ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Effect of Hypothyroidism on the Lipid Profile Among Type 2 Diabetes Mellitus Patients in Tamil Nadu, South India: A Cross-Sectional Study.

Kayalvizhi V[1]*, Dhanapriya S[2], Manoji Selva Jaya Singh C[3], Anbumani C[4], and Hemapriya AS[5].

[1]Senior Assistant Professor, Dept of Biochemistry, Thanjavur Medical College, Thanjavur, Tamil Nadu, India.
[2]Assistant Professor, Dept of Biochemistry, Thanjavur Medical College, Thanjavur, Tamil Nadu, India.
[3]Assistant Professor, Dept of Biochemistry, Thanjavur Medical College, Thanjavur, Tamil Nadu, India.
[4]Assistant Professor, Dept of Biochemistry, Thanjavur Medical College, Thanjavur, Tamil Nadu, India.
[5]MPH, Independent Researcher, Chennai, Tamil Nadu, India.

ABSTRACT

Thyroid Dysfunction is an endocrine disorder caused by deficiency of thyroid hormones, while diabetes is a metabolic disorder characterized by hyperglycemia. Both conditions are associated with dyslipidemia and atherosclerosis, which can lead to various complications. The aim of this study was to assess the differences in lipid profile between patients suffering from both Thyroid disorder and diabetes Mellitus. This cross-sectional study was conducted at Thanjavur Medical College, Tamil Nadu, India, from January to June 2023. Using purposive sampling, 170 T2DM patients with thyroid dysfunction, aged 30–80 years, were recruited from outpatient departments. Selection was based on confirmed diagnoses through history and biochemical investigations. The study found significant associations between thyroid status and lipid profiles in T2DM patients. Hypothyroidism was linked to elevated cholesterol, triglycerides, and LDL, while hyperthyroidism showed minimal impact. HDL was notably reduced in hypothyroid cases. These findings highlight the influence of thyroid dysfunction on dyslipidemia in diabetes. The study highlights significant associations between thyroid dysfunction and lipid profile abnormalities in T2DM patients. Subclinical and clinical hypothyroidism were linked to elevated levels of cholesterol, triglycerides, and LDL, while HDL levels were notably reduced. Hyperthyroidism showed minimal impact on lipid profiles. These findings emphasize the importance of routine lipid profile evaluation in this population for the early detection and management of dyslipidemia, ultimately reducing cardiovascular risk and improving long-term clinical outcomes.

Keywords: Diabetes Mellitus, Thyroid Dysfunction, Lipid Profile.

https://doi.org/10.33887/rjpbcs/2025.16.1.9

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Thyroid disorders and diabetes mellitus are among the most frequently encountered endocrinopathies in clinical practice. Type 2 diabetes mellitus is a major global health concern, currently affecting over 463 million people worldwide, with projections indicating an increase to approximately 700 million by 2045 [1]. India ranks second globally, after China, with 69 million individuals living with diabetes, affecting nearly one in every ten adults. Despite being significantly underdiagnosed, type 2 diabetes (T2D) accounts for over 90% of the global diabetes burden [2]. Thyroid dysfunction (TD) encompasses a range of conditions affecting the thyroid gland, characterized by alterations in thyroid-stimulating hormone (TSH) levels. Clinically, it may manifest as hypothyroidism, hyperthyroidism, thyrotoxicosis, or thyroid enlargement (diffuse or nodular), or it may remain asymptomatic in its subclinical state [3]. Whether occurring separately or together, these conditions significantly influence an individual's lipid profile. The coexistence of thyroid disorders in individuals with diabetes exacerbates changes in the lipid profile, collectively leading to a heightened risk of cardiovascular complications [4].

Numerous studies suggest that TSH levels, even within the reference range, may have a positive correlation with total serum cholesterol and LDL cholesterol, while showing a negative correlation with high-density lipoprotein (HDL) cholesterol [4-6]. Gender-based differences may influence the type of thyroid disease and its effects on lipid metabolism. A study by A. Iqbal et al. found that females had significantly higher levels of total cholesterol and LDL cholesterol compared to males [7]. Hence, this study was conducted to assess the impact of thyroid dysfunction on the lipid profile of patients with type 2 diabetes mellitus (T2DM). Given the high prevalence of both conditions and their combined influence on lipid metabolism, understanding this relationship is essential for evaluating cardiovascular risk and improving clinical management strategies for T2DM patients.

Objectives

To examine the relationship between lipid profiles in patients with diabetes mellitus across various thyroid dysfunction statuses.

Methods

This Cross-sectional study was conducted at Thanjavur Medical College and Hospital, Tamilnadu, India from January to June 2023. The study population comprised of 170 Type 2 Diabetes Mellitus (T2DM) patients with Thyroid Dysfunction aged between 30 and 80 years using purposive sampling. Participants were recruited from the outpatient departments of Medicine, Surgery, and Endocrinology. Ethical approval was obtained from the Institutional Ethics Committee, and informed written consent was secured from all participants after explaining the study objectives. Patients were selected based on a confirmed diagnosis of T2DM and Thyroid dysfunction through history and biochemical investigations. Non-diabetic individuals within the same age range, Patients with Type 1 Diabetes Mellitus, specific types of diabetes, gestational diabetes mellitus, cancer, or serious illness were excluded. A thorough clinical history was taken, including details about the onset and duration of diabetes mellitus, any history of long-term illnesses, previous thyroid dysfunction, prior drug therapies, and whether the patient was using insulin or oral hypoglycemic drugs. Data were analyzed using SPSS version 20.0, with descriptive statistics presented as mean, standard deviation, frequencies, and percentages. Chi-square test was used for categorical variables. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of Study Participants

Characteristics	Frequency	Percentage
Age		
31-40 years	31	18.2
41-50 years	57	33.5
51-60 years	50	29.4
61-70 years	30	17.6
71-80 years	2	1.2
Gender		
Male	88	51.7

Female	82	48.2
BMI		
Underweight (<18.5)	1	0.6
Normal (18.5-22.9)	37	21.8
Overweight (23 - 24.9)	35	20.6
Obesity (≥ 25)	97	57.1
Thyroid Dysfunction		
Normal	113	66.5%
Hypothyroidism	15	8.8%
Hyperthyroidism	6	3.5%
Subclinical Hypothyroidism	36	21.2%

In Table 1, the demographic characteristics of the study participants are summarized. The majority of participants were aged 41–50 years (33.5%), with 51.7% being male and 48.2% female. Regarding BMI, 57.1% were classified as obese (BMI ≥ 25). Thyroid dysfunction analysis revealed that 66.5% had normal thyroid function, while subclinical hypothyroidism was observed in 21.2% of participants, followed by hypothyroidism (8.8%) and hyperthyroidism (3.5%).

Table 2: Distribution of Total Cholesterol according to the Thyroid status among Diabetic patients.

Thyroid Status	Total Cholesterol			P Value
	Normal (<200)	Elevated (>200)	Total	
Normal	84(71.8%)	29(54.7%)	113	**0.033**
Subclinical and clinical Hypothyroidism	28(23.9%)	23(43.4%)	51	
Hyperthyroidism	5(4.27%)	1(1.9%)	6	
Total	117	53	170	

In Table 2, among participants with normal thyroid function, 71.8% had normal cholesterol levels (<200 mg/dl), while 54.7% had elevated cholesterol levels (>200 mg/dl). Subclinical and clinical hypothyroidism showed a higher proportion of elevated cholesterol levels (43.4%) compared to normal levels (23.9%). Hyperthyroidism had a small representation, with 4.27% having normal cholesterol and 1.9% elevated cholesterol. The association between thyroid status and total cholesterol levels was statistically significant (P = 0.033).

Table 3: Distribution of Triglycerides according to the Thyroid status among Diabetic patients.

Thyroid Status	Triglycerides			P Value
	Normal (<150)	Elevated (>150)	Total	
Normal	78((75.8%)	35(52.2%)	113(66.5%)	**0.003**
Subclinical and clinical Hypothyroidism	21(20.4%)	30(44.8%)	51(30%)	
Hyperthyroidism	4(3.9%)	2(3%)	6(3.5%)	
Total	103	67	170	

In Table 3, the distribution of triglyceride levels according to thyroid status among diabetic patients is presented. Among those with normal thyroid function, 75.8% had normal triglyceride levels (<150 mg/dl), while 52.2% had elevated levels (>150 mg/dl). Subclinical and clinical hypothyroidism showed a higher proportion of elevated triglyceride levels (44.8%) compared to normal levels (20.4%). Hyperthyroidism had minimal representation, with 3.9% showing normal triglycerides and 3% elevated levels. The association between thyroid status and triglyceride levels was statistically significant (P = 0.003).

Table 4: Distribution of LDL according to the Thyroid status among Diabetic patients.

Thyroid Status	LDL			P Value
	Normal (<130)	Elevated (>130)	Total	
Normal	97(72.4%)	16(44.4%)	113(66.5%)	0.001
Subclinical and clinical Hypothyroidism	31(23.1%)	20(55.5%)	51(30%)	
Hyperthyroidism	6(4.5%)	0	6(3.5%)	
Total	134	36	170	

In Table 4, the distribution of LDL levels according to thyroid status among diabetic patients is shown. Among participants with normal thyroid function, 72.4% had normal LDL levels (<130 mg/dl), while 44.4% had elevated levels (>130 mg/dl). Subclinical and clinical hypothyroidism demonstrated a higher proportion of elevated LDL levels (55.5%) compared to normal levels (23.1%). Hyperthyroidism had no cases with elevated LDL, with all participants (4.5%) having normal levels. The association between thyroid status and LDL levels was statistically significant (P = 0.001).

Table 5: Distribution of HDL according to the Thyroid status among Diabetic patients.

Thyroid Status	HDL			P Value
	Normal (>40 in males,>50 in females)	Reduced (<40 in males, <50 in females)	Total	
Normal	65(79.3%)	48(54.5%)	113(66.5%)	0.002
Subclinical and clinical Hypothyroidism	16(19.5%)	35(39.7%)	51(30%)	
Hyperthyroidism	1(1.2%)	5(5.7%)	6(3.5%)	
Total	82	88	170	

In Table 5, among participants with normal thyroid function, 79.3% had normal HDL levels, while 54.5% had reduced levels. Subclinical and clinical hypothyroidism showed a higher proportion of reduced HDL levels (39.7%) compared to normal levels (19.5%). Hyperthyroidism had a small representation, with 1.2% having normal HDL and 5.7% showing reduced levels. The association between thyroid status and HDL levels was statistically significant (P = 0.002).

DISCUSSION

In the present study 33% of the participants were in the age group of 41-50 years followed by 51-60 years with a mean age of 50.65±9.92 years. About 52% were female by gender. This result was similar with a study conducted by Thorat et al [8]. Out of 170 study participants, Hypothyroidism was found in 8.8%, Hyperthyroidism in 3.5% and Subclinical Hypothyroidism in 21.2%, which is in contrast to the study by Thorat et al [8] and Udiong et al [9],. But in the study conducted by Pranav Kumar Raghuwanshi et al., the prevalence of hypothyroidism and subclinical hypothyroidism was reported as 4 (10.00%) and 6 (15.00%), respectively, while subclinical hyperthyroidism and hyperthyroidism were found to be 0 (0.0%) and 1 (2.5%), respectively in the Indian population [10]. These values were notably lower compared to the findings of our current study. Of the total Diabetic patients, 21% were overweight and 57% were obese which aligns with the study results of [11-13].

In this study, there is derangement in the total cholesterol more in patients with hypothyroidism (43%) than in hyperthyroidism (2%) and this association was statistically significant, while the same thing when seen with triglycerides level which was also found to be more among patients with hypothyroidism (45%) than hyperthyroidism (3%) patients and was to found to be significantly associated. Similar findings of a positive correlation between thyroid disorders and total cholesterol were observed by Asvold BO et al [14]. A study by SA Chubb et al [15], Damanpreet Singh et al [11], and Afkhami et al [16], also revealed strong positive associations between TSH levels and lipid parameters, indicating an increased cardiac risk, particularly in patients with low insulin sensitivity.

In the present study, the HDL and LDL values are found to be associated with the type of Thyroid dysfunction, but in a study by Ruhla S et al [5] found higher fasting triglyceride levels in individuals with abnormal TSH values. However, no significant association was observed between the type of thyroid

disorder and HDL, LDL, or VLDL cholesterol levels ($p > 0.05$). Interestingly, patients with hyperthyroidism were found to have better HDL cholesterol levels (73.33%) compared to those with hypothyroidism (56.10%).

CONCLUSION

The results of this study emphasize the necessity of comprehensive lipid profile monitoring in individuals with type 2 diabetes and thyroid dysfunction. The observed associations between thyroid abnormalities, particularly subclinical and clinical hypothyroidism, and adverse lipid parameters suggest a potential interaction that may exacerbate cardiovascular risk. Routine evaluation of lipid profiles in this population is imperative for the timely identification and management of dyslipidaemia, thereby contributing to improved clinical outcomes and the mitigation of long-term metabolic complications.

Limitations

The limitations of this study include the cross-sectional design, which limits the ability to establish causal relationships between thyroid dysfunction and lipid abnormalities in diabetic patients. Additionally, the study was conducted at a single center, which may restrict the generalizability of the findings to other populations. The sample size, though adequate for the analysis, may not fully represent the diversity of the broader diabetic population. Furthermore, other potential confounding factors such as medication use, lifestyle factors, and comorbidities were not controlled for, which could influence lipid levels and thyroid function. Lastly, the study did not assess the longitudinal impact of thyroid dysfunction on lipid profiles over time.

REFERENCES

[1] Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract 2019; 157:107843.

[2] Asuti S, Purad S, Hosamani P. Pattern of Thyroid Dysfunction in Type II Diabetes Mellitus Patients in a Tertiary Care Center: A Cross-Sectional Study. J Med Sci Health 2023;9(2):204–10.

[3] Papazafiropoulou A, Sotiropoulos A, Kokolaki A, Kardara M, Stamataki P, Pappas S. Prevalence of Thyroid Dysfunction Among Greek Type 2 Diabetic Patients Attending an Outpatient Clinic. J Clin Med Res 2010;2(2):75.

[4] Minniti G, Traish D, Ashley S, Gonsalves A, Brada M. Risk of Second Brain Tumor after Conservative Surgery and Radiotherapy for Pituitary Adenoma: Update after an Additional 10 Years. J Clin Endocrinol Metab 2005;90(2):800–4.

[5] Ruhla S, Weickert MO, Arafat AM, Osterhoff M, Isken F, Spranger J, et al. A high normal TSH is associated with the metabolic syndrome. Clin Endocrinol (Oxf). 2010;72(5):696–701.

[6] Ittermann T, Baumeister SE, Völzke H, Wasner C, Schminke U, Wallaschofski H, Nauck M, Lüdemann J. Are serum TSH levels associated with oxidized low-density lipoprotein? Results from the Study of Health in Pomerania. Clin Endocrinol (Oxf) 2012;76(4):526-32.

[7] Iqbal A, Jorde R, Figenschau Y. Serum lipid levels in relation to serum thyroid-stimulating hormone and the effect of thyroxine treatment on serum lipid levels in subjects with subclinical hypothyroidism: the Tromsø Study. J Intern Med 2006;260(1):53-61.

[8] Sanjay Thorat, Tejas Rane, Akshay Kulkarni, and Aniket Avhad. Relationship between lipid profile and thyroid profile in type 2 diabetes patients. MedPulse Int J Med 2019;9(1):62–6.

[9] Udiong CEJ, Udoh AE, Etukudoh ME. Evaluation of thyroid function in diabetes mellitus in Calabar, Nigeria. Indian J Clin Biochem 2007;22(2):74–8.

[10] Raghuwanshi PK, Rajput DPS, Ratre BK, Jain R, Patel N, Jain S. Evaluation of thyroid dysfunction among type 2 diabetic patients. Asian J Med Sci 2014;6(3):33-7.

[11] Singh D, Mohan G, Bansal A. Effect of hypothyroidism on lipid profile of type 2 diabetic patients. Int J Adv Med 2020;7(5):754–9.

[12] Strollo F, Carucci I, Morè M, Marico G, Strollo G, Masini MA, Gentile S. Free Triiodothyronine and Cholesterol Levels in Euthyroid Elderly T2DM Patients. Int J Endocrinol 2012; 2012:420370.

[13] Triolo M, Kwakernaak AJ, Perton FG, de Vries R, Dallinga-Thie GM, Dullaart RP. Low normal thyroid function enhances plasma cholesteryl ester transfer in Type 2 diabetes mellitus. Atherosclerosis 2013;228(2):466-71.

[14] Asvold BO, Vatten LJ, Nilsen TIL, Bjøro T. The association between TSH within the reference range and serum lipid concentrations in a population-based study. The HUNT Study. Eur J Endocrinol 2007 Feb;156(2):181–6.
[15] Chubb SA, Davis WA, Davis TM. Interactions among thyroid function, insulin sensitivity, and serum lipid concentrations: the Fremantle diabetes study. J Clin Endocrinol Metab 2005;90(9):5317-20.
[16] Afkhami-Ardekani M, Rashidi M, Shojaoddiny A. Effect of Thyroid Dysfunction on Metabolic Response in Type 2 Diabetic Patients. Iran J Diabetes Obes 2010;2(1):20–6.