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Original Article

Prevalence of Thyroid Dysfunction in Type 2 Diabetes Mellitus Patients

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Abstract

Background: Diabetes mellitus (DM) and thyroid dysfunction (TD) are the two most common endocrine disorders in clinical practice. The unrecognized TD may adversely affect the metabolic control and add more risk to an already predisposing scenario for cardiovascular diseases. The objective of this study was to investigate the prevalence of TD in patients with type 2 DM (T2DM).

Materials and Methods: This is an observational study. Hundred patients with T2DM visiting medicine outpatient department of RIMS Raichur included in the study. All patients underwent a clinical and laboratory evaluation. All patients were investigated for TD (thyroid-stimulating hormone, T3, T4).

Results: Out of the 100 patients studied 85 of them were euthyroid, ten patients found to have subclinical hypothyroidism and five patients had overt hypothyroidism. Female patients had higher prevalence of hypothyroidism.

Conclusions: TD is frequently observed in T2DM. Subclinical hypothyroidism is the most common thyroid abnormality detected, followed by overt hypothyroidism. TD was commonly seen in female patients.

Key words: Prevalence, subclinical and overt hypothyroidism, Thyroid dysfunction, Type 2 diabetes mellitus

INTRODUCTION

Diabetes mellitus (DM) is a common metabolic disease characterized by hyperglycemia and metabolic disturbances of carbohydrates, proteins, and lipids principally caused by pancreatic β-cell dysfunction, hyperglucagonemia, and increased renal glucose reabsorption.[1] DM is rapidly becoming one of the major health problems worldwide. About 422 million people worldwide have diabetes, particularly low- and middle-income countries. Diabetes is one of the leading causes of death worldwide.[2] There were over 72.946.400 cases of diabetes in India in 2017, 8.8% of the adult population.[3]

Thyroid hormones are essential for metabolism and energy homeostasis and participate in insulin action and glucose regulation. The previous studies reported higher prevalence rates of thyroid disorders in diabetic patients compared with non-diabetic individuals, and overt hypothyroidism was frequently observed in type 2 DM (T2DM).[1] Subclinical hypothyroidism (SCH), a pathological status defined as an elevated serum thyroid stimulating hormone (TSH) value with normal concentrations of free thyroid hormones,[4] is receiving increasing concerns in recent years. A meta-analysis reported that the pooled prevalence of SCH in T2DM patients was 10.2%. Meanwhile, high levels of TSH and low levels of free triiodothyronine (FT3) within the normal range were related to a higher risk of chronic kidney disease.[5] Furthermore, low level of serum FT3 was found to be independently associated with urinary protein in T2DM patients.[6]

Hence, the present study is done to find the prevalence of thyroid dysfunction (TD) in diabetic patients in our institute so that it can be included as a must screening investigation in patients with T2DM.

Aims and Objectives

The aim of the study was to find the prevalence of TD in T2DM in RIMS, Raichur, Karnataka, India.

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MATERIALS AND METHODS

Source of Data

Patients diagnosed with T2DM attending medicine Outpatient Department (OPD), RIMS, Raichur.

Method of Collection of Data

Information will be collected through a pretested and structured pro forma for each patient. The study will be

Table 1: Age distribution of patients studied

Age in years	Number of patients	%
<30	2	2.0
30–40	35	35.0
41–50	26	26.0
51–60	26	26.0
>60	11	11.0
Total	100	100.0

Mean±SD=46.95±10.97

Table 2: Gender distribution of patients studied

Gender	Number of patients	%
Female	83	83.0
Male	17	17.0
Total	100	100.0

Table 3: Duration of DM distribution of patients studied

Duration of DM in years	Number of patients	%
1–2	15	15.0
3–5	42	42.0
6–10	36	36.0
11–15	2	2.0
16–20	5	5.0
Total	100	100.0

Mean±SD: 6.47±4.09; DM: Diabetes mellitus

Table 4: RBS (mg/dl) distribution of patients studied

RBS (mg/dl)	Number of patients	%
<200	75	75.0
>200	25	25.0
Total	100	100.0

RBS: Random blood sugar

Table 5: Thyroid status distribution of patients studied

Thyroid status	Number of patients	%
Euthyroid	85	85.0
SCH	10	10.0
Overt Hypothyroidism	5	5.0
Total	100	100.0

SCH: Subclinical hypothyroidism

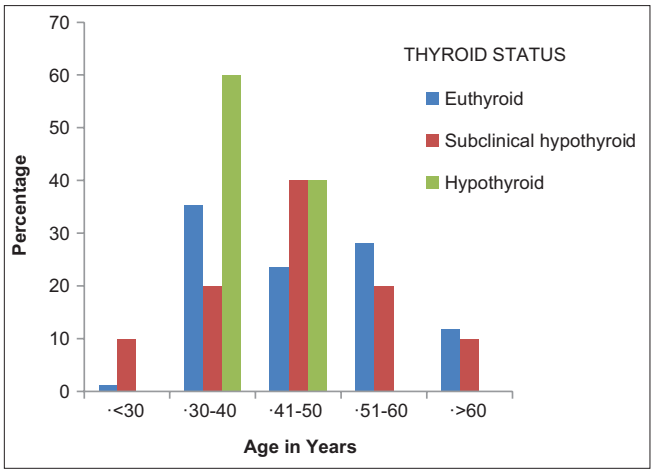

Figure 1: Distribution of study participants depending upon thyroid status and age

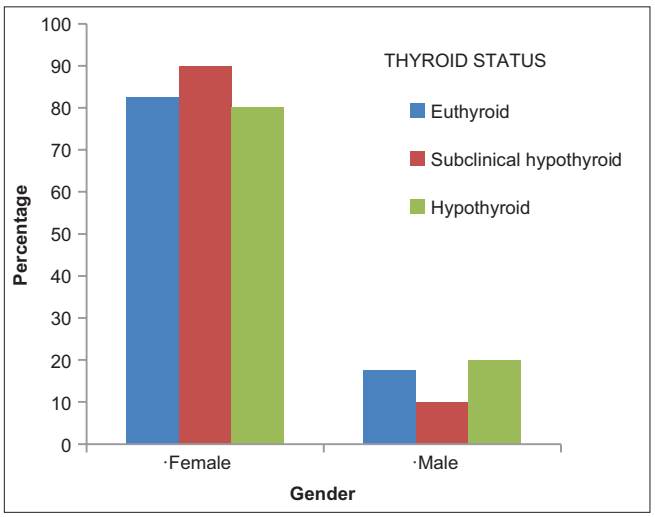

Figure 2: Distribution of study participants depending upon thyroid status and gender

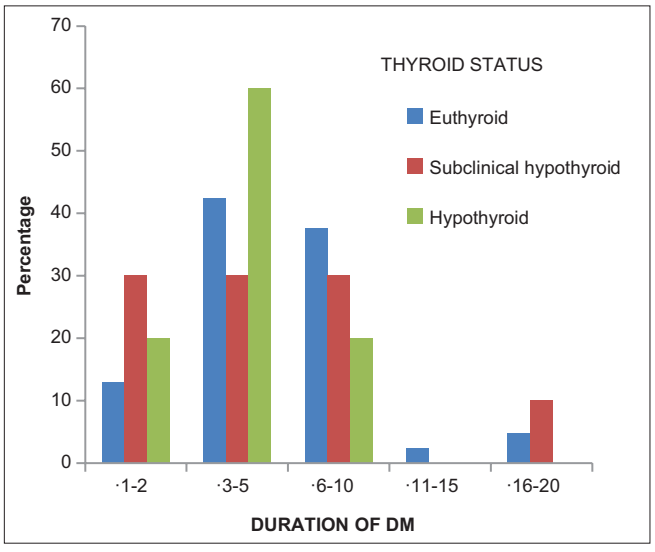

Figure 3: Distribution of study participants depending upon thyroid status and duration of Diabetes

Table 6: Association of frequency distribution of clinical variables in relation to thyroid status of patients studied

Variables	Thyroid status (%)			Total (%)	*P*-value
	Euthyroid	Subclinical hypothyroid	Hypothyroid		
Age in years					
<30	1 (1.2)	1 (10)	0 (0)	2 (2)	0.351
30–40	30 (35.3)	2 (20)	3 (60)	35 (35)	
41–50	20 (23.5)	4 (40)	2 (40)	26 (26)	
51–60	24 (28.2)	2 (20)	0 (0)	26 (26)	
>60	10 (11.8)	1 (10)	0 (0)	11 (11)	
Gender					
Female	70 (82.4)	9 (90)	4 (80)	83 (83)	1.000
Male	15 (17.6)	1 (10)	1 (20)	17 (17)	
Duration of DM					
1–2	11 (12.9)	3 (30)	1 (20)	15 (15)	0.699
3–5	36 (42.4)	3 (30)	3 (60)	42 (42)	
6–10	32 (37.6)	3 (30)	1 (20)	36 (36)	
11–15	2 (2.4)	0 (0)	0 (0)	2 (2)	
16–20	4 (4.7)	1 (10)	0 (0)	5 (5)	
Total	85 (100)	10 (100)	5 (100)	100 (100)	

Chi-square Test/Fisher exact test; DM: Diabetes mellitus

Table 7: Association of frequency distribution of clinical variables in relation to thyroid status of patients studied

Variables	Thyroid status (%)			Total (%)	*P*-value
	Euthyroid	Subclinical hypothyroid	Hypothyroid		
RBS (mg/dl)					
<200	62 (72.9)	9 (90)	4 (80)	75 (75)	0.695
>200	23 (27.1)	1 (10)	1 (20)	25 (25)	
HBA1C					
<6.0	5 (5.9)	3 (30)	0 (0)	8 (8)	0.095
6.0–6.4	15 (17.6)	0 (0)	1 (20)	16 (16)	
>6.5	65 (76.5)	7 (70)	4 (80)	76 (76)	
Total	85 (100)	10 (100)	5 (100)	100 (100)	

RBS: Random blood sugar

Table 8: Comparison of clinical variables according to thyroid status of patients studied

Variables	Thyroid status			Total	*P*-value
	Euthyroid	Subclinical hypothyroid	Hypothyroid		
Age	47.45±10.96	46.50±11.87	39.20±6.76	46.95±10.97	0.263
Duration of DM	6.63±4.10	6.10±4.72	4.40±1.94	6.47±4.09	0.477
RBS (mg/dl)	162.90±102.19	135.60±71.36	131.60±87.54	158.61±98.69	0.588
HBA1C (%)	7.65±1.59	7.34±1.72	6.98±0.72	7.59±1.57	0.566

Table 9: Comparison of thyroid variables according to thyroid status of patients studied

Variables	Thyroid status			Total	*P*-value
	Euthyroid	Subclinical hypothyroid	Hypothyroid		
T3 (nmol/L)	1.79±0.34	1.67±0.35	0.91±0.70	1.74±0.41	<0.001**
T4 (nmol/L)	102.55±23.64	91.73±15.33	55.92±6.08	99.13±24.63	<0.001**
TSH (mIU/L)	2.49±1.21	7.44±1.17	26.15±24.07	4.18±7.31	<0.001**

TSH: Thyroid-stimulating hormone

carried out on T2DM patients fulfilling the inclusion and exclusion criteria.

Sample Size

100 patients attending the medicine OPD, RIMS, Raichur.

Table 10: Pearson correlations

Pair	r value	*P*-value
T3 (nmol/L) versus age in years	0.063	0.531
T3 (nmol/L) versus duration of DM	0.051	0.612
T3 (nmol/L) versus RBS (mg/dl)	–0.136	0.178
T3 (nmol/L) versus HBA1C (%)	–0.076	0.452
T4 (nmol/L) versus age in years	0.226	0.024*
T4 (nmol/L) versus duration of DM	0.217	0.030*
T4 (nmol/L) versus RBS (mg/dl)	0.104	0.304
T4 (nmol/L) versus HBA1C (%)	–0.014	0.891
TSH (mIU/L) versus age in years	–0.148	0.140
TSH (mIU/L) versus duration of DM	–0.065	0.518
TSH (mIU/L) versus RBS (mg/dl)	–0.075	0.457
TSH (mIU/L) versus HBA1C (%)	–0.069	0.496

RBS: Random blood sugar; DM: Diabetes mellitus

Table 11: Comparison of age group

Study	Pramanik *et al.*[7]	Nair *et al.*[8]	Palma *et al.*[9]	Present study
Mean age group	45.4±11.2 years	53±11.15 years	60.7±10.6 years	46.95±10.97 years

Table 12: Gender distribution

Study	Pramanik *et al.*[7]	Nair *et al.*[8]	Demitrost and Ranabir[10]	Present study
Male (%)	51	64.4	30.19	17
Female (%)	49	35.6	69.80	83

Table 13: Average duration of DM

Study	Pramanik *et al.*[7]	Nair *et al.*[8]	Demitrost and Ranabir[10]	Present study
Average duration of DM	7.76±5.57 years	9.6±7.8 years	5 years	6.47±4.09 years

DM: Diabetes mellitus

Type of Study

This was a cross-sectional study.

Inclusion Criteria

The following criteria were included in the study:

1. Patients diagnosed with DM
2. Adults aged more than 18 years
3. Both male and female patients included.

Exclusion Criteria

The following criteria were excluded from the study:

1. Known cases of thyroid disorder
2. Patients on drugs altering thyroid hormone metabolism
3. Abnormal liver function test's with SGOT/SGPT levels >3 times normal range
4. Abnormal renal function test's with serum creatinine >1.6 mg%
5. Pregnant women.

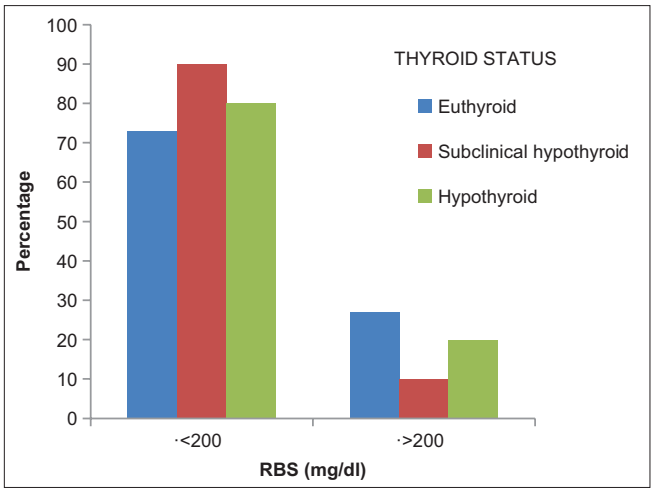

Figure 4: Distribution of study participants depending upon thyroid status and blood sugar levels

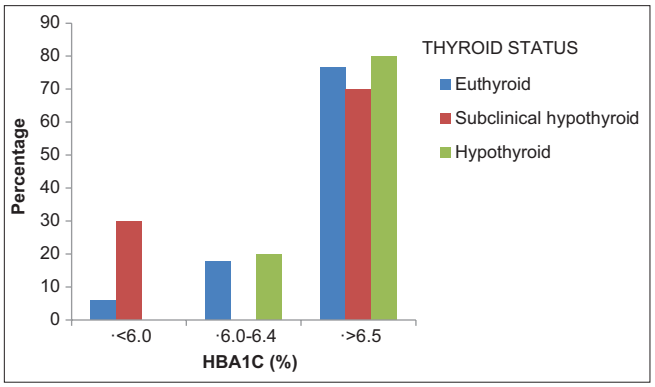

Figure 5: Distribution of study participants depending upon thyroid status and HbA1c levels

Investigations

1. Thyroid profile
2. HbA1C
3. RFT
4. Liver function test.

RESULTS

Percentages, proportions, and Chi-square chart correlation are used, with respect to age and sex.

Most of the patients in the study group belonged to the age group of 30–40 years (35%), with the mean age 46.95 ± 10.97 years [Table 1].

Majority of the study participants were females [Table 2].

Forty-two patients in the study had DM of 3–5 years duration. Mean duration of DM in the study population was 6.47 ± 4.09 years [Table 3].

Seventy-five patients in the study had random blood sugar (RBS) <200 mg/dl and 25 patients had >200mg/dl [Table 4].

Eighty-five patients in the study were euthyroid, ten patients had SCH and five patients had overt hypothyroidism [Table 5].

In the study out of ten patients who are found to have SCH, four belonged to the age group of 41–50 years, two patients in each 30–40 years and 51–60 years group, and one patient each in <30 years and >60 years group [Table 6].

Among the five patients who are found to have hypothyroidism three belonged to 30–40 years group and two patients in 41–50 years group [Figure 1].

Out of the ten SCH patients, nine were females. Out of the five overt hypothyroid patients, four were females [Figure 2].

Of the ten SCH patients, nine had diabetes for a duration of <10 years and all patients with overt hypothyroidism had diabetes for <10 years duration [Figure 3].

Nine and four patients in the subclinical hypothyroid and overt hypothyroid patients had RBS of <200 mg/dl [Figure 4].

Seven and four patients in the subclinical and overt hypothyroidism, respectively, had HbA1C value of >6.5% [Figure 5].

When the association of thyroid status and blood glucose levels were seen, there was no difference in the prevalence of hypothyroidism in both the groups. Similarly, the association between HbA1c and thyroid status was calculated and it was not statistically significant [Table 7].

No statistical significance was found between TD and age of the patient, duration of DM, RBS value, or HBA1C levels [Table 8].

The association between thyroid hormone levels and thyroid status was found to be statistically significant [Table 9].

Moderately significant correlation noted between T4 with age in years and duration of DM [Table 10].

Different similar studies were compared with the present study and the findings were similar [Table 11].

DISCUSSION

Nair *et al*.[8] study found that 8.33% patients had known history of hypothyroidism; 17 (1.5%) persons were diagnosed to have newly detected hypothyroidism (TSH >10 μ IU/ml) during the study period. Hence, the prevalence of clinical hypothyroidism was 9.83. 68 (5.9%) patients were found to have SCH. When comparison was done between the clinical hypothyroid and euthyroid persons, the presence of hypothyroidism was found to be associated with female sex, hypertension, dyslipidemia, obesity, a duration of diabetes more than 2 years, anemia, and an elevated ESR.[7]

Demitrost and Ranabir study, data of 202 T2DM patients studied. Out the 202 T2DM patients, 139 (68.8%) were euthyroid, 33 (16.3%) had SCH (10 males and 23 females), 23 (11.4%) had hypothyroidism (6 males and 17 females), 4 (2%) SCH, and 3 (1.5%) hyperthyroidism cases. Maximum TD noted in the age group of 45–64 years. Patients with BMI >25 were at increased risk of having hypothyroidism ($P < 0.016$) [Tables 11-13].[9]

In the present study, there were no patients with the previous history of thyroid abnormalities. Out of the 100 patients studied 85 of them were euthyroid, ten patients found to have SCH and five patients had overt hypothyroidism. Female patients had higher prevalence of both subclinical (nine out of ten) and overt (four out of five) hypothyroidism. <10 years was the duration of DM in SCH (90%) and overt hypothyroidism (100%). Mean duration of DM, RBS, and HBA1C values was 6.10 ± 4.72 years, 135.60 ± 71.36 mg/dl, 7.34 ± 1.72 and 4.40 ± 1.94 years, 131.60 ± 87.54 mg/dl and 6.98 ± 0.72, respectively, in subclinical and overt hypothyroidism.

CONCLUSION

TD is frequently observed in T2DM. SCH is the most common thyroid abnormality detected, followed by overt hypothyroidism. TD was commonly seen in female patients. No statistical significance was found between TD and age of the patient, duration of DM, RBS, and HBA1C values.

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