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Prevalence of Hypothyroidism among Type 2 Diabetes Mellitus Patients Attending at Tertiary Health Care Centre

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A B S T R A C T

This cross-sectional study aimed to determine the prevalence of hypothyroidism among Type 2 Diabetes Mellitus (T2DM) patients at a tertiary healthcare center. The study also examined the association of various risk factors with hypothyroidism in these patients. A total of 101 T2DM patients were included, and data on thyroid function, blood glucose levels, and other metabolic parameters were collected. The results indicated a high prevalence of hypothyroidism among T2DM patients, with significant associations found between hypothyroidism and factors such as diabetes duration, BMI, and blood glucose levels. These findings highlight the need for routine thyroid function screening in T2DM patients to manage and mitigate complications.

Keywords: Type 2 Diabetes Mellitus, Hypothyroidism, Prevalence.

INTRODUCTION

Diabetes mellitus is a collection of common metabolic disorder mainly considered by hyperglycemia which results commencing from defective insulin secretion or insulin action or together [1]. It is a diverse group of diseases with different groups of etiology such as social, environmental, and genetic factors which act concurrently or mutually [2].

Thyroid hormones play an indispensable role in various metabolic processes in our body. The thyroid gland produces two types of hormones, T3 and T4 [7]. The major variation in the thyroid hormones system is a decrease in the Thyroid stimulating hormone (TSH) stimulation over the thyroid gland, which is possibly caused by central hypothyroidism and in the local production of T3 and T4 [3, 4]. These hormones play a important role in cell differentiation during development and also help to maintain thermogenesis and metabolic homeostasis in the adults [5, 6].

In addition, they have a crucial role in maintaining cellular homeostasis; when thyroid hormone levels in the body are out of balance, they can cause multiple disorders, which include diabetes mellitus, cardiovascular disease, and chronic liver disease [7, 8]. Thyroid diseases in Diabetes mellitus patients are regularly encountered. The clinical

relationships between them are more commonly recognized with hypothyroidism among Diabetes patients. Thyroid hormones are insulin antagonists. Iodothyronines with high levels act as diabetogenic while low levels of iodothyronines inhibit the development of Diabetes [9, 10].

Glycemic control is influenced by thyroid hormones through a range of actions on intermediary metabolism. Hyperglycemia is promoted by Excess thyroid hormones levels through facilitating glucose intestinal absorption, enhancing glycogenolysis and Gluconeogenesis and increasing insulin clearance [11, 12]. In diabetes patients, hypothyroidism may control glucose metabolism at various levels. These effects consist of decreases in hepatic glucose production, Gluconeogenesis, and increased peripheral glucose consumption. The general effects of these processes are progress to hypoglycemia. Recurrent hypoglycaemic attacks were recognized in children and adolescents who have diabetes and subclinical hypothyroidism [13, 14].

With these backgrounds, the present study aims to focus on to find out the prevalence of thyroid dysfunction in Type 2 DM patients. An effort was made to study Risk factors associated With Hypothyroidism among Type 2 Diabetes mellitus patients and to study hypothyroidism among type 2 Diabetes Mellitus with special reference to the duration of Diabetes Mellitus.

MATERIAL AND METHODS

This cross-sectional study was conducted on patients from medicine wards, the Medicine Intensive Care Unit, and the Medicine OPD of Government Medical College from August 1, 2017, to December 1, 2019. Patients were enrolled based on specific inclusion and exclusion criteria, and consent was obtained.

Eligibility Criteria:

- **Inclusion Criteria:** Type 2 DM patients over 40 years old willing to participate.
- **Exclusion Criteria:** Pregnant women, Type 2 DM patients with nephropathy or acute illness, hyperthyroid patients on treatment, individuals with previous thyroid surgery or radioiodine therapy, those on drugs causing thyroid dysfunction, and those unwilling to give consent.

Sample Size and Sampling Technique

The prevalence of hypothyroidism among type 2 diabetes was 51.25%. 81 Considering a 95% confidence level and 10% allowable error, our sample size was 101. All the patients fulfilling the inclusion criteria were included in the study till the sample size was complete using purposive sampling.

Statistical Analysis

Data were analyzed using Epi Info, Version 7. Means were tested with the t-test and proportions with the chi-square test. Variables with p-values less than 0.05 were considered statistically significant. Various statistical measures, including range, frequencies, percentages, means, standard deviations, chi-square, and p-values, were calculated.

Sample Collection

5ml of fasting venous blood samples were collected in clot activator-coated polypropylene tubes by venipuncture under strict aseptic precaution as soon as the subjects were admitted as per the inclusion criteria. Similar way 2 hours post-prandial was also collected. Blood samples were centrifuged at 3500 rpm for 10 minutes and serum was separated. 8-12 hours of fasting samples and 2 hours of postprandial samples were collected from all subjects during their hospital visit, and an analysis of the below-said parameters was done.

Investigations

Fasting and Postprandial blood glucose _ Fasting Serum Lipid parameters which include (Total cholesterol, Triglycerides, LDL-cholesterol, HDL- HDL-cholesterol) Above mentioned test were analyzed in BS-420 Fully auto analyzer _ Serum Thyroid profile - fT3, fT4, and TSH was done in ELISA reader.

RESULTS AND OBSERVATIONS

A total of 101 type 2 diabetes mellitus patients were studied and final analysis was done on the data collected from these study subjects. The results of the 101 study subjects are as follows:

Table 1: Distribution of study subjects according to age and sex

Age in Years	Sex		Total No. (%)
	Male No. (%)	Female No. (%)	
40–49	12(11.9)	16(15.8)	28(27.2)
50–59	8(7.9)	11(10.9)	19(18.8)
60andabove	22(21.8)	32(31.7)	54(53.5)

Total	**42(41.6)**	**59(58.4)**	**101(100.0)**

Table 1 shows age wise distribution of study subjects. The mean age of study subjects was 57.4(±11.43SD) years. Out of total 101 study subjects, 42(41.6%) were males and 59(58.4%) were females. Out of total, most of the study subjects i.e.54 (53.5%) were in age group of 60 and above years followed by 28 (27.2%) in 40 —49 years of age group. However only 19 subjects (18.8%) were in age group of 50-59 years.

Table 2: Association of Duration of type 2 diabetes mellitus and hypothyroidism

Duration of diabetes	**Hypothyroidism**		**Euthyroidism**
	Subclinical	**Overt**	
<10years	13(12.9%)	2(1.9%)	67(66.3%)
>10years	13(12.9%)	5(4.9%)	1(0.9%)
Total	**26(25.7%)**	**7(6.9%)**	**101(100.0)**

(χ^2=42.63, df=2, p=< 0.00001)

Table 2 shows association between Duration of type 2 diabetes mellitus and hypothyroidism among study subjects. Out of 101 subjects, 67(66.3%) were euthyroid having duration of type 2 diabetes mellitus less than 10 years and only one had duration of diabetes more than 10 years. Out of total 33 (32.7%) study subjects having subclinical hypothyroidism 13(12.9%) were subclinical with duration of diabetes mellitus less than 10 years and 13(12.9%) had type 2 diabetes mellitus more than 10 years. Out of total 7 (6.9%) study subjects having overt hypothyroidism 2(1.9%) were with duration of diabetes mellitus less than 10 years and 5(4.9%) had type 2 diabetes mellitus more than 10 years. The hypothyroidism was significantly associated with the duration of diabetes more than 10 years (p<0.00001).

Association between pulse rate and hypothyroidism among study subjects. Out of 101 subjects, 3(2.9%) were euthyroid having pulse rate less than 60bpm and 65(64.4%) had pulserate more than 60bpm

Among 33(32.8%) hypothyroid study subjects, 14(13.9%) were having pulserate less than 60bpm and 19(18.8%) hadpulseratemorethan60bpm.Thehypothyroidism was significantly associated with the pulse rate less than 60 bpm (Fisher' sex act test-p=0.0001).

Association between mean systolic blood pressure and hypothyroidism among study subjects. Themeansystolicanddiastolicbloodpressurewas133.45±19.36 and 83.33±8.16 among hypothyroid studysubjects, 131.76 ±20.14 and 84.0 ±10.37 euthyroid study subjects. The mean systolic blood pressure was not significantly associated between hypothyroid study subjects and euthyroid study subjects (p=0. 6897). The mean diastolic blood pressure was not significantly associated between hypothyroid study subjects and euthyroid study subjects (p=0.7457).

Association between systolic blood pressure and hypothyroidism among study subjects. Out of 101 subjects, 74 (73.3%) had normal systolic blood pressure and 27 (26.7%) were having higher systolic blood pressure. Among the hypothyroid study subjects, 23(22.8%) had normal systolic blood pressure and 10(9.9%) were having higher systolic blood pressure. The hypothyroidism was not significantly associated with the high systolic blood pressure (p=0.5722).

Association between diastolic blood pressure and hypothyroidism among study subjects. Out of 101 subjects, 91 (90.1%) had normal diastolic blood pressure and 10(9.9%) were having higher diastolic blood pressure. Among the hypothyroid study subjects, 32(31.7%) had normal diastolic blood pressure and 1(0.9%) was having higher diastolic blood pressure. The hypothyroidism was not significantly associated with the high diastolic blood pressure (p=0.1597).

Table 3: Association of Body Mass Index and hypothyroidism

BMI	**Hypothyroidism**	**Euthyroidism**
<22.9	16(15.8%)	19(18.8%)
≥23	17(16.8%)	49(48.5%)
Total	**33(32.8%)**	**68(67.3%)**

(χ^2=4.141, df=1, p=0.0419)

Table 3 shows the association of body mass index with hypothyroidism among study subjects. Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 16(15.8%) were having BMI less than 22.9

while 17(16.8%) were overweight with a BMI of ≥ 23. Of the 68 euthyroid study subjects, 19(18.8%) were having BMI less than 22.9 while 49(48.5%) were overweight with a BMI of ≥ 23. The BMI was significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects (p=0.0419).

Table 4: Association of Body Mass Index and hypothyroidism

BMI	Hypothyroidism	Euthyroidism
<22.9	16(15.8%)	19(18.8%)
≥23	17(16.8%)	49(48.5%)
Total	**33(32.8%)**	**68(67.3%)**

(χ^2=4.141, df=1, p=0.0419)

Table 4 shows the association of body mass index with hypothyroidism among study subjects. Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 16(15.8%) were having BMI less than 22.9 while 17(16.8%) were overweight with a BMI of ≥ 23. Of the 68 euthyroid study subjects, 19(18.8%) were having BMI less than 22.9 while 49(48.5%) were overweight with a BMI of ≥ 23. The BMI was significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects (p=0.0419)

Table 5: Association of blood sugar level and hypothyroidism

Blood sugar level		Hypothyroidism	Euthyroidism
Fasting	<126	5(4.9%)	12(11.9%)
	≥126	28(27.7%)	56(55.4%)
Total		**33(32.8%)**	**68(67.3%)**
Postprandial	<200	3(2.9%)	9(8.9%)
	≥200	30(29.7%)	59(58.4%)
Total		**33(32.8%)**	**68(67.3%)**

Fasting-(χ^2=4.841, df=1, p=0.0354) Postprandial-(χ^2= 5.887, df=1, p=0.0234)

Table 5 shows the association of blood sugar level with hypothyroidism among study subjects. Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 5(4.9%) were having Fasting blood sugar level less than 126 while 28(27.7%) were with a Fasting blood sugar level more than or equal to 126. Among the 68 euthyroid study subjects, 12(11.9%) were having Fasting blood sugar level less than 126 while 56(55.4%) were with a Fasting blood sugar level more than or equal to 126. The fasting blood sugar level was significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects (p=0.0354). Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 3(2.9%) were having Post prandial blood sugar level less than 200 while 30(29.7%) were with a Postprandial blood sugar level more than or equal to 200. Of the 68 euthyroid study subjects, 9(8.9%) were having Post prandial blood sugar level less than 200 while 59(58.4%) were with a Post prandial blood sugar level more than or equal to 200. The post prandial blood sugar level is significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects (p=0.0234).

Table 6: Distribution of different risk components associated with Hypothyroidism and Type 2 diabetes mellitus

Risk components associated with Hypothyroidism		Hypothyroidism	Euthyroidism	Pvalue
Mean Age(SD)		57.85±11.67	57.21±11.40	0.7934
Mean Blood glucose level (SD)	Fasting	156.45±32.47	131.88±26.04	**0.0001**
	Postprandial	246.98±41.23	235.24±54.11	0.2740
Mean systolic BP(SD)		133.45±19.36	131.76±20.14	0.6897
Mean diastolic BP(SD)		83.33±8.16	84.0±10.37	0.7457
Mean weight (SD)		61.39±12.72	61.34±11.24	0.9840
Mean BMI (SD)		26.86±3.99	23.44±4.06	**0.0001**

DISSCUSSION

Present cross sectional study was done to find out the prevalence of thyroid dysfunction in Type 2 DM patients. An effort was made to study Risk factors associated With Hypothyroidism among Type 2 Diabetes mellitus patients and to study hypothyroidism among type 2 Diabetes Mellitus with special reference to duration of Diabetes Mellitus. A total of 101 type 2 diabetes mellitus patients were studied and final analysis was done on the data collected from these subjects.

The findings of this study are discussed below.

Age and sex wise distribution of study subjects

The mean age of study subjects was 57.4(+ 11.43SD) years. Out of total 101 study subjects, 42(41.6%) were males and 59(58.4%) were females. Out of total, most of the study subjects i.e. 54 (53.5%) were in age group of 60 and above years followed by 28 (27.2%) in 40 – 49 years of age group. However only 19 subjects (18.8%) were in age group of 50-59 years.

Wei Zhao *et al*., (2018) [15], did a single center study of thyroid function in patients with Type 2 diabetes mellitus and diabetic nephropathy. The included 103 healthy volunteers, 100 Type 2 DM patients without Diabetic nephropathy and 139 Diabetic nephropathy. The study included patients with Type 2 DM aged 18-80 years who were hospitalized in the Department of Endocrinology, Dalian Municipal Central Hospital Affiliated of Dalian Medical University, China. In this study no difference was found in gender or age among the three groups.

Prevalence of hypothyroidism among type 2 diabetes mellitus

The prevalence of Hypothyroidism among subjects in the study group who had type 2 diabetes was 32.67% whereas euthyroid were 67.3%. Considering the prevalence of hypothyroidism among subjects in the study group who had diabetes, 25.7% had subclinical hypothyroidism and 6.9% had overt hypothyroidism. Akbar *et al*., [16] in their study found that the prevalence of thyroid dysfunction in T2DM patients was reported to be 12.3% in Greece and 16% in Saudi Arabia. Vij V *et al*., [17] in their case control revealed that 28.75% of patients with diabetes mellitus had abnormal thyroid function and also it justified the view that all type 2 diabetic patients should be screened for thyroid disorders.

Duration of type 2 diabetes mellitus and hypothyroidism

Out of 101 subjects, 67 (66.3%) were euthyroid having duration of type 2 diabetes mellitus less than 10 years and only one had duration of diabetes more than 10 years. Out of total 33 (32.7%) study subjects having subclinical hypothyroidism 13(12.9%) were subclinical with duration of diabetes mellitus less than 10 years and 13(12.9%) had type 2 diabetes mellitus more than 10 years.Out of total 7 (6.9%) study subjects having overt hypothyroidism 2(1.9%) were with duration of diabetes mellitus less than 10 years and 5(4.9%) had type 2 diabetes mellitus more than 10 years. The hypothyroidism was significantly associated with the duration of diabetes more than 10 years ($p < 0.00001$). Kuldeep Chandel *et al*., [18] in their study conducted in Jhansi found that hypothyroidism was more prevalent with duration of diabetes more than 5-10 years. Abhay Tirkey*et al*., [19] in their study in India, they found that the prevalence of thyroid dysfunction increases with duration of diabetes.

Association of Body Mass Index and hypothyroidism

Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 16(15.8%) were having BMI less than 22.9 while 17(16.8%) were overweight with a BMI of ≥ 23. Of the 68 euthyroid study subjects, 19(18.8%) were having BMI less than 22.9 while 49(48.5%) were overweight with a BMI of ≥ 23. The BMI is significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects ($p = 0.0419$). Athanasia Papazafiropoulou *et al*., (2010) [20] conducted a study to determine the prevalence of thyroid dysfunction in patients with type 2 diabetes attending an outpatient clinic. They examined thyroid dysfunction in a total of 1092 patients with Type 2 diabetes. It was found that diabetic patients with thyroid dysfunction had higher values of BMI ($p=0.03$). Pankaj Kumar Jha*et al*., (2017) [21], did a study on 80 patients in geriatric age group with Type-2 diabetes mellitus visiting the medicine out-patients department. A significant association was seen between increasing BMI values with the prevalence of thyroid dysfunction where 26(78%) of the 32 hypothyroid patients in the study group had BMI >25 (Grade I and II obesity) with diabetes.

Association of blood sugar level and hypothyroidism

Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 5(4.9%) were having Fasting blood sugar level less than 126 while 28(27.7%) were with a Fasting blood sugar level more than or equal to 126. Among the 68 euthyroid study subjects, 12(11.9%) were having Fasting blood sugar level less than 200 while 56(55.4%) were with a Fasting blood sugar level more than or equal to 200. The fasting blood sugar level is significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects ($p = 0.0354$). Out of 101 subjects, 33(32.8%) were hypothyroid and among hypothyroid study subjects 3(2.9%) were having Postprandial blood sugar level less than 200 while 30(29.7%) were with a Postprandial blood sugar level more than or equal to 200. Of the 68 euthyroid study subjects, 9(8.9%) were having Postprandial blood sugar level less than 200 while 59(58.4%) were with a Postprandial blood sugar level more than or equal to 200. The postprandial blood sugar level is significantly associated with hypothyroidism among type 2 diabetes mellitus study subjects. ($p = 0.0234$) Sarguru Datchinamoorthi *et al*., (2016) [22] did a prospective study for thyroid dysfunction in type II diabetics. The study included 50- type II DM patients of age group (35-60 years), and 50- age matched healthy controls. They found that the FPG level in patients with type II DM was found to be 170+ 10 mg/dl which is significantly higher than control subjects i.e. 93+13 mg/dl. Abilash Nair (2018) *et al*., [23], conducted a retrospective study at Indian Institute of Diabetes, Thiruvananthapuram to determine the prevalence of hypothyroidism in Indian patients in Type 2 Diabetes Mellitus. In this study it was found that the mean

FBS in clinically hypothyroid patients was 171. 71+ 65.5 mg/dl and the PPBS was 258.51+109.8 mg/dl. There was no significant association between blood sugar level and hypothyroid patients with type 2 diabetes mellitus.

CONCLUSION

In the present study the prevalence of hypothyroidism among subjects in the study group who had type 2 diabetes was 32.67% where aseuthyroid were 67.3%. Statistical significance of association was observed between hypothyroidism and duration of type 2 diabetes mellitus, bradycardia, body mass index and fasting and post-prandial blood sugar level. In this study no statistically significant association was found with respect to age, sex, systolic blood pressure and diastolic blood pressure. This study provides insight to the association of duration of type 2 diabetes mellitus, bradycardia, body mass index, blood sugar level and hypothyroidism.

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