

## ORIGINAL RESEARCH

# The relationship between lipid profile among individuals who have both hypothyroidism and type II diabetes mellitus (T2DM)

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## ABSTRACT

**Background:** Diabetes mellitus and hypothyroidism is a group of endocrine diseases that causes cardiovascular complications. The level lipid profile is an important diagnostic tool that is used to predict coronary artery diseases in hypothyroid with type II diabetes patients. This study focuses on reducing the lipid profile level during diabetes and hypothyroidism with cardiovascular complications. **Materials and methods:** 100 samples were taken and divided into four groups with control. 25 cases of hypothyroid, 25 cases of type II diabetes, 25 cases of hypothyroid with type II diabetes, and 25 samples were taken as control. **Result:** The lipid profile levels were increased when compared with controls. There was a high statistical significance p-value ( $<0.001$ ) seen among three groups when compared with the control group. **Conclusion:** The current study concludes that there is a significant increase in the level of lipid profile in hypothyroid and type 2 diabetes patients. Controlling the lipid profile levels through laboratory investigations is recommended in the current medical world to decrease the risk of cardiovascular disease.

**Keywords:** Hypothyroidism, Cardiovascular disease, Diabetes mellitus, Lipid profile.

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## INTRODUCTION

Type 2 Diabetes mellitus is the most common current metabolic disorder as it affects more than 385 million and it is expected to reach about 590 million by 2035 worldwide [1]. Type 2 diabetes mellitus is usually associated with dyslipidemia, which increases the risk of cardiovascular disorders. [2,3] These disorders may be manifested by an elevation of the serum total cholesterol, low-density lipoprotein (LDL) cholesterol, triglyceride concentrations, and a decrease in the high-density lipoprotein (HDL) cholesterol concentration [4]. The lipid abnormalities are prevalent in diabetes mellitus because insulin resistance or deficiency affects key enzymes and pathways in lipid metabolism [5].

Hypothyroidism is defined as a deficiency of thyroid activity. It results from reduced secretion of total thyroxine (T4) and triiodothyronine (T3) and

amplified increases in serum TSH levels. Thyroid hormones have significant effects on the synthesis, mobilization, and metabolism of lipids. They affect serum cholesterol mainly by altering lipoprotein metabolism [6]. There is a known pathogenic relationship between patients with hypothyroidism developing atherosclerotic cardiovascular disease.

Diabetes mellitus and thyroid disease appear to be closely linked [7]. Thyroid hormone (TH) enhances the absorption, production, and utilization of glucose. Diabetes mellitus appears to influence thyroid function at several sites, from the hypothalamic control of TSH, the release of T3, and the production of T4 in the target tissue. [8] Thyroid dysfunction and T2DM are the most common endocrinal disorders. There is an association between diabetes and thyroid dysfunction which have important clinical implications for lipid abnormalities. [9,10]

## MATERIALS AND METHODS

The study was conducted with approval from the institutional ethics committee. The study was conducted in the Department of Biochemistry of Saveetha Medical College. Patients who satisfied all inclusion and exclusion criteria were selected and the subjects were divided into four groups.

**Group 1:** consisted of 25 diagnosed cases of diabetes mellitus.

**Group 2:** consisted of 25 diagnosed cases of hypothyroidism.

**Group 3:** consisting of 25 diagnosed cases of diabetes having hypothyroidism was selected for the study.

**Group 4:** 25 age and sex-matched controls who have no history of diabetes and hypothyroidism were taken as controls

## INCLUSION CRITERIA

- Patients with a known diagnosis of type II diabetes mellitus
- Both gender patients

- Patients with a known diagnosis of hypothyroid

## EXCLUSION CRITERIA

- Patients with type I diabetes mellitus
- Patients on hormonal replacement therapy
- Tobacco usage
- Chronic illness
- Oral contraceptive usage

## OBSERVATION & RESULTS

The sample of 25 hypothyroidism cases, 25 type II diabetes cases, 25 hypothyroid with type II diabetes cases, and 25 controls was taken and analyzed for lipid profile consisting of triglycerides (TGL), total cholesterol (TCH), High-density lipoprotein (HDL), low-density lipoprotein (LDL) determined by friedewald equation.

Hypothyroid and type II diabetes are directly associated with triglycerides, total cholesterol, and LDL and inversely associated with HDL.

S.no	Parameters	Group 1		Group 2		Group 3	
		Control	patient	Control	patient	Control	patient
1	TG	104.3±28.5	236.96±40.78	104.36±28.5	252.56±44.79	104.36±28.5	252.64±59.49
2	Total cholesterol	164.9±18.1	241.73±37.3	164.94±18.14	266.24±14.8	164.94±18.14	248.24±66.43
3	LDL	94.5±16.5	154.7±39.1	94.5±16.5	179.8±116.1	94.5±16.5	162.6±71.3
4	HDL	49.5±5.8	34.17±2.8	49.5±5.8	33.2±3.3	49.5±5.8	34.9±6.1
5	VLDL	20.8±5.7	51.8±13.9	20.8±5.7	52.9±13.47	20.8±5.7	51.4±12.2

Mean and SD of Group 1, Group 2, and Group 3 patients compared with control

**Group – 1: Patients with hypothyroidism**

**Group – 2: patients with type II diabetes mellitus**

**Group – 3: patients of hypothyroidism with type II diabetes mellitus**

**Table – 1: ANOVA test values among cases and controls**

Parameters	Group - I	Group – II	Group – III	Group - IV	F- value	p- value
TGL	236.96±40.78	252.56±44.79	252.64±59.49	104.36±28.5	64.42	<0.001
TCH	241.73±37.3	266.24±114.8	248.24±66.43	164.94±18.14	10.38	<0.001
HDL	34.17±2.8	33.2±3.3	34.9±6.1	49.5±5.8	65.7	<0.001
LDL	154.7±39.1	179.8±116.1	162.6±71.3	94.5±16.5	6.8	<0.001
VLDL	51.8±13.9	52.9±13.47	51.4±12.2	20.8±5.7	43.2	<0.001

Table-1: Shows the comparison of lipid profile with all the case and control groups with ANOVA methods. And compare the lipid profile levels between group and within group of case and control groups. The results show a positive correlation in all groups with a (F) value and high statistical significance with a (p) value of (<0.001).

## DISCUSSION

### GROUP: 1 (HYPOTHYROIDISM)

All lipid parameters were increased when compared with the control group. Alteration of thyroid functions

results in changes in the composition and transport of lipoproteins. Hence, there is often an increase in serum TC concentration despite the reduced activity of the HMG CoA reductase enzyme due to elevated

LDL and IDL levels<sup>[11]</sup>. LDL level is increased due to decreased activity of receptor-mediated catabolism of LDL and IDL<sup>[12,13]</sup>. Hypertriglyceridemia also occurs due to increased VLDL and fasting chylomicronemia but is less common.<sup>[14]</sup> Hypothyroid patients usually have high levels of HDL mainly due to increased HDL-2 fraction<sup>[15]</sup>. Further, there is decreased activity of hepatic lipase helping decreased catabolism of HDL-2 fraction and increase its level<sup>[16]</sup>. Lipoprotein (a) which is a predictor of cardiovascular risk is also elevated in Hypothyroidism.<sup>[17]</sup> These abnormalities of lipid metabolism are associated with OH predisposing to atherosclerotic coronary artery diseases<sup>[18,19]</sup>.

## GROUP: 2 (TYPE2 DIABETES MELLITUS)

The level of total cholesterol, LDL, VLDL were significantly increased when compared with control group and other case groups. The serum HDL level was significantly decreased. The lipid changes associated with DM are attributed to increased free fatty acid flux secondary to insulin resistance. The increased flux of free fatty acid into the liver in the presence of adequate glycogen stores promotes TG production which in turn stimulates the secretion of VLDL-cholesterol<sup>[20]</sup>.

## GROUP: 3 (HYPOTHYROID WITH TYPE2DM)

In our study the level of TGL was increased when compared with other case and control groups and HDL level was increased when compared with among hypothyroid and diabetic group. We have to bear in mind the close interface of metabolic control of these two chronic diseases demands recommendations for screening in higher risk groups like age over 50 or 55, particularly with suggestive symptoms such as dyslipidemia. Elevated levels of lipid parameters especially triglycerides are associated with atherosclerosis and predispose to cardiovascular disease.

## RESULT

The discussion compares the lipid profiles of three groups: individuals with hypothyroidism, individuals with type 2 diabetes mellitus, and individuals with both hypothyroidism and type 2 diabetes mellitus. Group 1 (hypothyroidism) shows increased lipid parameters, including elevated total cholesterol (TC), low-density lipoprotein (LDL), intermediate-density lipoprotein (IDL), and high-density lipoprotein (HDL). Hypertriglyceridemia also occurs but is less common. Group 2 (type 2 diabetes mellitus) shows a significant increase in total cholesterol, LDL, and VLDL, with a significant decrease in HDL. These lipid changes are attributed to increased free fatty acid flux secondary to insulin resistance. Group 3 (hypothyroidism with type 2 diabetes mellitus) shows increased triglyceride levels compared to other case and control groups, and HDL levels were increased compared to the hypothyroid and diabetic group. The

discussion emphasizes that elevated levels of lipid parameters, especially triglycerides, are associated with atherosclerosis and predispose individualsto cardiovascular disease.

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