International Journal Dental and Medical Sciences Research
Volume 5, Issue 3, May - June 2023 pp 495-501 www.ijdmsrjournal.com ISSN: 2582-6018

A Study of Thyroid Dysfunction in Patients with Diabetes

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Date of Submission: 01-06-2023 Date of Acceptance: 10-06-2023

ABSTRACT:

INTRODUCTION:

Type 2 diabetes mellitus (T2DM) is a significant global health concern, and it frequently coexists with thyroid dysfunction, which often develops later in life. Thyroid dysfunction and diabetes mellitus are closely linked, with an increased prevalence of thyroid disorders observed in diabetic populations compared to non-diabetic individuals [1,2,3,4]. Subclinical hypothyroidism is the most commonly found abnormality among diabetic subjects [5, 6]. Hyperglycemia in diabetes can affect cellular metabolism, which can be further exacerbated by coexisting thyroid disease [49]. Uncontrolled thyroid function abnormalities in diabetic patients can impact glycemic control, with hyperthyroid patients prone to hyperglycemic emergencies and hypothyroid patients prone to recurrent hypoglycemic episodes. The duration of diabetes does not significantly impact the occurrence of thyroid dysfunction [7,8]. Subclinical hypothyroidism in diabetic patients has been associated with an increased risk of nephropathy and cardiovascular disease while coexisting hypothyroidism can worsen microangiopathic complications of diabetes such as retinopathy and neuropathy due to dyslipidemia [9, 10]. Screening for thyroid abnormalities in diabetic patients is important as it enables early detection and treatment of subclinical and overt thyroid dysfunction, thereby potentially mitigating complications.

AIMS AND OBJECTIVES: To assess the level of thyroid dysfunction in patients with diabetes mellitus and to identify the association of thyroid dysfunction with diabetic complications.

METHODS AND MATERIALS: This is a hospital-basedcross-sectional study of 175 patients with known Diabetes Mellitus (Type 1 diabetes mellitus and Type 2 diabetes mellitus) without known thyroid disorders attending the outpatient departments between August 2019 to June 2021 who met the inclusion and exclusion criteria.

RESULT: Among the 175 patients in the study, 30.29% had thyroid dysfunction, with subclinical hypothyroidism being the most common abnormality, while subclinical hyperthyroidism was present in 4%. Middle-aged patients (45-59 years) had the highest prevalence of thyroid dysfunction, reaching 53.72%.Among the patients with an HbA1c level greater than 8%, 25.29% had hypothyroidism and 9.20% had hyperthyroidism.

CONCLUSION: This study emphasizes the significant association between diabetes mellitus and thyroid dysfunction thus highlighting the need for regular thyroid screening in diabetic patients.

KEYWORDS: Diabetes mellitus, thyroid dysfunction, HbA1c, complications.

I. INTRODUCTION:

Diabetes mellitus is characterized by chronic hyperglycemia with carbohydrate, fat, and protein metabolism disturbances resulting from defects in insulin secretion, insulin action, or both. Diabetes is a major health problem producing serious health-related and socioeconomic impacts on individuals and populations. Glycated haemoglobin (HbA1c) has been considered an important marker of long-term glycemic control. In the recent past, the American Diabetes Association has suggested the use of HbA1c as a diagnostic tool for prediabetes and diabetes. A value between 5.7% and 6.5% represents prediabetes while a value ≥6.5% is considered diabetes mellitus. Hyperglycemia in diabetes mellitus can affect the cellular metabolism which may be further worsened by coexisting thyroid disease.[11]Uncontrolled thyroid function abnormalities in the diabetic population may alter glycemic control in such a way that hyperthyroid patients are prone to hyperglycemic emergencies and hypothyroid patients are prone to recurrent hypoglycemic episodes. Microangiopathic

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complications of diabetes like retinopathy and neuropathy can worsen in the presence of co-existing hypothyroidism due to dyslipidemia. Screening for thyroid abnormalities in diabetic patients will allow early treatment of sub-clinical and overt thyroid dysfunction.

AIMS AND OBJECTIVES:

AIM: To study thyroid dysfunction in diabetic patients.

OBJECTIVE: 1) Toestimate the prevalence of thyroid dysfunction among individuals with diabetes

2)To determine the correlation between glycemic control (as measured by HbA1C levels) and the development of thyroid dysfunction in diabetes mellitus.

3) To determinethe association between thyroid dysfunction and diabetic complications.

METHODS: This is a hospital-based cross-sectional study of 175 patients with known Diabetes Mellitus (Type 1 diabetes mellitus and Type 2 diabetes mellitus) without known thyroid disorders attending the outpatient departments between August 2019 to June 2021 who met the inclusion and exclusion criteria.

INCLUSION CRITERIA: Patients of Age 18 years and above and either gender diagnosed with Diabetes Mellitus (Type 1 and 2).

EXCLUSION CRITERIA: Patients with known thyroid disease, on thyroid medication and have undergone radiation or thyroid surgery, acute illness and chronic liver disease were excluded from the study.

SAMPLING METHODS AND DIAGNOSTIC TOOL: Patient demographics including age and gender were assessed, and a detailed medical history was recorded. Clinical, physical, haematological, and biochemical examinations were conducted. Body mass index (BMI) was calculated using weight and height measurements, with a BMI between 25 and 29.9 kg/m2 classified as overweight and a BMI above 30 kg/m2 classified as obesity.

Laboratory investigations included glycosylated haemoglobin, fasting lipid profile, and urine albumin. Diabetic retinopathy was evaluated through dilated fundus examination and categorized as non-proliferative or proliferative. Diabetic nephropathy was diagnosed based on the presence of albuminuria, with microalbuminuria defined as urinary albumin excretion between 30-300 mg/day and macroalbuminuria as urinary albumin exceeding 300 mg/day.

Serum levels of thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4) were measured in fasting samples. Reference values for FT3, FT4, TSH, T4, and T3 were provided. Thyroid antibodies were assessed as indicated.

The criteria for thyroid dysfunction were defined as follows: overt hypothyroidism (TSH > 10 mIU/ml, FT4 < 0.7 ng/dl), subclinical hypothyroidism (TSH > 5 mIU/ml, normal FT3 and FT4), overt hyperthyroidism (TSH < 0.3 mIU/ml, FT4 > 1.8 ng/dl), and subclinical hyperthyroidism (TSH < 0.03 mIU/ml, normal FT3 and FT4).

STATISTICAL METHOD:The data were recorded and entered in Microsoft Excel Worksheet. Categorical variables were expressed in numbers and percentages, and normally distributed data were presented as mean ± standard deviation. Unpaired t-test, chi-square test and ANOVA (analysis of variance) were used to calculate the p-value as appropriate. P value < 0.05 has been considered statistically significant.

II. RESULTS AND DISCUSSIONS:

175 cases which fulfilled the inclusion criteria were studied. The mean age of the patients in the study was 49.47 years with a standard deviation of 14.97. The majority of the patients in the study were middle-aged (50-59 years) and the average age of the patients was approximately 49.47 years. The study had a higher representation of males compared to females.

TABLE 1: AGE AND GENDER DISTRIBUTION OF STUDY PARTICIPANTS

MALE	FEMALE
106	69

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Age in years	Number of patients
20-29	33(18.86%)
30-39	6 (3.43%)
40-49	32(18.29%)
50-59	62 (35.43%)
60-69	29 (16.57%)
>70	13 (7.42%)
Total	**175 (100%)**
Mean Age (yrs)	**49.47 ± 14.97**

The study identified that subclinical hypothyroidism was the most prevalent type of thyroid dysfunction, accounting for 24 cases (13.72%). Among these cases, the majority, 12 (50.00%), were in the age group of 40-59 years. Overt hypothyroidism was observed in 15 cases (8.57%), with the highest occurrence in the age group of 60-79 years, representing 6 cases (40.00%). Additionally, the study found 7 cases (4.00%) of subclinical hyperthyroidism and 5 cases (2.86%) of overt hyperthyroidism. The age group of 40-59 years had the highest representation in both subclinical hyperthyroidism (5 cases, 71.43%) and overt hyperthyroidism (5 cases, 100%).

TABLE 2: DISTRIBUTION OF STUDY PARTICIPANTS ACCORDING TO AGE

THYROID DYSFUNCTION	AGE GROUP (IN YEARS)			Total patients
	20-39	40-59	60-79	
Euthyroid	26 (21.31%)	68 (55.74%)	28 (22.95%)	122 (69.71%)
Subclinical Hypothyroidism	5 (20.83%)	12 (50%)	7 (29.17%)	24 (13.72%)
Overt Hypothyroidism	5 (33.33%)	4 (26.67%)	6 (40.00%)	15 (8.57%)
Subclinical Hyperthyroidism	1 (14.29%)	5 (71.43%)	1 (14.28%)	7 (4.00%)
Overt Hyperthyroidism	0	5 (100%)	0	5 (2.86%)
Hashimoto's Thyroiditis	2 (100%)	0	0	2 (1.14%)
Total	39	94	42	175 (100%)

The study identified that subclinical hypothyroidism was the most prevalent type of thyroid dysfunction, accounting for 24 cases (13.72%). Among these cases, the majority, 12 (50.00%), were in the age group of 40-59 years. Overt hypothyroidism was observed in 15 cases (8.57%), with the highest occurrence in the age group of 60-79 years, representing 6 cases (40.00%). Additionally, the study found 7 cases (4.00%) of subclinical hyperthyroidism and 5 cases (2.86%) of overt hyperthyroidism. The age group of 40-59 years had the highest representation in both subclinical hyperthyroidism (5 cases, 71.43%) and overt hyperthyroidism (5 cases, 100%).

TABLE 3: DISTRIBUTION OF PATIENTS ACCORDING TO TYPE OF DIABETES AND THYROID DYSFUNCTION

	NO. OF PATIENTS	
THYROID DYSFUNCTION	**TYPE 1 DM**	**TYPE 2 DM**
Euthyroid	**25 (65.79%)**	**97 (70.80%)**
Sc Hypothyroidism	**5 (13.16%)**	**19 (13.87%)**
Overt Hypothyroidism	**5 (13.16%)**	**10 (7.30%)**

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Sc Hyperthyroidism	**1 (2.63%)**	**6 (4.38%)**
Overt Hyperthyroidism	**0 (0%)**	**5 (3.65%)**
Hashimoto's Thyroiditis	**2 (5.26%)**	**0 (0%)**
Total	**38**	**137**

In this study, among 38 patients with Type 1 DM, 5 (13.16%) had subclinical hypothyroidism, 5 (13.16%) had overt hypothyroidism, and 1 (2.63%) had subclinical hyperthyroidism.Among 137 patients with Type 2 DM, 19 (13.87%) had subclinical hypothyroidism, 10 (7.30%) had overt hypothyroidism, 6 (4.38%) had subclinical hyperthyroidism, and 5 (3.65%) had overt hyperthyroidism**.**

TABLE 4: DISTRIBUTION OF PATIENTS ACCORDING TO BMI

THYROID DYSFUNCTION	**BMI (Kg/m^2)**			**TOTAL**
	<25	**25-30**	**>30**	
Euthyroid	54 (83.08%)	50 (58.14%)	18 (75%)	122
Subclinical Hypothyroidism	3 (4.61%-)	17(19.77%)	4(16.66%)	24
Overt Hypothyroidism	2 (3.07%)	12(13.95%)	1(4.17%)	15
Subclinical Hyperthyroidism	3 (4.61%)	3(3.49%)	1(4.17%)	7
Overt Hyperthyroidism	1 (1.53%)	4(4.65%)	0	5
Hashimoto's Thyroiditis	2 (3.10%)	0	0	2
Total	65 (37.14%)	86(49.14%)	24(13.72%)	175 (100%)

In this study, among patients with different BMI categories, 11 (16.92%) with BMI <25 kg/m2, 36 (41.86%) with BMI 25-30 kg/m2, and 6 (25.00%) with BMI >30 kg/m2 had thyroid dysfunction, with subclinical hypothyroidism being the most common. The highest number of patients (86 or 49.14%) had a BMI of 25-30 kg/m2, with 17 (19.77%) of them having subclinical hypothyroidism and 12 (13.95%) having overt hypothyroidism. In this study, 24 (13.72%) patients had a BMI >30 kg/m2, with 4 (16.66%) of them having subclinical hypothyroidism.

TABLE 5: DISTRIBUTION OF DM PATIENTS ACCORDING TO HBA1C LEVEL

Treatment	**No of patients**
6-8 %	88 (50.28%)
8.1-11 %	47 (26.86%)
11.1-14%	40 (22.86%)
Total	**175 (100%)**

In the present study, out of 175 subjects of the study group, 88 (50.28%) had HBA1C values between 6-8 % and the rest 87 (49.46%) had HBA1C values greater than 8%.

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TABLE 6: DISTRIBUTION OF PATIENTS IN ACCORDANCE TO THYROID DYSFUNCTION AND HBA1C

THYROID DYSFUNCTION	HBA1C (%)			TOTAL NO. PATIENTS
	6-8	8.1-11	11.1-14	
Euthyroid	67 (76.14%)	27 (57.45%)	28 (70.00%)	122
Sc Hypothyroidism	12 (13.64%)	7 (14.89%)	5 (12.50%)	24
Overt Hypothyroidism	5 (5.68%)	7 (14.89%)	3 (7.50%)	15
Sc Hyperthyroidism	2 (2.27%)	2 (4.26%)	3 (7.50%)	7
Overt Hyperthyroidism	2 (2.27%)	3 (6.38%)	0	5
Hashimoto's Thyroiditis	0	1 (2.13%)	1 (2.50%)	2
Total	88 (50.29%)	47 (26.86%)	40 (22.85%)	175 (100%)

In this study, among patients with different HbA1c levels, 47 (26.86%) with HbA1c between 8.1-11% had thyroid dysfunction, with 7 (14.89%) having subclinical hypothyroidism, 7 (14.89%) having overt hypothyroidism, 2 (4.26%) having subclinical hyperthyroidism, and 3 (6.38%) having overt hyperthyroidism. Among 40 (22.85%) patients with HbA1c greater than 11.1%, 5 (12.50%) had subclinical hypothyroidism, 3 (7.50%) had overt hypothyroidism, and 3 (7.50%) had subclinical hyperthyroidism.

TABLE 7: DISTRIBUTION OF PATIENTS IN ACCORDANCE TO DIABETIC RETINOPATHY AND THYROID DYSFUNCTION

THYROID DYSFUNCTION	FUNDUS EXAMINATION (NO. OF PATIENTS)		
	NORMAL	NPDR	PDR
Euthyroid	100 (71.94%)	16 (61.54%)	6 (60.00%)
Sc Hypothyroidism	17 (12.23%)	4 (15.38%)	3 (30.00%)
Overt Hypothyroidism	10 (7.19%)	4 (15.38%)	1(10.00%)
Sc Hyperthyroidism	6 (4.32%)	1 (3.85%)	0
Overt Hyperthyroidism	4 (2.88%)	1 (3.85%)	0
Hashimoto's Thyroiditis	2 (1.44%)	0	0
Total (175)	139(79.43%)	26 (14.86%)	10 (5.71%)

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In the present study, among patients with non-proliferative retinopathy (26 patients, 14.86%), 4 (15.38%) had subclinical hypothyroidism, 4 (15.38%) had overt hypothyroidism, 1 (3.85%) had subclinical hyperthyroidism, and 1 (3.85%) had overt hyperthyroidism.Among patients with proliferative retinopathy (10 patients, 5.71%), 3 (30.00%) had subclinical hypothyroidism, and 1 (10.00%) had overt hypothyroidism.

TABLE 8: DISTRIBUTION OF PATIENTS ACCORDING TO URINE ACR

	URINE ACR (Mg/G Of Creat)		
THYROID DYSFUNCTION	**Normal**	**Microalbuminuria (30-300)**	**Macro-Albuminuria (>300)**
Euthyroid	91 (70.00%)	28 (70.00%)	3 (60.00%)
Sc Hypothyroidism	17 (13.08%)	6 (15.00%)	1 (20.00%)
Overt Hypothyroidism	9 (6.92%)	5 (12.50%)	1 (20.00%)
Sc Hyperthyroidism	6 (4.62%)	1 (2.5%)	0
Overt Hyperthyroidism	5 (3.85%)	0	0
Hashimoto's Thyroiditis	2 (1.53%)	0	0
Total (175)	130 (74.29%)	40 (22.86%)	5 (2.85%)

In our study, among patients with microalbuminuria (40 patients, 22.86%), 6 (15.00%) had subclinical hypothyroidism, 5 (12.50%) had overt hypothyroidism, and 1 (2.50%) had subclinical hyperthyroidism. Among patients with macroalbuminuria (5 patients, 2.85%), 1 (20.00%) had subclinical hypothyroidism and 1 (20.00%) had overt hypothyroidism.

III. CONCLUSION:

Our study found that thyroid dysfunction was present in 30.29% of the 175 diabetic patients included. Subclinical hypothyroidism was the most common abnormality, followed by overt hypothyroidism. Female patients had a higher prevalence of thyroid dysfunction. Routine screening for thyroid disorders is recommended, especially in diabetic patients with uncontrolled glycemic status and those in the middle age group. Early detection and management of thyroid dysfunction can help reduce morbidity and mortality among diabetic patients.

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