



Original Research Article

Association between thyroid hormones & lipid profile in type 2 diabetes mellitus patients- A case control study in tertiary care hospital

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ARTICLE INFO

Article history:

Received 23-01-2021

Accepted 01-02-2021

Available online 30-04-2021

Keywords:

Dyslipidemia

T2DM

Thyroid hormones

ABSTRACT

Background: Diabetes mellitus & thyroid dysfunction are the most common endocrinological disorders in the current era. Diabetes mellitus is a group of metabolic disorders usually associated with dyslipidemia which increases risk of cardiovascular disorders and resultant morbidity & mortality. Thyroid dysfunction particularly hypothyroidism is frequently encountered in diabetic patients. T2DM results in reduction in thyroid releasing hormone (TRH) synthesis & limits T3 & T4 production, which results in increased total cholesterol & LDL in circulation. By studying the association of thyroid hormones & lipid profile in diabetes patients, we can enhance the knowledge about the interrelation between diabetes, thyroid hormones & dyslipidemia.

Aim: To study the association between thyroid hormones & lipid profile in Type 2 Diabetes Mellitus patients.

Methodology: This is a case control study comprising of 50 cases (T2DM) & 50 age & sex matched healthy controls. Fasting blood sample was taken and analysed for blood sugar, lipid profile, Triiodothyronine(T3), Thyroxine(T4) & TSH.

Results: In this study, higher serum level of total cholesterol, LDL-cholesterol & triglycerides seen in T2DM patients. Also significantly lower T3&T4 and higher TSH are observed in T2DM. Moreover, there was a significant positive correlation between TSH and TC, LDL-C and TGL & significant negative correlation between T3&T4 and TC, LDL-C & TGL.

Conclusion: Thyroid dysfunction is associated with lipid dysregulation in T2DM patients. Early & routine screening of thyroid disorders in T2DM patients can reduce morbidity due to dyslipidemia.

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1. Introduction

Diabetes mellitus and thyroid dysfunction are the most common endocrinological disorders in the current era. Type 2 Diabetes mellitus is one of the most important global health issue as it affects more than 463 million people and it is expected to reach around 700 million by 2045.¹ Type 2 Diabetes mellitus consists of an array of dysfunctions characterized by hyperglycemia, resulting from the combination of resistance to insulin action and/or inadequate insulin secretion. It is usually associated with dyslipidemia, which increases risk of

cardiovascular events leading to morbidity & mortality. Thyroid dysfunction has been frequently encountered in diabetes patients with hypothyroidism being the most common type of dysfunction.² Hypothyroidism, an important cause of secondary dyslipidemia, is often accompanied with increased levels of total cholesterol & low density lipoprotein-cholesterol (LDL-C).³ By studying the association of thyroid hormones & lipid profile in diabetes patients, we can enhance the knowledge about the interrelation between diabetes, thyroid hormones and lipid profile.

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2. Materials and Methods

This is a case control study conducted in a tertiary care hospital comprising of 50 Type 2 DM cases attending outpatient department and 50 age & sex matched healthy controls.

Patients with history of thyroid disorders, chronic liver disease, chronic kidney disease, cardiovascular disease, pregnant & lactating women and patients on drugs affecting thyroid hormones were excluded from the study.

2.1. Sample collection

After overnight fast, 5 ml of venous blood was collected in a plain tube and a tube containing EDTA. Serum and plasma are separated by centrifugation at 3000 rpm for 10 minutes. Fasting blood glucose and Postprandial blood glucose estimated by Glucose oxidase- peroxidase method in ERBA XL 640 auto analyser. Total cholesterol was estimated by cholesterol oxidase phenol 4-aminoantipyrine peroxidase (CHOD PAP) method, Triglycerides by Glycerol phosphate oxidase phenol 4-aminoantipyrine peroxidase (GPO PAP) method, and HDL-C by PEG/CHOD-PAP method in ERBA XL 640 auto analyser.

2.2. Low-Density Lipoprotein cholesterol (LDL-C) was calculated using Friedewald's equation

LDL- Cholesterol = total cholesterol - (HDL cholesterol + triglycerides/ 5) T3, T4, TSH (normal range : T3: 0.69 – 2.15 ng/ml, T4: 5.2 -12.7 $\mu\text{g/dl}$, TSH :0.3-4.5 $\mu\text{IU/ml}$) estimated by chemiluminescence immunoassay method in Maglumi 800.

2.3. Statistical analysis

Statistical analysis was done by IBM SPSS Statistics for Windows, Version 20.0. Mean and SD were used to summarize the continuous variables. Independent samples t test was used to test the significance in difference between the parameters for cases and controls. Pearson's correlation coefficient was used to check the linear relation between parameters of lipid profile and thyroid profile. A P value of <0.05 was considered as statistically significant.

3. Result

Age and sex distribution is shown in Table 1 and Table 2. Cases include 28 males & 22 females whereas controls include 25 males & 25 females with mean age of 51.85 ± 12.42 & 51.37 ± 12.81 respectively.

The mean fasting blood glucose and post prandial blood glucose level among cases and controls which was found to be statistically significant.

Figure 1 shows the mean fasting blood glucose and post prandial blood glucose level among cases and controls which was found to be statistically significant.

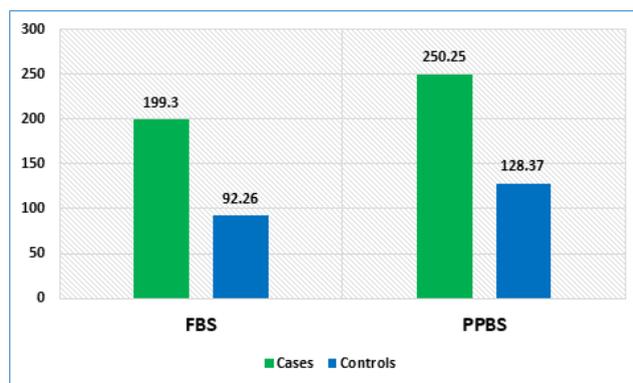


Fig. 1: Comparison of FBS and PPBS in cases and controls

Table 3 shows that levels of TC, TG, LDL-C were significantly higher in T2DM patients, while HDL-C were significantly lower in T2DM patients as compared to controls. Serum levels of T3 and T4 were significantly lower in cases compared to controls whereas the level of serum TSH was significantly higher in cases as compared to the controls.

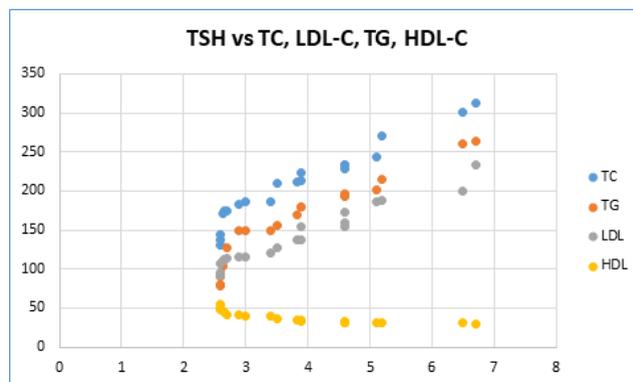


Fig. 2: Correlation between TSH and lipid profile

Figure 2 shows that TSH is significantly and positively correlated with LDL-C, TG and TC and negatively correlated with that of HDL-C.

T3 & T4 levels are significantly and negatively correlated with LDL-C, TG and TC and positively correlated with that of HDL-C as shown in Figures 3 and 4.

4. Discussion

In this present study, higher serum level of Total cholesterol, triglycerides & LDL-C seen in T2DM patients. Dyslipidemia in diabetes is due to low activity of lipoprotein lipase or limited lipoprotein clearance.⁴

Result of the present study showed that the levels of serum T3, T4 were significantly lower in diabetes while serum TSH was significantly higher in diabetes when compared to that of controls. These findings were consistent

Table 1: Age distribution of cases and controls

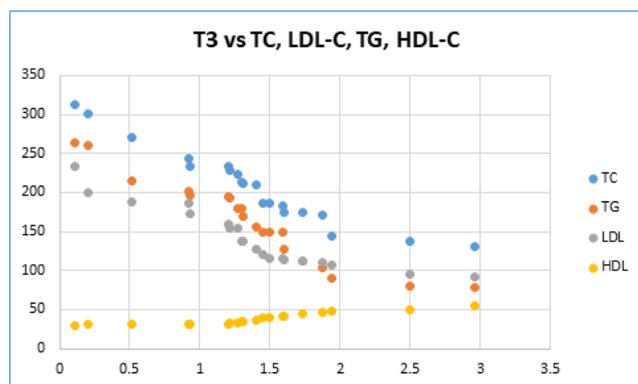
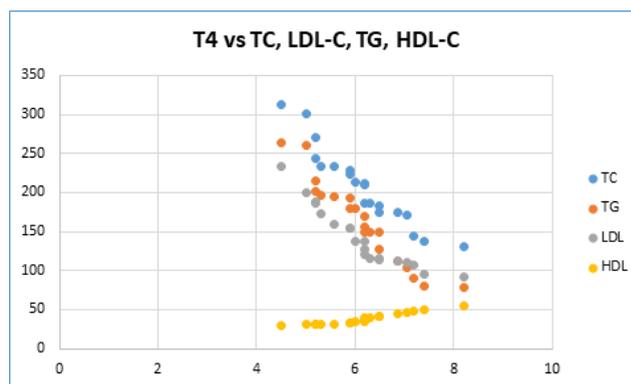
Variable	Group	Mean	SD	P value
Age (Yrs)	Cases	51.85	12.42	0.92
	Controls	51.37	12.81	

Table 2: Gender distribution of cases and controls

Gender	N (Cases)	%	N (Controls)	%
Male	28	56.0	25	50.0
Female	22	44.0	25	50.0

Table 3: Biochemical parameters of cases and controls

Variable	Group	Mean	SD	P value
FBS (mg/dL)	Cases	199.30	29.61	0.0008
	Controls	92.26	13.99	
PPBS (mg/dL)	Cases	250.25	28.29	0.0005
	Controls	128.37	20.61	
TC (mg/dL)	Cases	208.50	29.67	0.007
	Controls	174.21	17.41	
TG (mg/dL)	Cases	162.50	23.55	0.0001
	Controls	99.79	17.56	
LDL-C (mg/dL)	Cases	141.80	18.39	0.0004
	Controls	87.47	11.65	
HDL-C (mg/dL)	Cases	27.9	4.3	0.0005
	Controls	50.5	8.7	
T3 (ng/mL)	Cases	0.59	0.08	0.029
	Controls	1.79	0.12	
T4 (μ g/dL)	Cases	4.5	1.90	0.005
	Controls	8.84	1.17	
TSH (μ IU/mL)	Cases	4.98	1.32	0.0002
	Controls	1.97	0.98	

**Fig. 3:** Correlation between T3 and lipid profile**Fig. 4:** Correlation between T4 and lipid profile

with that found by Sarala Devi Tenepalli et al.,³ Jiffri EH et al.,⁴ Demitrost et al.,⁵ In diabetic patients, the nocturnal TSH peak is blunted and the TSH response to TRH is impaired,⁶ resulting in reduced iodide uptake by the thyroid gland that limits T3 and T4 production.⁷

Also this study shows TSH is significantly and positively correlated with LDL-C, TG and TC and negatively correlated with that of HDL-C. T3 & T4 levels are

significantly and negatively correlated with LDL-C, TG and TC and positively correlated with that of HDL-C. Our findings are in harmony with that of Palacios et al.,⁸ Asvold et al.,⁹ Saeed W et al.,¹⁰ Decreased levels of thyroid hormones attenuate activity of lipoprotein lipase (LPL), the enzyme responsible for clearance of TG-rich lipoproteins and thus lead to increased levels of TG in the serum.¹¹ Thyroid hormones such as T3 have been demonstrated

to regulate LDL receptors by directly binding to thyroid hormone responsive elements (TREs) and controlling sterol regulatory element-binding protein. In hypothyroidism, decreased thyroid hormones lead to reduced expression of LDL receptors, which may attenuate cellular uptake of LDL-C from circulation and catabolism of LDL-C and finally result in increased levels of circulating TC.^{12,13}

5. Conclusion

Thyroid dysfunction is associated with lipid dysregulation in T2DM patients. By maintaining good glycemic control in T2DM, we can prevent the development of thyroid dysfunction and its complications. Also, screening for thyroid disorders and early intervention in T2DM patients can reduce morbidity due to dyslipidemia. Hence thyroid function tests may be included as part of routine investigations in patients with Type 2 DM.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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. doi:10.1016/j.diabres.2019.107843.
2. Anveetha P. Study of thyroid profile in patients with Type 2 Diabetes Mellitus. *Int J Pharma Bio Sci.* 2015;5(1):24–30.
3. Tenepalli SD, Kulkarni PR, Pyadala N. A comparative evaluation of lipid profile and hormones in patients with type 2 diabetes mellitus: A hospital-based case control study. *Int J Biochem.* 2017;4(1):11–5.
4. Jiffri EH. Relationship between Lipid Profile Blood and Thyroid Hormones in Patient with Type 2 Diabetes

- Mellitus. *Adv Obes Weight Manag Control.* 2017;6(6):178–82. doi:10.15406/aowmc.2017.06.00176.
5. Demitrost L, Ranabir S. Thyroid dysfunction in type 2 diabetes mellitus: A retrospective study. *Indian J Endocr Metab.* 2012;16:334–5.
6. Hage M, Zantout MS, Azar ST. Thyroid Disorders and Diabetes Mellitus. *J Thyroid Res.* 2011;2011:1–7. doi:10.4061/2011/439463.
7. Zhang Y, Lu P, Zhang L. Association between lipids profile and thyroid parameters in euthyroid diabetic subjects: a cross-sectional study. *BMC Endocr Disord.* 2015;15(1):1–5.
8. Santos-Palacios S, Brugos-Larumbe A, Guillén-Grima F, Galofré JC. A Cross sectional study of the association between circulating TSH level and lipid profile in a large Spanish population. *Clin Endocrinol (Oxf).* 2013;79(6):874–81.
9. Asvold V. The association between TSH within the reference range and serum lipid concentrations in a population-based study. The HUNT study. *Eur J Endocrinol.* 2007;156(2):181–6.
10. Saeed WM, ElRahman SFA, Abdrabo EA. Evaluation of Thyroid Function Test in Sudanese Patients with Type 2 Diabetes Mellitus. *J Med Biol Sci Res.* 2016;2(8):131–5.
11. Rizos CV, Elisaf MS, Liberopoulos EN. Effect of thyroid dysfunction on Lipid profile. *Open Cardiovasc Med J.* 2011;5:76–84.
12. Chen Y, Wu X, Wu R, Sun X, Yang B, Wang Y, et al. Changes in profile of lipids and adipokines in patients with newly diagnosed hypothyroidism and hyperthyroidism. *Sci Rep.* 2016;doi:10.1038/srep26174.
13. Shin DJ, Osborne TF. Thyroid Hormone Regulation and Cholesterol Metabolism Are Connected through Sterol Regulatory Element-binding Protein-2 (SREBP-2). *J Biol Chem.* 2003;278(36):34114–8. doi:10.1074/jbc.m305417200.

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Cite this article: Pangajam P, Juliette A V. Association between thyroid hormones & lipid profile in type 2 diabetes mellitus patients- A case control study in tertiary care hospital. *Int J Clin Biochem Res* 2021;8(1):25-28.