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Correlation of thyroid function with lipid parameters in patients with diabetes and hypertensive diabetes: A prospective study

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Abstract
Background: Lipid and thyroid function abnormality is commonly observed in patients with type 2 diabetes mellitus (T2DM). Both hypothyroidism and hyperthyroidism are the reasons to develop secondary dyslipidemia.
Aims and objective: To study the thyroid function and its correlation with the lipid parameters in patients with diabetes and hypertensive diabetics.
Materials and Methods: A total 140 T2DM patients were studied in the Department of Endocrinology, Gandhi Medical College, Bhopal between January 2016 to December 2017. Patients were divided into Group A (n=42, patients having diabetes only) and Group B (n=98, patients having diabetes with hypertension). Detailed demographic parameters, glycemic parameters including fasting plasma glucose (FPG), post prandial glucose (PPG), glycated hemoglobin (HbA1c) and average blood glucose were estimated. Thyroid function test viz. T3, T4 and TSH along with lipid parameters were estimated for all the patients.
Results: Out of 140 patients, 29.78% were diabetics whereas 70.22% were hypertensive diabetics. Male preponderance was recorded in both Group A (80.95%) and Group B (76.76%). HbA1c (p=0.001) and average blood glucose (p=0.023) was higher in Group A. Thyroid function test was comparable between both the groups but correlation of lipid parameters with the thyroid function test parameters has revealed that LDL-C was positively correlated with T3 (r=0.303, p=0.0004), T4 (r=0.181, p=0.036) and TSH (r=0.184, p=0.034). VLDL-C was also positively correlated with the T3 (r=0.201, p=0.021).
Conclusion: Positive correlation was obtained between LDL-C and T3, T4 and TSH and VLDL-C with T3 which highlight the importance of screening thyroid function among diabetes patients with or without hypertension.

Keywords: thyroid function, lipid parameters, correlation, LDL-C

1. Introduction
Hypertension with diabetes is a deadly duo; high blood pressure (hypertension) can result in the worsening of many diabetes related complications such as eye and kidney disease. [1, 2] Reports have also shown that most of people with diabetes develop hypertension at some or the other point of time in their life [3].
Thyroid hormones act by antagonizing insulin action. Both thyroid hormone and insulin are required for proper cellular metabolism. Raised or decreased level of any one can significantly alter the function of other [4].
Reports from different authors have shown an increased thyroid dysfunction among diabetes patients with increasing age. Among them women have high prevalence compared to men. Prevalence of thyroid disease as reported by Perros *et al* was 13.4% in patients with diabetes mellitus [5]. A recent study in Greek patients with diabetes showed prevalence of 12.3% whereas in Saudi diabetics patients it was 16% [6, 7].
Hence present study was performed with the aim of findings the relationship of thyroid function between patients with diabetes and hypertensive diabetes.

Materials and Methods
A prospective study was performed on 140 diabetic patients in the Department of Endocrinology, Gandhi Medical College, Bhopal between January 2016 to December 2017. All the patients were divided into Group D (n=42, patients having diabetes) and Group HD (n=98, hypertensive diabetics).
A written Informed consent from all patients and Institutional Ethics Committee approval was obtained before starting the study.
Demographic parameters such as age, height, weight and body mass index (BMI) were recorded for all the patients. Glycemic parameters such as fasting plasma glucose (FPG), post prandial glucose (PPG), HbA1c and average blood glucose was estimated after drawing blood from all the patients. Thyroid function test parameters viz. T3, T4 and TSH along with lipid parameters were estimated for all the patients.
All the statistical analysis was performed using IBM SPSS ver. 20. Mean and standard deviations were calculated for time varying variables and percentages were calculated for categorical variables. Persian correlation was used to find out the relation between thyroid function parameters with lipid parameters. *P* value <0.05 was considered as significant.

Results
Out of 140 patients, 42 (29.78%) were having diabetes alone whereas 98 (70.22%) were hypertensive diabetes. There were 34 (80.95%) males and 8 (19.05%) females in patients with diabetes whereas there were 75 (76.76%) males and 23

(23.23%) females who were hypertensive diabetics.

Table 1: Demographic parameters of diabetes and hypertensive diabetics patients

Variable	DM (n=42)	DM+HTN (n=98)	P value
Age (year)	40.24±13.02	52.77±11.15	NS
Height (inch)	6.36±21.46	4.75±21.34	NS
Weight (kg)	69.52±12.64	70.24±11.46	NS
BMI (kg/m^2)	21.63±4.30	24.56±5.72	NS
FBS(mg/dl)	133.68±32.94	142.54±41.29	NS
PPG (mg/dl)	244.16±91.67	242.85±76.10	NS
HbA1c (%)	8.21±2.24	8.21±1.83	0.001
ABG (mg/dl)	228.41±68.55	191.08±51.33	0.023
TC (mg/dl)	160.28±42.98	164.08±47.22	NS
HDL-C (mg/dl)	42.90±19.27	40.71±11.12	NS
TG (mg/dl)	131.58±77.33	150.61±125.87	NS
LDL-C (mg/dl)	189.77±141.14	161.51±114.76	NS
TC/HDL	6.43±11.28	9.69±52.51	NS
LDL/HDL	2.42±0.89	2.31±0.85	NS
VLDL-C (mg/dl)	48.60±32.05	46.12±30.32	NS
Non HDL-C (mg/dl)	139.86±74.03	123.56±44.07	NS

Data is expressed as mean± SD, DM+ HTN; diabetic hypertensive, DM; diabetes, BMI; body mass index, FBG; fasting blood glucose, PPG; post prandial glucose, HbA1c; glycated hemoglobin, ABG; average blood glucose calculated from HbA1c values, TC; total cholesterol, HDL-C; high density lipoprotein cholesterol, LDL-C; low density lipoprotein cholesterol, TG; triglyceride, VLDL-C; very low density lipoprotein cholesterol, P value < 0.05 is considered as significant.

Table 2: Comparison between thyroid function parameters between patients with diabetes and hypertensive diabetes

Thyroid function parameter	DM (n=42)	DM+HTN (n=98)	P value
T3	91.44±41.91	96.24±26.49	NS
T4	8.89±1.78	8.74±1.89	NS
TSH	3.70±3.91	3.97±5.89	NS

Data is expressed as mean± SD, DM+ HTN; diabetic hypertensive, DM; diabetes, T3, T4, TSH; thyroid stimulating hormone, *P* value < 0.05 is considered as significant.

Table 3: Correlation between thyroid function parameters with different lipid parameters

Lipid parameters		TSH	T3	T4
TC	r	0.04	0.108	0.062
	p	NS	NS	NS
	N	133	132	133
HDL-C	r	-0.063	-0.106	0.032
	p	NS	NS	NS
	N	134	133	134
LDL-C	r	0.184	0.303	0.181
	p	0.034	0.0004	0.036
	N	133	132	133
Non HDL-C	r	0.012	0.126	0.049
	p	NS	NS	NS
	N	123	122	123
TC/HDL	r	-0.017	0.072	-0.004
	p	NS	NS	NS
	N	133	132	133
TG	r	-0.056	-0.080	-0.159
	p	NS	NS	NS
	N	134	132	133
VLDL-C	r	0.085	0.201	0.047
	p	NS	0.021	NS
	N	133	132	133

P value < 0.05 is considered as significant, TC; total cholesterol, HDL-C; high density lipoprotein cholesterol, LDL-C; low density lipoprotein cholesterol, TG; triglyceride, VLDL-C; very low density lipoprotein cholesterol, r- correlation co-efficient

Discussion

Higher prevalence of thyroid dysfunction is reported in patients with both T1DM and T2DM. Reports of different study have shown that hyperglycaemia exert a negative effect on thyroid function mainly decreasing the TSH response from the pituitary gland [8]. The possible reason for this may be due to alteration in post translational glycosylation of TRH hence striking the biological activity. This results in the

predisposition of thyroid dysfunction in patients with diabetes mellitus [9].

Saha *et al* in their study of 120 subjects in Bangladesh, compared the thyroid function between patients with and without diabetes and they reported significantly higher level of lipid parameters as compared to non-diabetes patients which is contrary to present study data as we have compared the lipid parameters between diabetes and hypertensive diabetes which signifies that hypertension does not contribute in abnormal thyroid function [10].

Saha *et al* also correlated different lipid parameters with thyroid functions and reported that total cholesterol and HDL-C were negatively correlated withT4 whereas total cholesterol and triglyceride were positively correlated with TSH [10].

A study done by Singh *et al* including 80 T2DM Punjabi population, revealed higher level of thyroid function, lower level of HDL-C and raised level of LDL-C, triglyceride, total cholesterol and VLDL-C as compared to non-diabetic patients [11]. In present study also diabetes and hypertensive diabetic patients were having abnormal lipid profile ($p>0.05$).

Ghazali *et al* did a similar study at Nigeria on 64 T2DM patients and compared thyroid function parameters with non-diabetic patients. Ghazali *et al* has also reported higher prevalence of thyroid dysfunction in T2DM, but has not compared it with hypertensive diabetes [12].

Study performed by Bharat *et al* involving 60 patients with T2DM, reported that diabetes patients who had higher TSH level were having hypertension too as a complication; in present study also TSH was insignificantly higher in patients with hypertensive diabetics as compared to diabetic patients.[13]

The present study had few limitation of being small in sample size; a large clinical trial is needed to compare thyroid function between patients with diabetes and hypertensive diabetes.

Conclusion

Though thyroid function test parameters were comparable in both the groups in present study, but the positive correlation of LDL-C with T3, T4 and TSH and VLDL-C with T3 highlight the importance of screening thyroid function test in patients with diabetes. Hypertension was not a significant contributor for abnormal thyroid function in present study.

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