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The Frequency of Thyroid Dysfunctions among Patients of Diabetes Mellitus Presenting in Tertiary Care Hospital of a Developing Country

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: Thyroid disease is a pathological state associated significantly with diabetes mellitus (DM) Type 1 and Type 2. As the prevalence of diabetes mellitus is on the rise in our population, so the purposed significance of our study was to evaluate the frequency of thyroid dysfunction in diabetic patients of our local population.
Study Design: Cross-sectional study.
Place and Duration of Study: This study conducted among patients of diabetes (Type 1 and Type 2) from September 2020 to March 2021 while their visit in Holy family hospital, Rawalpindi, for a routine clinical check-up on an OPD basis.
Methodology: A total of 96 patients with diabetes mellitus on regular medication, 20 to 60 years of age, were included. Patients with diabetic ketoacidosis, hyperlipidemia, pregnant females, and those taking medication that can affect thyroid functions (dopamine antagonists, antiepileptics, oral

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contraceptives, lithium, glucocorticoids) were excluded. A venous blood sample was drawn and sent to the laboratory to analyze thyroid function tests for the presence or absence of any thyroid dysfunction. Data analysis was done through SPSS.v.23. Descriptive statistics and Chi-square analysis was used, and a p-value of ≤ 0.05 was considered significant.

Results: The mean age of the patients was 42.97 ± 10.29 years. The majority of the patients, 37.50%, were between 41 to 50 years of age. Out of 96 patients, 61 (63.54%) were male, and 35 (36.46%) were females with a male to female ratio of 1.7:1. The majority of patients, 69 (71.88%), had type II diabetes mellitus. The frequency of thyroid dysfunction found in diabetic patients was 30 (31.25%), with hypothyroidism in 19 (19.79%) and hyperthyroidism in 11 (11.46%) patients.

Conclusion: This study deduced that there is a high frequency of thyroid dysfunction in diabetic patients. In the same vein, hypothyroidism was the common thyroid dysfunction associated with diabetes mellitus.

Keywords: Diabetes mellitus; hypothyroidism; hyperthyroidism; thyroid dysfunction; tertiary care hospital.

1. INTRODUCTION

Diabetes mellitus (DM) is regarded as a single disease entity. It is a heterogeneous group of diseases characterized by chronic hyperglycemia with multifactorial associations such as environmental, genetic and geographical factors acting simultaneously or jointly [1]. There are three main types of diabetes mellitus (DM): (i) Type I or insulin-dependent DM or juvenile diabetes, (ii) Type II or non-insulin-dependent DM or adult-onset diabetes, (iii) gestational diabetes occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. Other forms of diabetes mellitus include congenital diabetes due to genetic defects of insulin secretion, cystic fibrosis-related diabetes, steroid diabetes induced by high doses of glucocorticoids, and several forms of monogenic diabetes [2]. There is currently no cure for diabetes. The condition, however, can be managed so that patients can live relatively normal life. Treatment of diabetes focuses on two goals: keeping blood glucose within normal range and preventing long-term complications. The major long-term complications relate to damage to blood vessels. Diabetes doubles the risk of cardiovascular disease [3]. The primary "macrovascular" diseases (related to atherosclerosis of larger arteries) are ischemic heart disease (angina and myocardial infarction), stroke, and peripheral vascular disease. Diabetes also damages the capillaries (causes microangiopathy) [4].

Occasionally other endocrine disorders like abnormal thyroid hormone levels are found in diabetes. Various studies have reported a significant association between Diabetes and thyroid disorders [5]. On the one hand, studies have also reported the significance of thyroid hormones' contribution to regulating carbohydrate metabolism and pancreatic function; in the same vein, studies are also showing the paramount significance of DM in regulating the thyroid function tests [6,7]. The Thyroid hormones and pancreatic hormones like insulin antagonize each other, and excess and deficit of any one of them can lead to functional derangement of the other [8]. DM appears to influence thyroid function in two sites; firstly, at the level of the hypothalamus where TSH release is regulated, and secondly, at the level of the peripheral tissues where T4 is converted into T3 [9]. A study by M V Jali et al. demonstrated an overall prevalence of 16.2% of thyroid diseases in diabetics [10]. In another study, Udiong CEJ et al. [11] showed hypothyroidism in 26.6% and hyperthyroidism in 19.8% of patients with diabetes mellitus.

As the prevalence of diabetes mellitus is on the rise in our population, so the purposed significance of our study is to evaluate the frequency of thyroid dysfunction in diabetic patients of our local population. As routinely thyroid functions in diabetic patients are not assessed in our general practice, and failure to recognize the presence of abnormal thyroid hormone levels in diabetics might be a primary cause of poor management often encountered in some treated diabetics, so the results of our study would not only provide the magnitude of the local population but also help the clinicians to design a proper management protocol for these particular patients in order to reduce the morbidity of our population.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

It is a cross-sectional study conducted among patients of diabetes (Type 1 and Type 2) from

19th September 2020 to 26th March 2021 while their visit in Holy family hospital, Rawalpindi, for a routine clinical check-up on an OPD basis.

2.2 Sample Size and Study Sampling

A total of 96 patients were included in our study, and consecutive sampling technique was followed during data collection. Sample size calculation was done by utilizing these values (Z=1.96, p=19.8%, q=100-p, d=8%) [11].

2.3 Inclusion and Exclusion Criteria

All patients, either males or females with age group between 20-60 years, diagnosed with diabetes mellitus and on regular medication as per operational definition of >2 years duration were included in our study. Similarly, the patients with diabetic ketoacidosis, chronic renal failure, taking medication that can affect thyroid functions (dopamine antagonists, antiepileptics, oral contraceptives, lithium, glucocorticoids), known cases of thyroid disorders, and hyperlipidemic patients were excluded from our sample population.

2.4 Data Collection Technique

After the approval of the study by the hospital committee of faculty members, 96 patients with diabetes mellitus (as per operational definition) presented to the outpatient department of medicine, Holy Family Hospital, Rawalpindi, fulfilling the inclusion/exclusion criteria were selected. Informed written consent was taken from each patient. A venous blood sample was taken and sent to the laboratory for analysis of thyroid function tests presence or absence of any thyroid dysfunction such as hypothyroidism defined as TSH more than 4.0mIU/L and hyperthyroidism defined as TSH less than 0.4mIU/L. All the data obtained from patients were recorded on the predesigned Performa.

2.5 Statistical Analysis

Data was entered and analyzed using the computer program SPSS version 23.0. Descriptive statistics were applied to calculate the mean and standard deviation for the age of the patients and the duration of diabetes mellitus. Frequencies and percentages were calculated for categorical variables such as gender, type of diabetes (Type I or II), hypothyroidism (yes/no), and hyperthyroidism (yes/no). Effect modifiers like age, gender, duration of diabetes mellitus, type of diabetes, and BMI (<27kg/m2 / ≥27kg/m2) were controlled by stratification, chi-square test was applied post-stratification, and p-value ≤ 0.05 was considered as significant.

3. RESULTS AND DISCUSSION

3.1 Results

According to demographic characterizations, the age range in this study was from 20 to 60 years, with a mean age of 42.97 ± 10.29 years. The majority of the patients, 37.50%, were between 41 to 50 years of age, as shown in Table 1. Out of 96 patients, 61 (63.54%) were male, and 35 (36.46%) were females with a male to female ratio of 1.7:1, as shown in Fig. 1. The majority of patients, 69 (71.88%), had Type II DM, as shown in Fig. 2. The mean duration of disease in our study was 5.86 ± 2.65 years, with the majority of patients, i.e., 57 (59.38%), were between >2-5 years duration as shown in (Table 1). similarly, the frequency and percentage of patients according to BMI are shown in (Table 1).

Table 1. Demographic characterizations of the patients (Mean Age ± SD = 42.97 ± 10.29 years, Mean Duration of disease ± SD = 5.86 ± 2.65 years)

Variables	Frequencies (n)	Percentages (%)
Age (in years)		
20-30	12	12.50
31-40	27	28.13
41-50	36	37.50
51-60	21	21.87
Duration of disease (in years)		
>2-5 years	57	59.38
>5 years	39	40.32
BMI (in kg/m^2)		
<27	37	38.54
≥27	59	61.48

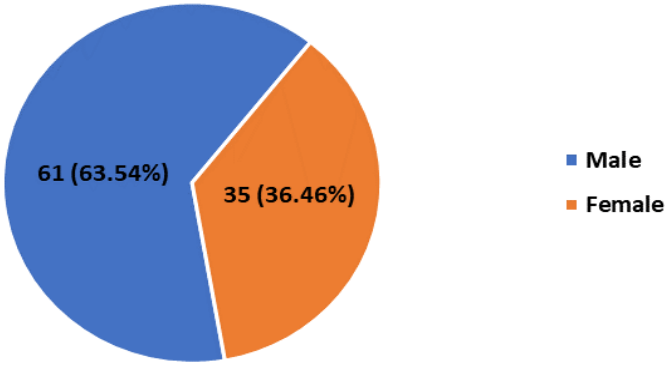

Fig. 1. Frequencies and percentages of patients according to gender

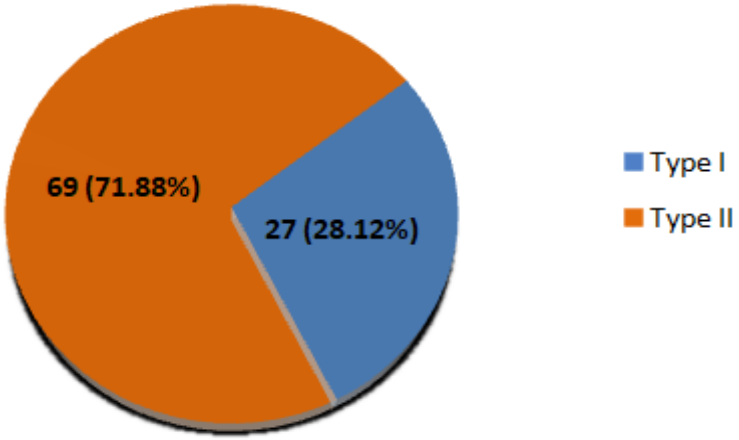

Fig. 2. Frequency and percentage of patients according to Type of Diabetes Mellitus

In our study, the overall frequency of thyroid dysfunction found in diabetic patients was 30 (31.25%) with hypothyroidism in 19 (19.79%), and hyperthyroidism in 11 (11.46%) patients and 66 (68.75%) patients were euthyroid in our study Table 2.

Stratification of thyroid dysfunction with respect to age groups and gender is shown in Table 3. Table 3 has also shown the stratification of thyroid dysfunction with respect to the type of diabetes mellitus and BMI, respectively. Stratification of thyroid dysfunction with respect to the duration of the disease is shown in Table 3.

3.2 Discussion

This paper demonstrates the importance of recognizing this interdependent relationship between thyroid disease and diabetes, which will help guide clinicians on the optimal screening and management of these conditions. We have conducted this study to determine the frequency of thyroid dysfunction in patients with DM.

Table 2. Frequency and percentage of patients with thyroid dysfunction

Thyroid dysfunction	Frequency (%)	
	yes	no
Hyperthyroidism	11 (11.46%)	83 (88.54%)
Hypothyroidism	19 (19.79%)	74 (80.21%)
Total	30 (31.25%)	66 (68.75%)

The age range in our study was from 20 to 60 years, with a mean age of 42.97 ± 10.29 years. The majority of the patients, 37.50%, were between 41 to 50 years of age. In our study, out of 96 patients, 61 (63.54%) were male, and 35 (36.46%) were females with a male to female ratio of 1.7:1. The majority of patients, 69 (71.88%), had Type II DM. In our study, the overall frequency of thyroid dysfunction found in diabetic patients was 30 (31.25%) with hypothyroidism in 19 (19.79%) and hyperthyroidism in 11 (11.46%) patients that is higher than the usual prevalence of thyroid dysfunction in the diabetic population. According to a study by Perros et al., who has

Table 3. Stratification of thyroid dysfunction (hypothyroidism, hypothyroidism) and overall thyroid dysfunction with respect to age groups, gender, thyroid dysfunction, Type of DM, BMI, and duration of disease

Variables	Categories	Hypothyroidism		Hyperthyroidism		Total	
		Yes	No	Yes	No	Yes	No
Age groups	20-30	01 (8.33%)	11 (91.67%)	01 (8.338%)	11 (91.67%)	02 (16.67%)	10 (83.33%)
	31-40	04 (14.81%)	23 (85.19%)	04 (14.81%)	23 (85.19%)	08 (29.63%)	19 (70.37%)
	41-50	08 (22.22%)	28 (77.78%)	04 (11.11%)	32 (88.89%)	12 (33.33%)	24 (66.67%)
	51-60	06 (28.57%)	15 (71.43%)	02 (9.52%)	19 (90.48%)	08 (38.10%)	13 (61.90%)
	P-value	0.463		0.920		0.626	
Gender	Male	12 (19.67%)	49 (80.33%)	08 (13.11%)	53 (86.89%)	20 (32.79%)	41 (67.21%)
	Female	07 (20.0%)	28 (80.0%)	03 (8.57%)	32 (91.43%)	10 (28.57%)	25 (71.43%)
	P-value	0.969		0.501		0.668	
Type of Diabetes Mellitus	I	03 (11.11%)	24 (88.89%)	06 (22.22%)	21 (77.78%)	09 (33.33%)	18 (66.67%)
	II	16 (23.19%)	53 (76.81%)	05 (7.25%)	64 (92.75%)	21 (30.43%)	48 (6.57%)
	P-value	0.182		0.038		0.783	
Body Mass Index (BMI)	<27 kg/m^2	02 (5.41%)	35 (94.59%)	05 (13.51%)	32 (86.49%)	07 (18.92%)	30 (81.08%)
	≥27 kg/m^2	17 (28.81%)	42 (71.19%)	06 (10.17%)	53 (89.83%)	23 (38.98%)	36 (61.02%)
	P-value	0.005		0.617		0.039	
Duration of Diabetes Mellitus	>2-5 years	10 (17.54%)	47 (82.46%)	07 (12.28%)	50 (87.72%)	17 (29.82%)	40 (70.18%)
	>5 years	09 (23.08%)	30 (76.92%)	04 (10.26%)	35 (89.74%)	13 (33.33%)	26 (66.67%)
	P-value	0.504		0.760		0.716	

demonstrated an overall prevalence of 13.4% of thyroid diseases in diabetics with the highest prevalence in Type 1 female diabetics (31.4%) and lowest prevalence in Type 2 male diabetics (6.9%). However, these findings are contrary to our study findings, where the frequency of thyroid dysfunction was high (31.25%), and more significantly, this frequency was high in patients with Type II DM [12]. Various studies have also reported the prevalence of thyroid dysfunction with diabetes as a study in Greek diabetic patients also showed a prevalence of 12.3% [13], but this is much lower than our study findings. Similarly, another study shows the prevalence of 16% of thyroid dysfunction among Saudi patients with type 2 diabetes, validating our study findings of the increasing prevalence of thyroid dysfunction with DM and, more specifically, Type II DM [14].

In our study, hypothyroidism was the main thyroid dysfunction present in 19 (19.79%) patients with DM compared to hyperthyroidism that was present only in 11(11.46%) patients. These study findings are inconsistent with the study results from CEJ et al., which was also showing a higher frequency of hypothyroidism (26.6%) in patients with DM as compared to hyperthyroidism (19.8%) [11]. In the same vein, the study by Subekti et al. is also validating our study findings by showing the high frequency of hypothyroidism among 7 (7.59%) patients with coexisting DM as compared to hyperthyroidism in 7 (2.31%) subjects with coexisting DM [15]. Another significant finding of our study was the association of thyroid dysfunction, particularly hypothyroidism in patients with BMI ≥ 27; this finding of high BMI and hypothyroidism association is in concordance with a study by Demitrost et al. in which the patients with higher BMI ≥ 25 were at increased risk of having hypothyroidism [16]. Another interesting finding in our study was an association of DM duration with thyroid dysfunction showing that patients with DM for greater than five years were at increased risk of developing thyroid dysfunction as validated by a study by Ogbonna et al. in which patients with DM greater than five years were at increased risk of developing thyroid dysfunction (OR= 3.3, p= 0.012) [17].

The limitation of this study is the small sample size and the single centered conduction of the study in the population of Rawalpindi and associated areas, which could have limited objectivity. The geographical and individual variation could impact the study findings if conducted in different hospitals of Pakistan. We recommend more studies in this subject to get more insight into these two (DM and thyroid dysfunction) interlinked diseases so that better patient's management could be carried out.

4. CONCLUSION

This study concluded that there is a high frequency of thyroid dysfunction in diabetic patients. In the same vein, hypothyroidism is the most common thyroid dysfunction associated with Type II DM. So, we recommend that there should be a routine screening of thyroid functions in every diabetic patient; thus, proper management can be done in these patients for good glycemic control and to reduce morbidity.

CONSENT

All authors declare that informed consent was obtained from each patient for publication of this research article and purpose of this study was thoroughly explained while they participated in our study.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki."

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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