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### Original Article

## Study of lipid profile in hypothyroidism

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#### ABSTRACT

**Objective :** It is uncertain whether hypothyroidism is associated with alterations of lipid profile in some sample populations. The present study aimed to assess the association between hypothyroidism and lipid levels. **Design :** Serum lipid parameters of 75 patients with different levels of TSH (related to hypothyroidism) and 25 age and sex matched euthyroids as controls were evaluated in a cross sectional study. **Methods :** 75 cases of hypothyroidism in the age group of 20-60 years with 25 cases of age and sex matched euthyroids as controls were studied for thyroid profile over a period of 1 year and grouped on the basis of TSH levels as follows : Group I : 25 cases of normal healthy euthyroids as controls; Group II : 25 cases of TSH levels between 6-20 IU/ml; Group III : 25 cases of TSH levels between 21-40 IU/ml; Group IV : 25 cases of TSH level <40 IU/ml. serum lipid profile parameters were analyzed in all the cases. Data was subjected to ANOVA, through SPSS version 17. **Results :** Group I : Mean and SD of serum total cholesterol, triglycerides, HDL-C and LDL-C were 163.4 9.4, 122.2 11.9, 39.3 3.1 and 99.3 7.2 mg/dl respectively. Group II : Mean and SD of total cholesterol, triglycerides, HDL and LDL were 204.7 7.5, 165.4 9.1, 43.8 3.5 and 127.8 5.2 mg/dl respectively. Group III : Mean and SD of total cholesterol, triglycerides, HDL and LDL were 214.9 7.3, 166.5 8.1, 44.3 2.3 and 136.7 4.9 mg/dl respectively. Group IV : Mean and SD of total cholesterol, triglycerides, HDL and LDL were 295.8 21.4, 242.8 33.2, 46.7 1.7 and 199.9 16.9 mg/dl respectively. **Conclusions :** Our data statistically suggest that the effect of hypothyroidism on the serum concentrations of lipids is more marked in patients with higher serum TSH levels. Therefore the lipid abnormalities exhibited great individual variability, there might be a potential link between hypothyroidism and atherosclerosis.

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### 1.Introduction

Hypothyroidism is defined as a deficiency of thyroid activity, which results from reduced secretion of both T3 and T4 irrespective of the cause [1].

It is the most common pathologic hormone deficiency among the endocrine disorders. Hypothyroidism may be due to primary disease of the thyroid gland itself or lack of pituitary TSH [2]. Biochemically decrease in T4 and T3 concentrations lead to hypersecretion of pituitary TSH and an amplified increase in serum TSH levels. This is a key laboratory finding, particularly in the early detection of thyroid failure [3].

Clinically hypothyroidism may present with variety of symptoms and signs involving major systems of the body like endocrine, cardio vascular, central nervous system, musculo skeletal, hematological, reproductive, gastrointestinal and dermatological [4].

Thyroid hormones have significant effects on synthesis, mobilization and metabolism of lipids. Overt hypothyroidism is associated with significant increase in circulating concentrations of total LDL-Cholesterol leading to coronary artery disease. Hypercholesterolemia is favoured due to the hormone deficit and to the decreased activity of lipoprotein lipase [5,6].

The present study aims to assess the association of hypothyroidism with lipid abnormalities.

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## 2. Materials and methods

This study was conducted in the department of biochemistry in collaboration with department of general medicine at Prathima Institute of Medical Sciences, Karimnagar, Andhra Pradesh, India.

75 patients ( mostly females ) clinically diagnosed as hypothyroidism in the age group of 20 – 60 years along with 25 cases of age and sex matched euthyroids were studied over a period of 1 year. Patients with TSH level above 6  $\mu$ U/ml ( as the upper limit of normal range given by the kit manufacturer is 6  $\mu$ U/ml ) were considered to be having hypothyroidism. Patients suffering from overt hypothyroidism who were undergoing treatment with anti thyroid drugs/thyroxine, end stage renal disease, post myocardial infarction, congestive cardiac failure, type II diabetes mellitus, patients on anti lipidemic drugs, women on oral contraceptive pills were excluded from the study.

### 2.1. Blood collection and sample preparation

5 ml of venous blood was withdrawn from patients of hypothyroidism and normal healthy subjects after overnight fasting with dry disposable syringe and needle by vene puncture under all aseptic conditions. Then the serum was separated after 30 minutes of blood collection by centrifusing at 3000 rpm for 10 minutes. This serum sample was used for various biochemical assays.

### 2.2. Biochemical assays

#### 2.2.1. Lipid profile

- serum total cholesterol was estimated by CHOD-PAP end point method.(7)
- serum triglycerides was estimated by Trinder's method (8)
- HDL-Cholesterol was estimated by Phosphotungstic acid method (9)
- LDL-Cholesterol & VLDL were calculated by Friedewald's formula:

$$\text{VLDL} = \text{TG}/5 \text{ mg/dl}$$

$$\text{LDL-Cholesterol} = \text{total cholesterol} - (\text{HDL} + \text{TG}/5) \text{ mg/dl} \quad (10)$$

TSH, T3 and T4 estimations were done by Chemiluminescence immuno assay (CLIA) by ELECSYS 1010, ROCHE.

Patients with TSH level 6  $\mu$ U/ml and above were considered are to be having hypothyroidism and grouped as follows:

- n Group I – Normal healthy euthyroids as control.
- n Group II – TSH levels of 6 – 20  $\mu$ U/ml.
- n Group III – TSH levels of 21 – 40  $\mu$ U/ml.
- n Group IV – TSH level > 40  $\mu$ U/ml.

### 2.3. Statistical analysis

The numerical data was presented as Mean  $\pm$  SD. Two groups. ANOVA was applied to analyze the significance in more than 2 group means. 'p' value of > 0.05 was considered as statistically significant. The analysis was performed through statistical package SPSS version 17

## 3. Results

The study included 75 cases of hypothyroidism and 25 cases of normal healthy euthyroids as controls.

In Group I (controls): The means and SD of T3 & T4 was found to be  $1.3 \pm 0.3$  ng/ml and  $7.9 \pm 1.3$   $\mu$ g/dl respectively (Table – 1). The Means and SD of serum total cholesterol, triglycerides, HDL-Cholesterol and LDL-Cholesterol were found to be  $163.4 \pm 9.4$ ,  $122.2 \pm 11.9$ ,  $39.3 \pm 3.1$  and  $99.4 \pm 7.2$  mg/dl respectively (Table – 2).

Table - 1

Parameters	Normal range	Group - I n=25	Group - II n=25	Group - III n=25	Group - IV n=25
T3 (ng/ml)	0.5 - 1.9	$1.3 \pm 0.2$	$0.4 \pm 0.2$	$0.3 \pm 0.1$	$0.3 \pm 0.1$
T4 ( $\mu$ g/dl)	4.5 - 10.5	$7.8 \pm 1.3$	$3.0 \pm 0.8$	$3.3 \pm 0.8$	$3.0 \pm 0.8$

- In Group II: The Means and SD of T3 & T4 was found to be  $0.4 \pm 0.2$  ng/ml and  $3.0 \pm 0.9$   $\mu$ g/dl respectively (Table – 1). The means and SD of serum total cholesterol, triglycerides, HDL-Cholesterol and LDL-Cholesterol were found to be  $204.8 \pm 7.5$ ,  $165.4 \pm 9.0$ ,  $43.8 \pm 3.4$  and  $127.8 \pm 5.2$  mg/dl respectively (Table – 2).

- In Group III: The Means and SD of T3 & T4 was found to be  $0.3 \pm 0.1$  ng/ml and  $3.3 \pm 0.8$   $\mu$ g/dl respectively (Table – 1). The Means and SD of serum total cholesterol, triglycerides, HDL-Cholesterol and LDL-Cholesterol were found to be  $214.8 \pm 7.3$ ,  $166.5 \pm 8.1$ ,  $44.3 \pm 2.2$  and  $136.7 \pm 4.8$  mg/dl respectively (Table – 2).

- In Group IV: The Means and SD of T3 & T4 was found to be  $0.3 \pm 0.1$  ng/ml and  $3.0 \pm 0.8$   $\mu$ g/dl respectively (Table – 1). The Means and SD of serum total cholesterol, triglycerides, HDL-Cholesterol and LDL-Cholesterol were found to be  $295.8 \pm 21.4$ ,  $242.8 \pm 33.2$ ,  $46.7 \pm 1.7$  and  $199.6 \pm 16.9$  mg/dl respectively (Table – 2).

## 4. Discussion

The results in this study suggest that the effect of hypothyroidism on lipid metabolism is more marked in patients with higher serum TSH levels. Even mild elevation in TSH in primary hypothyroidism was associated with raised serum total cholesterol, LDL-Cholesterol, triglycerides and decrease in HDL-Cholesterol levels (Table – 3&4). Our figures are in consistent with the figures mentioned in local as well as in the international literature [11-14].

The higher prevalence of hypothyroidism among middle aged women, associated with increase in serum total cholesterol level [15]. Although there is no clear evidence that hypothyroidism causes coronary artery disease, but hypothyroidism increases the oxidation of plasma cholesterol mainly because of an altered pattern of binding and due to the increased levels of cholesterol, which presents substrate for oxidative stress. Hypothyroidism is often accompanied by diastolic hypertension, in association with dyslipidemia may promote atherosclerosis and may lead to coronary artery disease [16].

TABLE - 2

Parameters	Normal range	Group - I n=25	Group - II n=25	Group - III n=25	Group - IV n=25
T.Cholesterol (mg/dl)	150 - 200	163.4±9.4	204.7±7.5	214.8±7.31	295.8±21.5
Triglycerides (mg/dl)	35 - 165	122.1±11.8	165.4±9.0	66.5±8.1	242.8±33.2
LDL-Cholesterol (mg/dl)	upto 135	99.3±7.1	127.7±5.2	136.7±4.8	199.9±16.9
HDL-Cholesterol	35 - 55	39.3±3.1	43.8±3.43	44.3±2.2	46.7±1.7
VLDL (mg/dl)		24.5±2.2	3.1±1.9	33.3±1.6	48.9±6.4

TABLE - 3

variables	TSH GROUP	N	Minimum	Minimum	Mean±SD	p' value
T3(ng/ml)	I (controls)	25	0.95	1.78	1.3±0.3	<0.001
T4µg/dl)	II (6-20)	25	0.21	0.81	0.4±0.2	
	III (21-40)	25	0.19	0.48	0.3±0.1	
	IV (>40)	25	0.17	0.42	0.3±0.1	
	I (controls)	25	6.12	10.32	7.8±1.3	<0.001
	II (6-20)	25	1.9	5.2	3.0±0.8	
	III (21-40)	25	1.8	5.1	3.3±0.8	
	Iv (>40)	25	1.8	4.5	3.0±0.8	

p' value shows the statistical difference between TSH groups among the tested variables (T3 & T4)

TABLE - 4

Variables	TSH GROUP	N	Minimum	Minimum	Mean±SD	p' value
T. Chol(mg/dl)	I (controls)	25	148	179	39.3±3.1	<0.001
	II (6-20)	25	194	218	43.8±3.4	
	III (21-40)	25	202	229	44.3±2.3	
	Iv (>40)	25	248	333	46.7±1.7	
TGs(mg/dl)	I (controls)	25	101	142	24.5±2.2	<0.001
	II (6-20)	25	145	178	33.1±1.9	
	III (21-40)	25	148	178	33.3±1.6	
	Iv (>40)	25	182	302	48.9±6.4	
LDL-C(mg/dl)	I (controls)	25	112	142	99.4±7.1	<0.001
	II (6-20)	25	136	178	127.8±5.2	
	III (21-40)	25	149	178	136.7±4.8	
	Iv (>40)	25	233	302	199.9±16.9	
HDL-C(mg/dl)	I (controls)	25	32	46	39.3±3.1	<0.001
	II (6-20)	25	36	48	43.8±3.4	
	III (21-40)	25	41	48	44.3±2.3	
	Iv (>40)	25	42	49	46.7±1.7	
VLDL(mg/dl)	I (controls)	25	21	28	39.3±3.1	<0.001
	II (6-20)	25	29	36	43.8±3.4	
	III (21-40)	25	29	36	44.3±2.3	
	Iv (>40)	25	36	60	46.7±1.7	

p' value shows the statistical difference between TSH groups among the tested variables ( T. Chol, TG, LDL-C, HDL-C)

## 5. Conclusions

From this study, it can be concluded that hypothyroidism most common in middle aged women. Our data statistically suggest that the effect of hypothyroidism is associated with lipid disorders that are characterized by increased serum total cholesterol, triglycerides, LDL-Cholesterol and decreased HDL-Cholesterol. So, clinicians should remain highly suspicious in middle aged women with hypothyroidism for increase in lipid parameters which may enhance the risk for atherosclerosis leading to coronary artery disease.

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