$	$45.99 \pm 11.33$	8.56	< 0.0001 *S

S\* = Statistically Significant.

## Discussion

In the present study, we evaluated the relationship between thyroid hormones and serum lipid profile. The present study reveals that the mean  $\pm$  SD of the TSH and total cholesterol, TG, LDL, and VLDL were significantly higher in hypothyroid patients compared to healthy euthyroid subjects.

In the present study, the mean  $\pm$  SD of age in cases was  $49.12 \pm 15.26$  and  $47.56 \pm 13.41$  in healthy controls and higher numbers of cases were seen in 40- 60 years age group. Similar studies were reported by Desai JP et al. and Luboshitzky, et al. [13, 14]. In the present study female predominance is more than the male of total cases. Similar findings were reported by Bhandopadhyay, et al., and Desai JP, et al. [15,

13]. The incidence and prevalence of thyroid disease are more prevalent in women than men and the percentage of thyroid dysfunction among women was 13% among men was 5% [16].

In the present study, the mean  $\pm$  SD levels of cholesterol were significantly higher in hypothyroid patients than that of healthy euthyroid subjects. Similar findings were reported by Evangelos N, et al. [17], Dalmacio A, et al. [18], Abrams JJ, et al. [19]. In hypothyroid patients, the activity of  $\beta$ -hydroxy  $\beta$  methyl glutaryl Co A (HMG-CoA) reductase is reduced, there is often an increase in the serum cholesterol, mainly due to increased levels of serum LDL and intermediate density lipoprotein (IDL) [17]. In addition, incompletely degraded VLDL particles enriched in TC and

apolipoprotein E, which is accumulating in the thyroid subjects and decreased activities of hepatic lipase and lipoprotein lipase, seems to contribute to those alterations [20, 21].

In the present study, the mean  $\pm$  SD levels of TSH  $10.61 \pm 3.20$   $\mu$ IU/ml, were significantly higher in hypothyroid patients than that of healthy euthyroid subjects. Similar findings were reported by Singh BM, et al. [22] and Prakash A, et al. [23]. In our study, there was a highly significant difference between normal and abnormal values of T3 and T4 ( $p < 0.0001$ ) similar findings were observed by Singh PA, et al. [24], who found that the (T3, T4) level significantly decrease when compared to control.

In the present study we observed a significant increase in mean  $\pm$  SD levels of and LDL and TG in study group compared with controls. Similar findings were observed by Al-Hakeim HK, et al. [25] and Archana Prakash, et al. [26] in hypothyroid patients showing significant increase in TC and LDL-C with decrease in HDL levels [26].

In the present study, we evaluated the relationship between thyroid hormones and serum lipid profile. The present study reveals that the mean  $\pm$  SD of the TSH and total cholesterol, TG, LDL, and VLDL were significantly higher in hypothyroid patients compared to healthy euthyroid subjects.

In our study, we evaluated the relationship between thyroid hormones and serum lipid profile among hypothyroid patients. To some extent, we have succeeded in correlating hypothyroid with the altered lipid profile. However, our study involved in small sample size due to limited period and therefore the results inferred may not be considered as the reflection of larger population. Regular evaluation of T3, T4, TSH and lipid profile is must in all hypothyroid cases to stop further aggravation and risk of cardiovascular diseases.

## Conclusion

The present study concludes that hypothyroidism is associated with dyslipidemia having raise in all lipid parameters, which may increase the risk of cardiovascular diseases. Finally regular assessment of thyroid hormones and lipid profile among hypothyroid patients can prevent progression of the disease to severity.

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