e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(5); 586-591

Original Research Article

Assessment of Thyroid Dysfunction in Type 2 Diabetes Mellitus Patients

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Received: 01-02-2026 / Revised: 15-03-2026 / Accepted: 21-04-2026

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Conflict of interest: Nil

Abstract

Background: Type 2 diabetes mellitus is a chronic metabolic disorder frequently associated with endocrine abnormalities, among which thyroid dysfunction is one of the most common. Thyroid hormones influence carbohydrate metabolism, insulin sensitivity, and glucose homeostasis. The coexistence of thyroid dysfunction with diabetes mellitus may adversely affect glycemic control and increase the risk of diabetic complications.

Aim: To study the thyroid function tests in type 2 diabetes mellitus patients.

Objectives: To estimate the levels of thyroid function tests in patients with type 2 diabetes mellitus.

Methodology: The present hospital-based observational cross-sectional study was conducted among 120 patients with type 2 diabetes mellitus attending a tertiary care centre. Patients fulfilling the inclusion criteria were enrolled after obtaining informed consent. Clinical evaluation and laboratory investigations including thyroid function tests such as serum T3, T4, and TSH were performed. Data were analyzed using appropriate statistical methods, and a p-value less than 0.05 was considered statistically significant.

Results: The majority of patients belonged to the 51–60 years age group (35.0%). Females constituted 56.7% of the study population. Thyroid dysfunction was present in 25.8% of patients, while 74.2% were euthyroid. Subclinical hypothyroidism was the most common thyroid abnormality observed in 16.7% of patients, followed by hypothyroidism in 6.7% and hyperthyroidism in 2.5%. Thyroid dysfunction was more common among females compared to males, although the association was statistically insignificant ($p>0.05$).

Conclusion: Thyroid dysfunction is common among patients with type 2 diabetes mellitus, with subclinical hypothyroidism being the predominant abnormality. Routine screening for thyroid dysfunction in diabetic patients may help in early diagnosis and better metabolic management.

Keywords: Type 2 diabetes mellitus, Thyroid dysfunction, Subclinical hypothyroidism, Thyroid function tests.

DOI: 10.25258/ijcpr.18.5.91

Introduction

Type 2 diabetes mellitus is one of the most common chronic metabolic disorders worldwide and is characterized by insulin resistance, progressive beta-cell dysfunction, and persistent hyperglycemia. Along with abnormalities in carbohydrate metabolism, patients with type 2 diabetes frequently develop disturbances in lipid metabolism, vascular function, and endocrine regulation. Among the endocrine abnormalities associated with diabetes, thyroid dysfunction is particularly important because both diabetes and thyroid disorders influence basal metabolic rate, glucose utilization, insulin sensitivity, lipid profile, body weight, and cardiovascular risk [1]. The coexistence of these two disorders may worsen metabolic control and increase the risk of long-term complications, making thyroid function testing clinically relevant in patients with type 2 diabetes mellitus. The thyroid gland plays an essential role in maintaining metabolic homeostasis through the secretion of triiodothyronine and thyroxine, under the regulatory control of thyroid-stimulating hormone. Thyroid hormones affect hepatic glucose production, intestinal glucose absorption, pancreatic insulin secretion, peripheral glucose uptake, and insulin-mediated glucose disposal. Therefore, even mild alterations in thyroid function can influence glycemic status in diabetic patients [2]. Hypothyroidism is commonly associated with reduced glucose disposal, weight gain, dyslipidemia, and increased insulin resistance, whereas hyperthyroidism may increase hepatic gluconeogenesis, accelerate insulin degradation, and worsen hyperglycemia. These mechanisms

explain why abnormal thyroid function may complicate diabetes management and alter the interpretation of glycemic control. Recent evidence shows that thyroid dysfunction is more common among patients with type 2 diabetes than in the general population. A recent systematic review and meta-analysis reported a pooled prevalence of thyroid dysfunction of approximately 20.24% among adult patients with type 2 diabetes mellitus, with subclinical hypothyroidism being the most frequent abnormality [1]. This finding is clinically significant because subclinical thyroid dysfunction may remain asymptomatic and can easily be missed unless thyroid function tests are performed. Since many symptoms of thyroid disease, such as fatigue, weight change, constipation, sweating, palpitations, and weakness, may overlap with diabetes-related complaints, laboratory evaluation becomes important for early detection.

The relationship between thyroid dysfunction and type 2 diabetes mellitus is bidirectional. Diabetes may influence the hypothalamic-pituitary-thyroid axis, alter peripheral conversion of thyroxine to triiodothyronine, and affect serum thyroid hormone levels during periods of poor glycemic control [3]. Conversely, thyroid dysfunction may contribute to insulin resistance and impaired glucose metabolism. Longitudinal evidence has suggested that dynamic changes in thyroid-stimulating hormone and free thyroxine levels may be associated with the future development of type 2 diabetes, further supporting the metabolic interconnection between thyroid hormones and glucose regulation [2]. Thus, thyroid function tests in diabetic patients are not only useful for detecting thyroid disease but may also help in understanding broader metabolic risk.

Subclinical hypothyroidism deserves special attention in type 2 diabetes mellitus because it is often the most commonly observed thyroid abnormality. It is characterized by elevated thyroid-stimulating hormone with normal circulating thyroid hormone levels and may not produce obvious clinical symptoms. However, it has been associated with dyslipidemia, endothelial dysfunction, increased body mass index, poor glycemic control, and higher cardiovascular risk [4]. In diabetic patients, these changes may aggravate pre-existing vascular risk factors and contribute to complications such as nephropathy, neuropathy, retinopathy, and cardiovascular disease. Therefore, identifying subclinical thyroid dysfunction may provide an opportunity for closer monitoring and timely management.

Several studies have shown that thyroid dysfunction in type 2 diabetes is more frequent among females, older individuals, patients with longer duration of diabetes, those with poor glycemic control, obesity, dyslipidemia, and family history of thyroid disease [1,5]. These risk factors are commonly encountered in tertiary care settings, where patients often present with advanced diabetes, multiple comorbidities, and complications. A hospital-based evaluation of thyroid function tests in such patients can therefore provide useful information regarding the pattern of thyroid abnormalities and their association with diabetic status. This is especially important in Indian tertiary care centres, where the burden of diabetes is high and routine screening practices may vary.

Thyroid dysfunction may also influence diabetic complications. Recent studies have observed that patients with type 2 diabetes and thyroid abnormalities may have a higher frequency of cardiovascular disease, neuropathy, nephropathy, and other metabolic complications compared with euthyroid diabetic patients [5,6]. Thyroid hormones have important effects on vascular tone, lipid metabolism, renal function, and myocardial contractility. As a result, undiagnosed thyroid dysfunction may silently worsen the clinical course of diabetes. Detecting abnormalities in T3, T4, free T4, and TSH may help clinicians identify patients requiring more detailed metabolic and cardiovascular assessment.

Poor glycemic control may further complicate thyroid status. Elevated HbA1c has been associated with altered thyroid-stimulating hormone levels and thyroid hormone changes in several clinical studies [7]. Chronic hyperglycemia, insulin resistance, and inflammatory changes may interfere with thyroid hormone metabolism and thyroid gland function. On the other hand, untreated hypothyroidism may worsen lipid abnormalities and contribute to difficulty in achieving good glycemic control. This close relationship highlights the need to evaluate thyroid function tests as part of comprehensive diabetic care, especially in patients with uncontrolled diabetes or long-standing disease.

The pattern of thyroid dysfunction in diabetic patients varies across different populations and clinical settings. Some studies report predominance of subclinical hypothyroidism, while others show higher rates of overt hypothyroidism or mixed thyroid abnormalities [8,9]. These variations may be due to differences in age, sex distribution, iodine status, autoimmune thyroid disease, duration of diabetes, obesity, drug use, and study methodology. Hence, local data from tertiary care centres remain important for understanding the actual burden and pattern of thyroid dysfunction among type 2 diabetes patients in a specific region. In this context, the present study titled “A study of thyroid function tests in type 2 diabetes mellitus patients in a tertiary care centre” is undertaken to estimate thyroid function test levels in patients with type 2

diabetes mellitus. By assessing thyroid parameters such as T3, T4, and TSH, the study aims to identify the frequency and pattern of thyroid abnormalities among diabetic patients. The findings may support the importance of routine thyroid screening in type 2 diabetes mellitus and may help in improving overall metabolic management, early diagnosis of thyroid dysfunction, and prevention of diabetes-related complications [10].

Material and Methods

The present study was conducted as a hospital-based observational cross-sectional study in the Department of Medicine at a tertiary care centre. The study included 120 patients diagnosed with type 2 diabetes mellitus who attended the outpatient department or were admitted during the study period. The aim of the study was to evaluate thyroid function tests in patients with type 2 diabetes mellitus and to assess the pattern of thyroid dysfunction among them.

Patients aged 30 years and above with a confirmed diagnosis of type 2 diabetes mellitus were included in the study after obtaining informed consent. Patients with known thyroid disease, those already receiving thyroid medication, pregnant women, patients with type 1 diabetes mellitus, critically ill patients, and patients taking drugs known to affect thyroid function such as amiodarone, lithium, steroids, or antithyroid drugs were excluded from the study.

A detailed clinical history was obtained from all participants, including age, sex, duration of diabetes, treatment history, and symptoms suggestive of thyroid dysfunction, family history, and associated comorbidities. General physical examination and systemic examination were performed. Relevant anthropometric measurements and clinical parameters were recorded in a predesigned proforma. Venous blood samples were collected from all participants under aseptic precautions. Fasting blood glucose, postprandial blood glucose, HbA1c, and thyroid function tests including serum T3, T4, and TSH were estimated using standard laboratory methods. Based on thyroid function test results, patients were categorized as euthyroid, hypothyroid, hyperthyroid, and subclinical hypothyroid, or subclinical hyperthyroid according to standard reference ranges used by the institutional laboratory.

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables such as age, duration of diabetes, blood glucose levels, HbA1c, T3, T4, and TSH were expressed as mean and standard deviation. Categorical variables such as sex distribution, thyroid status, and presence of thyroid dysfunction were expressed as frequency and percentage. The chi-square test was used to assess associations between categorical variables. Student's t-test was used to compare mean values between two groups wherever applicable. A p-value of less than 0.05 was considered statistically significant.

Prior approval was obtained from the Institutional Ethics Committee before the commencement of the study. Written informed consent was obtained from all participants after explaining the purpose and procedure of the study. Confidentiality of patient information was maintained throughout the study, and the data were used only for research purposes.

Results

Table 1 shows the distribution of patients according to age group among the 120 study participants. The majority of patients belonged to the 51–60 years age group comprising 42 patients (35.0%), followed by 41–50 years with 34 patients (28.3%). Patients aged 61–70 years constituted 23 patients (19.2%), while 31–40 years and 71–80 years accounted for 13 (10.8%) and 8 (6.7%) patients respectively. The findings indicate that type 2 diabetes mellitus was more commonly observed among middle-aged and elderly individuals, particularly in the fifth and sixth decades of life.

Table 2 demonstrates the gender-wise distribution of the study participants. Out of 120 patients, 68 (56.7%) were females and 52 (43.3%) were males, showing a slight female predominance among type 2 diabetes mellitus patients included in the study.

Table 3 depicts the distribution of thyroid dysfunction among the study population. Thyroid dysfunction was present in 31 patients (25.8%), whereas 89 patients (74.2%) were euthyroid without evidence of thyroid abnormality. The findings indicate that approximately one-fourth of patients with type 2 diabetes mellitus had some form of thyroid dysfunction. Table 4 shows categorization of patients according to thyroid function status. Euthyroid status was observed in 89 patients (74.2%). Among thyroid abnormalities, subclinical hypothyroidism was the most common and was seen in 20 patients (16.7%), followed by hypothyroidism in 8 patients (6.7%). Hyperthyroidism was noted in 3 patients (2.5%). The results demonstrate that subclinical hypothyroidism constituted the major thyroid dysfunction among diabetic patients. Table 5 illustrates the association between gender and thyroid dysfunction. Among males, thyroid dysfunction was present in 10 patients (19.2%), whereas among females it was observed in 21 patients (30.9%). The proportion of thyroid dysfunction was comparatively higher among females than males. However, the association

between gender and thyroid dysfunction was statistically insignificant (p>0.05).

Table 1: Distribution of the Patients in Terms of Age

Age Group	Frequency	Percentage	95% CI
31–40 Years	13	10.8%	6.4% – 17.5%
41–50 Years	34	28.3%	21.0% – 36.9%
51–60 Years	42	35.0%	27.0% – 43.9%
61–70 Years	23	19.2%	13.0% – 27.3%
71–80 Years	8	6.7%	3.4% – 12.5%
Total	120	100.0%	—

Table 2: Distribution of the Patients in Terms of Gender

Gender	Frequency	Percentage
Male	52	43.3%
Female	68	56.7%
Total	120	100.0%

Table 3: Distribution of the Patients in Terms of Thyroid Dysfunction

Thyroid Dysfunction	Frequency	Percentage
Present	31	25.8%
Absent	89	74.2%
Total	120	100.0%

Table 4: Categorization of the Patients based on Thyroid Function

Thyroid Function	Frequency	Percentage	95% CI
Euthyroid	89	74.2%	65.7% – 81.1%
Subclinical Hypothyroid	20	16.7%	11.0% – 24.5%
Hypothyroid	8	6.7%	3.4% – 12.5%
Hyperthyroid	3	2.5%	0.9% – 7.1%
Total	120	100.0%	—

Table 5: Association between Gender and Thyroid Dysfunction

Thyroid Dysfunction	Male	Female	Total	p-value
Present	10 (19.2%)	21 (30.9%)	31 (25.8%)	0.142
Absent	42 (80.8%)	47 (69.1%)	89 (74.2%)	
Total	52 (100.0%)	68 (100.0%)	120 (100.0%)	

Discussion

The present study was conducted to evaluate thyroid function tests among patients with type 2 diabetes mellitus attending a tertiary care centre. In the present study, the majority of patients belonged to the age group of 51–60 years, accounting for 35.0% of the study population, followed by the 41–50 years age group comprising 28.3% of patients. This finding reflects the increasing prevalence of type 2 diabetes mellitus in middle-aged and elderly populations due to sedentary lifestyle, obesity, insulin resistance, and metabolic disturbances. Similar observations were reported by Baisakhiya et al. [11], who observed that most diabetic patients with thyroid dysfunction belonged to the fifth and sixth decades of life. Increasing age has been recognized as an important factor associated with thyroid abnormalities because thyroid gland function gradually declines with advancing age, especially in patients with chronic metabolic diseases such as diabetes mellitus. In the current study, females constituted 56.7% of the study population, while males accounted for 43.3%. Female predominance among diabetic patients with thyroid dysfunction has been consistently documented in earlier studies. In the study conducted by Demitrost and Ranabir [12], thyroid dysfunction was found to be more common among female diabetic patients due to hormonal influences, autoimmune susceptibility, and higher prevalence of hypothyroidism in women. The higher proportion of female patients observed in the present study may therefore indicate the increased vulnerability of women with type 2 diabetes mellitus to thyroid abnormalities.

The present study demonstrated that thyroid dysfunction was present in 25.8% of patients, whereas 74.2% of patients were euthyroid. This finding indicates that approximately one-fourth of patients with type 2 diabetes mellitus had some form of thyroid abnormality. The prevalence observed in the present study was comparable to the findings reported by Palma et al. [13], who reported a significantly increased prevalence of

thyroid dysfunction among patients with type 2 diabetes mellitus compared to the general population. The coexistence of diabetes mellitus and thyroid dysfunction can be explained by the close interaction between insulin and thyroid hormones in regulating metabolism, glucose homeostasis, and energy utilization.

Among the thyroid abnormalities observed in the present study, subclinical hypothyroidism was the most common, accounting for 16.7% of patients, followed by overt hypothyroidism in 6.7% and hyperthyroidism in 2.5% of patients. Similar findings were observed by Chubb et al. [14], who demonstrated that subclinical hypothyroidism represented the most frequent thyroid abnormality among patients with type 2 diabetes mellitus. Subclinical hypothyroidism is often asymptomatic and may remain undiagnosed unless routine thyroid function tests are performed. Persistent insulin resistance, chronic inflammation, and altered hypothalamic-pituitary-thyroid axis function in diabetes mellitus may contribute to elevated TSH levels and subclinical thyroid dysfunction.

In the present study, thyroid dysfunction was more commonly observed among females compared to males. Thyroid dysfunction was present in 30.9% of female patients compared to 19.2% of male patients. However, the association between gender and thyroid dysfunction was statistically insignificant ($p>0.05$). Similar observations were reported by Díez and Iglesias [15], who noted a higher prevalence of thyroid dysfunction among women with type 2 diabetes mellitus, although gender-based differences were not statistically significant in all patient populations.

The increased prevalence among females may be attributed to autoimmune predisposition, hormonal factors, and higher rates of hypothyroidism in women.

The findings of the present study emphasize the importance of routine thyroid function assessment in patients with type 2 diabetes mellitus. Thyroid dysfunction may adversely affect glycemic control, lipid metabolism, cardiovascular risk, and diabetic complications. Early identification and treatment of thyroid abnormalities may therefore improve metabolic status and reduce morbidity in diabetic patients. Since subclinical hypothyroidism constituted the most common thyroid abnormality in the present study, routine screening for thyroid dysfunction in type 2 diabetes mellitus patients, particularly among females and elderly individuals, may be beneficial in tertiary care settings.

Conclusion

The present study concludes that thyroid dysfunction is relatively common among patients with type 2 diabetes mellitus, with subclinical hypothyroidism being the most frequently observed abnormality. The majority of patients with thyroid dysfunction belonged to the middle-aged population, and females were more commonly affected than males. Although the association between gender and thyroid dysfunction was statistically insignificant, the higher prevalence among females suggests the need for careful evaluation in this group. Routine thyroid function testing in patients with type 2 diabetes mellitus may aid in early diagnosis and management of thyroid abnormalities, thereby improving glycemic control and reducing the risk of diabetic complications.

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