

A STUDY OF THYROID FUNCTION TEST IN PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

Introduction:

Diabetes mellitus (DM) is a growing problem in our country and we have observed that many patients are associated with thyroid dysfunction later in their life. Hence, the prevalence of thyroid dysfunction in diabetes mellitus patients should be evaluated.

Objectives:

To evaluate spectrum of thyroid disorders in diabetic patients and To access altered thyroid function in patients with diabetes mellitus regarding age, sex, duration of diabetes, family history, regularity of treatment and BMI.

Materials and Methods:

In this cross sectional study, after taking permission from ethical committee, data of 280 DM patients who attended the OPD clinic of sir takhtasinhji hospital, Bhavnagar over period of 9 month, and whose thyroid stimulating hormone (TSH), free T3, free T4 level were investigated, were included. The inclusion criteria were known cases of DM. Exclusion criteria were patients with previous history of thyroid disorder and those on drugs affecting the thyroid profile, chronic renal failure and Diabetic nephropathy, acute illness, hepatic dysfunction, psychiatric illness, Pregnancy.

Results:

Out of 280 DM patients 158 were males and 122 were females, 195 (69.64%) were euthyroid, 37 (13.22%) had subclinical hypothyroidism, 23 (8.21%) had overt hypothyroidism, 14 (5%) had subclinical hyperthyroidism and 11 (3.9%) were overt hyperthyroidism cases. Female sex ($P < 0.0091$) and patient with irregular treatment ($P < 0.001$) were at increased risk of having hypothyroidism.

Conclusion:

Prevalence of thyroid dysfunction was high in DM patients with female sex and patients with irregular treatment.

Keywords: TSH, thyroid dysfunction, DM

DM: Diabetes Mellitus

TFT: Thyroid Function Test

TSH: Thyroid Stimulation Hormone

INTRODUCTION

Diabetes mellitus is a typical endocrine disorder that involves multiple organs of the body leading to significant morbidity and mortality due to its accompanying complications. It is described by high glucose because of irregularity in the carbohydrate, protein and fat metabolism. The basic pathology in diabetes mellitus is defective insulin secretion or action. The burden of diabetes mellitus in India as estimated by World Health Organization was 31.7 million in the year 2000 and 50.8 million in the year 2010. This number is expected to rise to 87 million in the year 2030¹. The Indian Council of Medical Research estimated that India has a prevalence of 77.2 million people with prediabetes and 62.4 million people with diabetes in the year 2011.²

Thyroid disorders are the second common endocrine disorders occurring next to diabetes mellitus. The prevalence of thyroid diseases are higher in people with diabetes mellitus than those without diabetes mellitus.^{3,4} Insulin and thyroid hormones play vital role in maintenance of cellular metabolism. Abnormality in one hormone level may alter the functional state of other hormone. Of all the thyroid dysfunctions subclinical hypothyroidism is the most common abnormality as per previous studies.^{5, 6, and 7}

Autoimmunity is the main reason explaining the association between type 1 diabetes mellitus and thyroid dysfunction. Though the mechanism behind association between type 2 diabetes mellitus and thyroid dysfunction is not clear it could be due to abnormal TSH response to TRH, absence of nocturnal TSH peak and a low T3 state.

Recognition and management of thyroid dysfunction in diabetes mellitus helps to achieve a good glycemic control, decrease the cardiovascular, renal risk and improve the general wellbeing. In view of background above, this study was taken up to study the relation between DM and thyroid dysfunction in patient attending medicine OPD to the Sir Takhtasinhji General Hospital, Bhavnagar.

AIM AND OBJECTIVES

➤ AIM:

- To access thyroid dysfunctions in patients with diabetes mellitus visiting outpatient department of medicine in sir takhtasinhji General hospital.

➤ OBJECTIVES:

- To evaluate spectrum of thyroid disorders in diabetic patients.
- To access altered thyroid Function in patients with diabetes mellitus regarding age, sex, duration of diabetes, family history, regularity of treatment and BMI.

MATERIALS AND METHODS

The present study is a Cross sectional study carried out after taking permission from ethical committee in patients who make visit of Sir Takhtasinhji General Hospital, Bhavnagar.

Study design: Cross sectional study.

Period of study: 9 month

Study group: The study group included 280 patients of diabetes without known thyroid disorders attending the outpatient departments who met the inclusion criteria.

Inclusion Criteria

- Patients of diabetes mellitus who gave informed consent to participate in the study.

Exclusion Criteria

- (1) Patients not willing for study ;
- (2) Patients with known thyroid disease;
- (3) Patients with chronic renal failure and Diabetic nephropathy;
- (4) Patients with acute illness (sepsis, acute MI, severe heart failure, recent admission in intensive care unit);
- (5) Patients with hepatic dysfunction ;
- (6) Patients with psychiatric illness;
- (7) Pregnancy ;
- (8) Patients on treatment with drugs interfering with thyroid function (amiodarone, propranolol, corticosteroids and oral contraceptives)

All patients in the study group were selected without any bias for sex, duration, severity or control of diabetes. A thorough history was recorded with particular emphasis on symptoms of hypothyroidism and hyperthyroidism. The presence of associated illness like coronary artery disease, hypertension and cerebrovascular accident were noted. Family history regarding diabetes mellitus and treatment history of oral hypoglycemic or insulin along with duration was also included.

BMI calculation

Body mass index (BMI) is calculated with height and weight of the subject using the following formula.

$$\text{BMI} = \text{weight (kg)} / \text{height (m}^2\text{)}$$

BMI (WHO criteria for Asian population): is used for classifying the subjects according to the weight status.

BMI Group BMI (kg/m²)

- (1) Underweight < 18.5 ; (2) Normal weight 18.5-24.9 ;(3) Overweight 25-29.9 ;(4) Obesity >30.0

Thyroid profile Reference values:

FT3: 1.7-3.7 pg/ml ; FT4: 0.7- 1.48 ng/dl ; TSH: 0.39-4.9 mIU/L

Estimation done in fasting serum sample.

Methods used:

- TSH - Ultrasensitive sandwich chemi luminescent immuno assay
- FT3 & FT4 - Competitive chemi luminescent immuno assay.

· Overt hypothyroidism is defined as TSH >10mIU/L with FT4 < 0.7 ng/dl. · Subclinical hypothyroidism is defined as TSH > 5mIU/L with normal FT3 and FT4 levels

· Overt hyperthyroidism is defined as TSH < 0.3 mIU/L with FT4 > 1.48 ng/dl · Subclinical hyperthyroidism is defined as TSH < 0.3mIU/L with normal FT3 and FT4 levels

OBSERVATION AND RESULTS**TABLE 1: AGE WISE DISTRIBUTION OF PATIENTS**

Age (in yrs)	Number of patients	
30-39	23	8.21%
40-49	75	26.79%
50-59	97	34.64%
60-69	57	20.36%
70-79	21	7.5%
≥ 80	7	2.5%
Total	280	100%

In the present study, it was found that the age range for cases was 32 to 86 years with a mean age of 54.03 ± 10.93 yrs. The maximum number of cases were between age group 50- 59 yrs.

TABLE 2: GENDER WISE DISTRIBUTION OF PATIENTS

Gender	Number of patients	
Male	158	56.42%
Female	122	43.57%
Total	280	100%

In the present study, the percentage of male patients presenting with DM was 158 (56.42%) to that of female patients which was 122 (43.57%). In addition, The ratio of male:female was 1.29:1.

TABLE 3: DURATION OF DM WISE DISTRIBUTION

Duration of DM	Number of patients	
< 1 yrs	37	13.21%
1-5yrs	125	44.64%

6-10yrs	91	32.5%
>10yrs	27	9.64%
Total	280	100%

In the present study, majority of cases that is 162 (57.85%) had duration of diabetes up to 5 years, 91 (32.5%) of patients had duration between 6-10 years and 27 (9.64%) of patients had duration of illness more than 10 years..

TABLE 4: FAMILY HISTORY WISE DISTRIBUTION

Family history of DM	Number of patients	
Yes	132	47.14%
No	148	52.85%
Total	280	100%

In the present study, 132 (47.14%) of patients had family history of diabetes and the remaining 148 (52.85%) had no family history.

TABLE 5: BMI WISE DISTRIBUTION

BMI (kg/m ²)	Number of patients	
18-24.9	131	46.79%
25-30	122	43.57%
>30	27	9.64%
Total	280	100%

Among the study population, 149 (53.21%) were overweight or obese; 131 (46.79%) had normal BMI and mean BMI was 25.79 ± 2.91

TABLE 6: TREATMENT WISE DISTRIBUTION

Treatment	No of patients	
Regular	211	75.35%
Irregular	69	24.64%
Total	280	100%

In the present study, out of 280 subjects of the study group 211 (75.35%) were on regular treatment and 69 (24.64%) were irregular.

TABLE 7: DISTRIBUTION OF THYROID FUNCTION

Thyroid Function	Number of patients	
Euthyroid	195	69.64%
SC Hypothyroidism	37	13.22%
Overt Hypothyroidism	23	8.21%
SC Hyperthyroidism	14	5.0%
Overt Hyperthyroidism	11	3.93%
Total	280	100%

In the present study, It was found that 37 (13.22%) of the patients had report suggestive of sub clinical hypothyroidism, 23 (8.21%) of the patients had overt hypothyroidism, 14 (5.0%) of the patients had sub clinical hyperthyroidism and 11 (3.93%) of the patients had overt hypothyroidism. Remaining, 195 (69.64%) had Normal Thyroid profile.

TABLE 7: CORRELATION OF THYROID FUNCTION IN DIABETIC PATIENTS

	Normal TSH (n=195)	Abnormal TSH (n=85)	P value
Age (in years)	54.01 ± 10.88	54.10 ± 11.02	0.9495
Gender: · Male	120(61.53%)	38 (44.7%)	0.0091

· Female	75 (38.46%)	47 (55.29%)	
Duration of DM (years)	5.73 ± 4.55	5.40 ± 3.78	0.5583
Family History of DM :			
· Yes	97 (49.74%)	35 (41.17%)	0.1866
· No	98 (50.25%)	50 (58.82%)	
Treatment :			
· Regular	169 (86.66%)	42 (49.41%)	<0.0001
· Irregular	26 (13.33%)	43 (50.85%)	
BMI (Kg/m ²)	25.69 ± 2.88	26.01 ± 3.01	0.3998

In the present study, it was found that abnormal thyroid profile of gender ($p=0.0091$) and treatment taken ($p<0.0001$) were statistically significant with normal thyroid profile respectively. While others parameters such as age, duration of DM, Family history and BMI (kg/m²) were statistically not significant. ($p>0.05$)

DISCUSSION

Diabetes mellitus is the most common endocrine disorder which involves multiple organ systems and leads to significant morbidity and mortality due to accompanying complications. Thyroid diseases are also a common endocrinopathy seen in the adult population. Thyroid hormones are intimately involved in cellular metabolism. Thus excess or deficit of either insulin or thyroid hormone could result in the functional derangement of the cellular metabolism.

AGE WISE DISTRIBUTION:

STUDIES	Mean Age
Sarode A et al ⁸	55.09±10.99 years
ChanderS et al ⁹	50.69 ± 11.48 years.
Reddy MS et al ¹⁰	55.98 ± 11.19 years
Present study	54.03 ± 10.93 years

In the present study, it was found that mean age of 54.03 ± 10.93 years. This observation is similar to WHO report which predicts that while the main increase in diabetes would be in the > 65 year age group in the developed countries, in India and developing countries the highest increase would occur in the age group of 45-65 year of age group. Similar observational study comprises in the above table.

GENDER WISE DISTRIBUTION:

STUDIES	Male	Female
M.V.Jali et al ¹²	10.1%	25%
Ibrahim M et al ¹¹	12%	17%
Present study	13.2%	16.27%

In the present study, the percentage of male patients of DM presenting with altered TFT was 13.2% to that of female patients which was 16.27%. This observation was similar to Ibrahim M et al¹¹ and M.V.Jali et al¹² who reported that prevalence of altered TFT among women was higher than in men. (TFT: Thyroid function tests)

DURATION OF DIABETESMELLITUS:

ChanderS et al ⁹	P value - 0.76
Present study	P value - 0.55

Majority of cases that is 162 (57.85%) had duration of diabetes up to 5 years followed by 91 (32.5%) of patients had duration between 6-10 years. Similar study was done by **ChanderS et al⁹** in which 65.3% had duration of diabetes up to 5 years

Duration of DM appears to influence thyroid function in two sites; firstly at the level of hypothalamic control of TSH release and secondly at peripheral tissue by converting T4 to T3. Hyperglycemia causes reduction in hepatic concentration of T4-5deiodinase, low serum concentration of T3, raised levels of reverse T3 and low, normal, or high level of T4. Thyroid Hormone regulates metabolism and diabetes can alter metabolism.

FAMILY HISTORY OF DIABETES MELLITUS:

In the present study, 132 (47.14%) of patients had family history of diabetes and the remaining 148 (52.85%) had no family history. **Vishwanthant et al¹³** conducted a study among 107 subjects. Out of 73 subjects who gave positive family history, 19 subjects (26%) later developed disease.

BMI:

Among the study population, 149 (53.21%) were overweight or obese; 131 (46.79%) had normal BMI. Moreover, the mean BMI was $25.79 \pm 2.91 \text{ kg/m}^2$. While the mean BMI of the patients with altered TFT was 26.01 ± 3.01 , compared to normal 25.69 ± 2.88 in patients with normal thyroid function. So, there is no significant correlation between BMI and altered TFT in present study. **Reddy MS et al¹⁰** reported that thyroid abnormalities increased with rising BMI in

Diabetic patients compared to control patients. So, smaller sample size in present study may be the limitation.

PREVALANCE OF THYROID PROFILE:

Pasupthi et al¹⁴	45%
Vinu V et al¹⁵	28.75%
Diez et al¹⁶	32.4%
Present study	30.35%

The prevalence of thyroid disorder found as 30.35%.which is comparable with other similar studies conducted by **Pasupthi et al¹⁴** which has 45%; **Vinu V et al¹⁵** which has 28.75%.In addition, **Diez et al¹⁶** study from Spain reported 32.4% prevalence of thyroid dysfunction.

DISTRIBUTION OF THYROID ABNORMALITIES:

	Subclinical Hypothyroidism	Overt (clinical) hypothyroidism	Subclinical hyperthyroidism	Overt(clinical) hyperthyroidism
Demitrost L et al⁵	16.3%	11.4%	2.0%	1.5%
ChanderS et al⁹	14.7%	10%	2%	0.6%
RaghuvanshiPK et al¹⁸	10%	15%	0%	2.5%
Present study	13.22%	8.21%	5.0%	3.93%

It was found that (13.22%) of the patients had report suggestive of sub clinical hypothyroidism, (8.21%)of the patients had overt hypothyroidism, (5.0%) of the patients had sub clinical hyperthyroidism and 11 (3.93%)of the patients had overt hypothyroidism.

Demitrost Let al⁵have found that 68.8% were euthyroid, 16.3% had subclinical hypothyroidism, 11.4% had clinical (overt) hypothyroidism, 2% had subclinical hyperthyroidism and 1.5% wereclinical(overt) hyperthyroidism cases.

Chander Set al⁹also found that the prevalence of subclinical hypothyroidism was 14.7 %, clinical hypothyroidism was 10%, and sub clinical hyperthyroidism was 2 % and clinical hyperthyroidism 0.6 %.

Raghuvanshi PK et al¹⁸had found that the prevalence of hypothyroidism, subclinical hypothyroidism and hyperthyroidism was found to be 10%, 15% and 2.5% respectively.

This study had smaller sample size (n=80), which might be reason for discrepancy in results.

The Presence Of Altered Thyroid Profile In Diabetic Patients May Be Due To The Fact That:

In euthyroid individuals with diabetes mellitus, the serum T3 levels, basal TSH levels and TSH response to thyrotropin releasing hormone (TRH) may all be strongly influenced by the glycemic status. Poorly controlled diabetes may also result in impaired TSH response to TRH or loss of normal nocturnal TSH peak. It may be related to older age of the DM patients.

CORRELATION OF NORMAL AND ABNORMAL THYROID WITH OTHER PARAMETERES

In the present study, it was found that abnormal thyroid profile of gender ($p=0.0091$) and treatment taken ($p<0.0001$) were statistically significant with normal thyroid profile respectively. While others parameters such as age, duration of DM, Family history and BMI (kg/m^2) were statistically not significant. ($p>0.05$) This is consistent with the results of **ChanderS et al⁹** and **Mehalingam et al¹⁹** who also reported that there is no significant association between thyroid disorders and duration of diabetes and age.

SUMMARY

Primary observations regarding thyroid profile in patients with diabetes mellitus.

- in the present study, 30.35% of patients with diabetes mellitus had abnormal thyroid profile.
 - in patients with abnormal thyroid profile (30.35%), most common abnormality was subclinical hypothyroidism (43.52%) followed by overt hypothyroidism (27.05%).
 - Our study showed significant correlation between abnormal thyroid profile and gender and type of treatment.
- in persons with abnormal thyroid profile, 55.29% were females and 44.70% were males. This is statistically significant. The prevalence of thyroid abnormalities is more common in females than in males.
- No significant correlation was found between altered thyroid profile and age, duration of DM, Family history and BMI (kg/m^2).

CONCLUSION

The prevalence of thyroid disorders was high (30.35%) in patients with diabetes. Among the thyroid disorders, subclinical hypothyroidism was the most common. Duration of diabetes had no significant impact on thyroid disorders. Therefore, considering the higher prevalence of thyroid disorders, early and routine screening for thyroid disorders is suggested to reduce the morbidity and mortality among the diabetic patients.

LIMITATION

- Study population was small and taken from one small geographical area
- Associated thyroid autoimmunity was not evaluated due to constraint of laboratory, so it was not able to refine the spectrum of thyroid dysfunction in diabetes.

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