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Thyroid Dysfunction in Type II Diabetes Mellitus: A Comparative Study

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ABSTRACT

Background: With improving socioeconomic conditions and sedentary life style the incidence of diabetes mellitus is steadily increasing. Diabetes mellitus is known to have effects on almost every system of the body including eyes, kidneys and endocrine glands. Incidence of thyroid function abnormalities in patients with diabetes mellitus type II has been a topic of interest amongst many researchers. We conducted this comparative study to find out thyroid function abnormalities in patients with Type II diabetes mellitus. **Methods:** 60 patients with diabetes mellitus (Group A) were enrolled in this study on the basis of a predefined inclusion and exclusion criteria. 60 healthy individuals were included as control group (Group B). The study was conducted in the department of internal medicine of a tertiary care medical college. The informed consent was obtained from all the participants. The thyroid function abnormalities were compared in both the groups (diabetic and healthy individuals). For statistical purposes p value less than 0.05 was taken as "significant". SSPS 21.0 was used for statistical analysis. **Results:** Out of 60 cases of diabetes mellitus (cases) there were 38 males and 22 females whereas amongst 60 individuals in control group (healthy individuals) there were 35 males and 25 females. The mean age of group A and group B was found to be 48.05 +/- 4.89 and 46.98 +/- 6.27 respectively. The mean age of both the groups were found to be comparable (P=0.2994). patients with diabetes mellitus type 2 (Group A) were more likely to be having abnormal thyroid function test as compared to healthy individuals (Group B) and this difference was found to be statistically significant (P=0.0138). **Conclusion:** Thyroid dysfunction was found to be more common in patients with diabetes mellitus as compared to healthy individuals. Screening of diabetes mellitus type II patients for thyroid dysfunction may help in early diagnosis and early intervention.

Keywords: Diabetes Mellitus Type II, Thyroid Dysfunction, Hypothyroidism, Screening.

INTRODUCTION

Diabetes mellitus is characterized by hyperglycemia caused either by defective insulin secretion (Type I) or insulin resistance (type II diabetes). Irrespective of the etiology this defective insulin secretion or insulin resistance is associated with enormous consequences in terms of effects on carbohydrate, lipid and protein metabolism.[1] With improving socioeconomic status and change towards more sedentary life style the incidence of diabetes mellitus is increasing globally. Growing incidence of diabetes mellitus pose a great challenge to almost all countries of the world and according to some studies by 3rd decade of this century more than 600 million will be affected by diabetes mellitus.[2] Not only its incidence is increasing in developing world but also it is affecting more and more younger individuals. Some studies have shown that almost 50% of the patients of diabetes mellitus are below 60 years of age.[3]

Diabetes mellitus is known to have effects on almost every system of the body. Its association with end-organ damage to retina (Diabetic retinopathy), kidney (Diabetic nephropathy) and peripheral nervous system (diabetic neuropathy) is well established.[4] In addition to end organ damage it also increases the risk of cardiovascular diseases and endocrinological abnormalities. Even in patients who have a tight glycemic control end-organ damage can only be delayed.[5]

The relationship between diabetes and thyroid hormone regulation is complex. Thyroid hormones are known to affect blood sugar levels by regulation of carbohydrate metabolism and any imbalance in thyroid function is known to affect carbohydrate metabolism.[6] On the other hand, a steady blood sugar level is essential for maintenance of euthyroid state and diabetes mellitus is known to affect thyroid function to a variable extent. Many researchers have found that there is an increased incidence of deranged glucose tolerance in patients having hyperthyroidism and successful management of hyperthyroidism in these patients were found to have resulted in better glycemic control in these patients.[7] The relationship between thyroid dysfunction and diabetes is a complex one and exact cause of thyroid dysfunction in patients with diabetes mellitus is not known, many authors have proposed the role of autoantibodies and autoimmunity to be one of the important causes of thyroid dysfunction in patients with diabetes mellitus.[8] The role of autoimmunity in causing thyroid dysfunction is substantiated by various

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studies and various authors have reported presence of autoantibodies such as Glutamic acid decarboxylase antibodies (GADA), tyrosine phosphatase IA2 antibodies (IA2A), and insulin autoantibodies (IAA) in patients with diabetes mellitus. Moreover, it was found that presence of any of these antibodies in patients with diabetes mellitus was associated with increased risk of autoimmune thyroiditis resulting in to thyroid dysfunction. Other than GADA, IA2A and IAA antibodies to thyroglobulin (anti-TG) and thyroperoxidase (anti-TPO) are also reported to be associated with increased incidence of thyroid dysfunction. Thyroid abnormalities are more commonly seen in patients with diabetes mellitus and presence of thyroid abnormalities is known to worsen glycemic control in these patients.

With this background in mind we conducted this comparative study of thyroid function abnormalities in patients with Type II diabetes mellitus.

MATERIALS AND METHODS

This was a comparative study conducted in the department of internal medicine of a tertiary care medical college in situated in an urban area. In this study 60 patients with diabetes mellitus type II and 60 healthy age matched donor were included on the basis of a predefined inclusion and exclusion criteria.

Cases	Individuals having fasting blood sugar level more than 140 mg/dl and postprandial blood sugar level more than 200 mg/dl on minimum 2 separate occasions
Control	Healthy Individuals.

In all the patients demographic details such as age, sex, height, weight, residential address and BMI were recorded. A detailed history was taken with respect to presence of diabetes in other family members, duration of diabetes in patient and treatment record was also reviewed. Presence of co-morbidities such as presence of hypertension, chronic obstructive pulmonary disease was also enquired into. Treatment history was reviewed and whether patients were on oral hypoglycemic agents or insulin was recorded. Possibility of patients being on drugs causing disturbances in thyroid metabolism such as lithium, amiodarone, interferon, aminoglutethimide etc. was ruled out by carefully going through the medication history.

A detailed general and systemic examination was done in all the cases. Fasting and postprandial blood sugar level, glycosylated hemoglobin, complete blood count and lipid profile was done in all the cases. To assess the severity of end organ damage renal function tests (blood urea and serum creatinine) and fundoscopy was done in all the cases. Serum Free T3, T4 and TSH was done in all the cases. On the basis of thyroid function tests the patients were classified into subclinical hypothyroidism, overt hypothyroidism, hyperthyroidism and subclinical hyperthyroidism.

Thyroid Dysfunction	Thyroid Function Test0
Subclinical hypothyroidism and	TSH- 4.5 to 10 mIU/L and normal free T4
Overt hypothyroidism,	TSH more than 10 mIU/L with low free T4 levels
Overt Hyperthyroidism	TSH less than 0.45 mIU/L and raised free T4
Subclinical hyperthyroidism.	TSH less than 0.45 mIU/L and normal free T4

The thyroid function abnormalities were compared in both the groups (diabetic and healthy individuals). For statistical purposes p value less than 0.05 was taken as "significant". SSPS 21.0 was used for statistical analysis.

Inclusion criteria

1. Patients with diabetes (fasting blood sugar level more than 140 mg/dl and postprandial blood sugar level more than 200 mg/dl on minimum 2 separate occasions) and 60 healthy individuals were included in cases and control group respectively.
2. Informed written consent was obtained from all the participants.
3. Age group 30-60 years.

Exclusion criteria

1. Patients who refused consent.
2. Patients with uncontrolled hypertension, severe chronic obstructive airway disease.
3. Patients known to be on drugs known to affect thyroid functions such as lithium, amiodarone, interferon, aminoglutethimide etc.
4. Known cases of thyroid disorders.
5. Patients with autoimmune diseases.
6. Age less than 30 years or above 60 years.

RESULTS

Out of 60 cases of diabetes mellitus (cases) there were 38 males and 22 females whereas amongst 60 individuals in control group (healthy individuals) there were 35 males and 25 females. Overall there was a male preponderance with M:F ratio being 1:0.64. The analysis of gender distribution amongst the cases and control group showed that gender distribution was comparable in both the groups with no statistically significant difference.

Table 1: Gender Distribution of the studied cases

Age Group	Group A		Group B	
	No of Patients	Percentage	No of Patients	Percentage
Males	38	31.67%	35	29.17%
Females	22	18.33%	25	20.83%
Total	60	50.00%	60	50%
P=0.708 (Not Significant)				

The age groups of the patients were analysed. Age distribution of group A (cases of diabetes mellitus)

showed that the most common age group was found to be between 51-55 years (23.33%) followed by 46-50 years (18.33%) and 41-45 years (5.83%). There were only 3 (2.50%) patients below 40 years of age. In group B (control Group) the most common age group was found to be 46-50 years (21.67%) followed by 51-55 years (15.83%) and 30-40 years (7.50%). The mean age of group A and group B was found to be 48.05 +/- 4.89 and 46.98 +/- 6.27 respectively. The age groups were found to be comparable and there was no statistically significant difference in mean age of both the groups (P=0.2994).

Table 2: Age group of the studied cases.

Age Group	Group A		Group B	
	No of Patients	Percentage	No of Patients	Percentage
30-40 years	3	2.50%	9	7.50%
41-45 years	7	5.83%	6	5.00%
46-50 years	22	18.33%	26	21.67%
51-55 years	28	23.33%	19	15.83%
Total	60	50.00%	60	50.00%
	Mean Age: 48.05 +/- 4.89		Mean Age: 46.98 +/- 6.27	
P= 0.2994 95% CI- -3.1028 to 0.9628				

Mean blood sugar glucose levels of patients in control as well as cases groups were analyzed. The mean fasting and postprandial blood glucose level in control group (healthy individuals) was found to be 80.12 +/- 12.76 mg/dl and 104 +/- 16.02 mg/dl. In cases group (individuals with diabetes mellitus) the mean fasting and postprandial blood glucose levels were found to be 168.34 +/- 32.72 and 234.72 +/- 42.12 mg/dl respectively. The difference in fasting and postprandial mean blood sugar levels in studied groups was found to be statistically highly significant significant (P<0.0001).

The analysis of thyroid function tests showed that in group A (Diabetes mellitus patients) 41 (68.33%) patients were euthyroid whereas in group B (healthy individuals) 53 (88.33%) patients were euthyroid. In Group A (diabetes mellitus group) either subclinical or overt hypothyroidism was seen in 16 (26.67%) patients and hyperthyroidism was seen in 3 (5%) patients. In Group B (healthy individuals) either subclinical or overt hypothyroidism was seen in 6 (10.00%) patients and hyperthyroidism was seen in 1 (1.67%) patients. There was no patient with subclinical hyperthyroidism in either of the groups.

Table 3: Mean fasting and postprandial blood Glucose levels in both the groups.

	Group A (Diabetes Mellitus)	Group B (Healthy individuals)	Significance
Fasting	168.34 +/- 32.72	80.12 +/- 12.76	P= < 0.0001
Post Prandial	234 +/- 42.12	104 +/- 16.02	P= < 0.0001

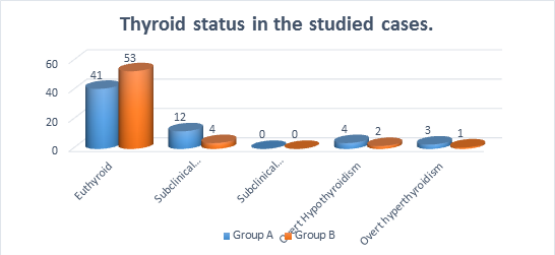

Figure 1: Thyroid Status In studied cases.

The comparison of the patients of control and cases groups on the basis of whether they had a normal or abnormal thyroid function test showed that patients with diabetes mellitus type 2 (Group A) were more likely to be having abnormal thyroid function test as compared to healthy individuals (Group B) and this difference was found to be statistically significant (P=0.0138).

The thyroid function test of patients were analysed for abnormalities. The mean Free T4 levels in group A (Diabetic individuals) was 1.12 +/- 0.28 whereas in group B (healthy individuals) it was found to be 1.34+/- 0.40. The difference was found to be statistically significant (P=0.0007). Mean TSH level in Group A (Diabetic individuals) was found to be 5.26 +/- 1.42 whereas in group B it was found to be 3.02 +/- 0.78. The difference was found to be statistically highly significant (P<0.0001).

Table 4: Thyroid status in studied groups.

Age Group	Group A		Group B	
	No of Patients	Percentage	No of Patients	Percentage
Euthyroid	41	68.33%	53	88.33%
Hypothyroidism (Subclinical or overt)	16	26.67%	6	10.00%
Hyperthyroidism (Subclinical or overt)	3	5.00%	1	1.67%
Total	60	100%	80	100%
P= 0.0138 (Significant)				

Table 5: Free T4 and TSH levels in studied cases.

Age Group	Group A		Group B		P Value
	Mean	Std Deviation	Mean	Std Deviation	
Free T4 Levels	1.12	0.28	1.34	0.40	P=0.0007
TSH levels	5.26	1.42	3.02	0.78	P < 0.0001

DISCUSSION

We undertook this comparative study to compare thyroid functions in diabetes mellitus patients and healthy individuals. We included total 120 individuals in this study out of which 60 patients were having diabetes mellitus type 2 (Group A) and remaining 60 were healthy individuals (group B). The gender and age distribution, fasting and post prandial glucose levels and thyroid functions of both the groups were compared.

The mean age of the patients of diabetes mellitus type II in our study was found to be 48.05 +/- 4.89 years and there is an overall male preponderance.

Noh JW et al conducted a study to assess the relationship between age of onset and risk factors including family history and life style in Korean population with type 2 diabetes mellitus (T2D). Subjects with T2D patients who received outpatient care for blood sugar control were randomly sampled at 13 general hospitals and 969 subjects were included. The mean age of onset of diabetes mellitus in this study was found to be current smoker was 45.2 years old, but it was 51.4 and 51.6 years old for past smoker and never smoked group.[10] Similar mean age of patients with diabetes was also reported by the authors such as Stryjewski PJ et al,[11] (mean age 66.9 years, SD 13.2) and Hayashino Y et al12 (61.4 years).

In our study subclinical or overt thyroid function abnormalities (either hypothyroidism or hyperthyroidism) were found in 19 (31.67 %) patients in group A (patients with diabetes) whereas in group B (healthy individuals) thyroid function abnormalities (either hypothyroidism or hyperthyroidism) were found in 7 (11.67%) patients. patients with diabetes mellitus type 2 (Group A) were more likely to be having abnormal thyroid function test as compared to healthy individuals (Group B) and this difference was found to be statistically significant (P=0.0138). Telwani AA et al conducted a study to find out the prevalence of thyroid disorders in patients of type 2 diabetes mellitus. In this study all the participants were evaluated for thyroid dysfunctions by testing thyroid profile. The correlation of prevalence of thyroid disorder with age distribution, gender distribution, BMI, duration of diabetes and HbA1C was then done. The authors found that the prevalence of thyroid dysfunctions were high in diabetic patients compared to controls (29% versus 9%, P value to controls (29% versus 9%, P value <0.001). Most common thyroid disorder in diabetic patients was subclinical hypothyroidism (16%) while least common was hyperthyroidism (1%). The levels of serum T3 and T4 were significantly low while serum TSH levels were significantly high in diabetic group compared to control group. The findings of study conducted by Telwani et al were similar to our study as our study also found that thyroid abnormalities are more common in patients with diabetes mellitus as compared to healthy individuals and the difference was found to be statistically significant (P=0.0138).[13] The studies conducted by Papanna J et al,[14] and Kadiyala R et al,[15] also found thyroid abnormalities to be more common in patients of diabetes as compared to their healthy individuals.

CONCLUSION

Our study found that overt as well as clinical thyroid dysfunction was more common in patients with Diabetes mellitus type II as compared to age matched healthy individuals. Screening of patients for presence of thyroid dysfunction therefore should be done in patients with diabetes so as to be able to diagnose thyroid dysfunction at an early stage and treat it accordingly.

REFERENCES

1. Leslie RD. Metabolic changes in diabetes. Eye (Lond). 1993;7 (Pt 2):205-8.
2. Tabish SA. Is Diabetes Becoming the Biggest Epidemic of the Twenty-first Century?. Int J Health Sci (Qassim). 2007;1(2):V–VIII.
3. Mordarska K, Godziejewska-Zawada M. Diabetes in the elderly. Prz Menopauzalny. 2017;16(2):38–43.
4. Papatheodorou K, Papanas N, Banach M, Papazoglou D, Edmonds M. Complications of Diabetes 2016. J Diabetes Res. 2016;2016:6989453.
5. Lichtenauer UD, Seissler J, Scherbaum WA. [Diabetic complications. Micro and macroangiopathic end-organ damage]. Internist (Berl). 2003 Jul;44(7):840-6, 848-52.
6. Saini JS, Narula AS, Khati C, Uberoi HS. carbohydrate metabolic disturbances in hyperthyroidism. Med J Armed Forces India. 1996;52(3):149–152.
7. Ogbonna SU, Ezeani IU, Okafor CI, Chinenye S. Association between glycemic status and thyroid dysfunction in patients with type 2 diabetes mellitus. Diabetes Metab Syndr Obes. 2019;12:1113–1122. Published 2019 Jul 12.
8. Uppal V, Vij C, Bedi GK, Vij A, Banerjee BD. Thyroid disorders in patients of type 2 diabetes mellitus. Indian J Clin Biochem. 2013;28(4):336–341.
9. Kretowski A, Kowalska I, Peczyńska J, Urban M, Kinalska I. [IA-2 and anti-GAD antibodies in patients with newly diagnosed type 1 diabetes and their first degree relatives]. Przegl Lek. 2000;57(3):143-6.
10. Noh JW, Jung JH, Park JE, et al. The relationship between age of onset and risk factors including family history and life style in Korean population with type 2 diabetes mellitus. J Phys Ther Sci. 2018;30(2):201–206.
11. Stryjewski PJ, Januś B, Krupa E, Nessler B, Badacz L, Nessler J. [Prevalence of age, gender and body weight on the frequency of hypertension and diabetes mellitus in patients hospitalized in cardiology department]. Przegl Lek. 2011;68(9):585-7.
12. Hayashino Y, Izumi K, Okamura S, et al. Duration of diabetes and types of diabetes therapy in Japanese patients with type 2 diabetes: The Japan Diabetes Complication and its Prevention prospective study 3 (JDCP study 3). J Diabetes Investig. 2017;8(2):243–249.
13. Telwani AA, Wani ZH, Ashraf Y, Shah AA. Prevalence of thyroid dysfunction in type 2 diabetes mellitus: a case control study. Int J Res Med Sci 2017;5:4527-31
14. Papanna JJ and Bettegowda S. "Thyroid dysfunction among type 2 diabetes mellitus patients: A study from rural hospital". Journal of Medical Science and Clinical Research 7.4 (2019): 433-436.

15. Kadiyala R, Peter R, Okosieme OE. Thyroid dysfunction in patients with diabetes: clinical implications and screening strategies. Int J Clin Pract. 2010 Jul;64(8):1130-9.

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