

Exploring the Prevalence of Thyroid Dysfunction in Type 2 Diabetes Mellitus in Central India

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Abstract

Background: Thyroid dysfunction is a commonly reported endocrine abnormality among patients with type 2 diabetes mellitus (T2DM) and may adversely influence glycaemic control and cardiovascular risk. However, the prevalence of thyroid dysfunction varies across populations and geographical regions. Data from Central India are relatively limited. This study aimed to determine the prevalence of thyroid dysfunction among patients with T2DM and assess its distribution according to age and sex. **Material and Methods:** A prospective longitudinal study was conducted among patients with T2DM attending the Medicine Outpatient Department in Central India from 1 May 2024 to 30 April 2025. Patients providing informed consent were included, while those with known autoimmune diseases or unwilling to participate were excluded. Demographic and clinical details were recorded, and thyroid function was assessed using serum thyroid-stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4). Thyroid dysfunction was categorized as hypothyroid or hyperthyroid pattern based on biochemical parameters and laboratory reference ranges. The prevalence of thyroid dysfunction was evaluated overall and according to sex and age groups. **Results:** Among 161 participants with available thyroid-function results, 53 (32.9%) had thyroid dysfunction, while 108 (67.1%) were euthyroid. Hypothyroid-pattern abnormalities were predominant, occurring in 50 (31.1%) participants, whereas hyperthyroid-pattern abnormalities were present in 3 (1.9%). Thyroid dysfunction was observed in 37 (34.9%) males and 16 (29.1%) females; this difference was not statistically significant ($p=0.570$). Prevalence according to age was 25.0% in participants aged <40 years, 23.1% in those aged 40–59 years, 39.8% in those aged 60–79 years, and 40.0% in those aged ≥80 years, with no statistically significant association ($p=0.193$). **Conclusion:** Thyroid dysfunction was common among patients with T2DM, with hypothyroid-pattern abnormalities predominating. Although no statistically significant association with sex or age was observed, the higher prevalence among older participants highlights the importance of considering thyroid dysfunction during routine evaluation of patients with T2DM.

Keywords: Type 2 diabetes mellitus, thyroid dysfunction, hypothyroidism, hyperthyroidism, TSH, prevalence, Central India.

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is one of the most common chronic metabolic disorders worldwide and represents a major public health challenge, particularly in developing countries such as India. The increasing prevalence of T2DM has resulted in a growing burden of associated metabolic and endocrine disorders. Thyroid dysfunction is one such endocrine abnormality that is frequently encountered in individuals with diabetes mellitus and may have important implications for metabolic control and the development of diabetic complications.^[1]

Thyroid hormones play an important role in glucose homeostasis, insulin sensitivity, lipid metabolism and energy expenditure. Alterations in thyroid function may therefore influence glycaemic control in patients with T2DM. Conversely, chronic hyperglycaemia and metabolic disturbances associated with diabetes may affect the hypothalamic–pituitary–thyroid axis, peripheral conversion of thyroid hormones and thyroid hormone metabolism. These complex interactions may partly explain the increased frequency of thyroid dysfunction observed among patients with T2DM.^[2,3]

Several studies have reported a higher prevalence of thyroid dysfunction among patients with T2DM compared with the general population. The prevalence, however, varies considerably between different studies and geographical regions depending on demographic characteristics, iodine status, duration of diabetes, glycaemic control and the criteria used to define thyroid dysfunction. A systematic review and meta-analysis reported a pooled prevalence of thyroid dysfunction of approximately 20% among adults with T2DM, with subclinical hypothyroidism being the most frequently observed thyroid abnormality.^[4]

Indian studies have also demonstrated a substantial burden of

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thyroid dysfunction among patients with T2DM. In a study from North India, thyroid dysfunction was observed in approximately 28% of patients with T2DM, with subclinical hypothyroidism being the predominant abnormality.^[5] Similarly, studies from other regions of India have reported varying prevalence rates, highlighting the geographical and demographic differences in the occurrence of thyroid dysfunction among diabetic patients.^[6,7]

Hypothyroidism, particularly subclinical hypothyroidism, appears to be the most common form of thyroid dysfunction in patients with T2DM. It may remain clinically asymptomatic and may therefore be overlooked during routine diabetic care. Untreated thyroid dysfunction can adversely affect lipid metabolism, body weight, insulin sensitivity and cardiovascular risk, thereby potentially complicating the management of T2DM.^[8,9] In addition, thyroid dysfunction has been reported to be associated with microvascular complications of diabetes, including diabetic retinopathy, further emphasizing its clinical importance.^[10] The occurrence of thyroid dysfunction in T2DM may be influenced by several demographic and clinical factors. Age and sex are particularly important variables. Several studies have reported a higher prevalence of thyroid dysfunction among females and older individuals.^[4,5]

Increasing duration of diabetes and poor glycaemic control have also been associated with thyroid abnormalities in some populations. Other potentially relevant factors include obesity, autoimmune predisposition and the presence of thyroid autoantibodies.^[4,8]

The coexistence of thyroid dysfunction and T2DM presents an important diagnostic and therapeutic challenge. Symptoms of thyroid disease may overlap with manifestations of diabetes and its complications, making clinical recognition difficult, particularly in patients with subclinical disease. Measurement of thyroid-stimulating hormone (TSH), together with thyroid hormone levels where appropriate, can facilitate the identification of clinically significant thyroid abnormalities. Early recognition and appropriate treatment may help optimize metabolic control and reduce the potential cardiovascular and metabolic consequences associated with untreated thyroid dysfunction.^[8,11]

Although thyroid dysfunction among patients with T2DM has been investigated in different parts of India, considerable variation exists in reported prevalence according to geographical location and study population. Data from

Central India are relatively limited. Studying patients attending a Medicine Outpatient Department can provide useful information regarding the magnitude of thyroid dysfunction in the local diabetic population and its distribution according to important demographic characteristics such as age and sex.

Therefore, the present study was undertaken to evaluate the prevalence of thyroid dysfunction among patients with T2DM attending the Medicine Outpatient Department in Central India and to assess its distribution across different sex and age groups.

MATERIALS AND METHODS

Study Design and Setting: A prospective longitudinal study was conducted among patients with type 2 diabetes mellitus (T2DM) attending the Medicine Outpatient Department of the study centre in Central India. The study was conducted from 1 May 2024 to 30 April 2025, with participants followed prospectively during the study period.

Study Population: Patients with T2DM attending the Medicine OPD during the study period were screened for eligibility. Patients who provided written informed consent were included. Patients who declined consent and those with known autoimmune diseases were excluded.

Data Collection: Demographic and relevant clinical details were recorded using a structured proforma. Age and sex were specifically documented for assessment of their association with thyroid dysfunction. Thyroid function was evaluated using serum thyroid-stimulating hormone (TSH), triiodothyronine (T3), and thyroxine (T4) levels. Participants were categorized as euthyroid or having thyroid dysfunction based on the laboratory reference ranges. Thyroid dysfunction was further categorized as hypothyroid or hyperthyroid pattern where appropriate.

Statistical Analysis: Data were analyzed using appropriate statistical software. Categorical variables were expressed as frequency and percentage, while continuous variables were summarized as mean $\pm$ standard deviation or median with interquartile range, as appropriate. The prevalence of thyroid dysfunction was calculated overall and according to sex and age groups. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, as appropriate. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants, and confidentiality of participant information was maintained throughout the study.

RESULTS

Table 1: Sociodemographic and clinical characteristics of study participant

Variable	Category	n	%
Total participants		202	100
Sex	Male	136	67.3
	Female	66	32.7
Age group	<40 years	16	7.9
	40–59 years	65*	32.2
	60–79 years	116*	57.4
	≥ 80 years	5	2.5
Duration of diabetes	1–5 years	51	25.2
	6–10 years	86	42.6
	>10 years	65	32.2

A total of 202 individuals with type 2 diabetes mellitus were included in the master chart. The study population was predominantly male (67.3%), while females constituted

32.7%. The majority of participants were aged 60–79 years. Regarding duration of diabetes, 42.6% had diabetes for 6–10 years, 32.2% for more than 10 years and 25.2% for 1–5 years.

Table 2: Distribution of thyroid function status among participants with available thyroid profile

Thyroid status based on TSH	TSH criterion	n	%
Euthyroid	0.4–4.0 mIU/L	108	67.1
Hypothyroid pattern	>4.0 mIU/L	50	31.1
Hyperthyroid pattern	<0.4 mIU/L	3	1.9
Total		161	100
Any thyroid dysfunction	TSH outside reference range	53	32.9

Among the 161 participants for whom thyroid-function test results were available, 53 (32.9%) demonstrated biochemical thyroid dysfunction based on TSH values. Hypothyroid-pattern abnormalities were observed in 50 (31.1%)

participants, whereas a hyperthyroid pattern was observed in 3 (1.9%). The remaining 108 (67.1%) participants had TSH values within the reference range.

Table 3: Association of thyroid dysfunction with sex among patients with type 2 diabetes mellitus

Sex	Euthyroid n (%)	Thyroid dysfunction n (%)	Total
Male	69 (65.1)	37 (34.9)	106
Female	39 (70.9)	16 (29.1)	55
Total	108 (67.1)	53 (32.9)	161

Chi-square = 0.322; p = 0.570

Thyroid dysfunction was observed in 37 (34.9%) males and 16 (29.1%) females. Although the prevalence was slightly

higher among males, the difference between the two sex groups was not statistically significant ($\chi^2=0.322$, $p=0.570$).

Table 4: Age-wise distribution of thyroid dysfunction among patients with type 2 diabetes mellitus

Age group	Euthyroid n (%)	Thyroid dysfunction n (%)	Total	Prevalence of dysfunction
<40 years	12	4	16	25.00%
40–59 years	40	12	52	23.10%
60–79 years	53	35	88	39.80%
≥80 years	3	2	5	40.00%
Total	108	53	161	32.90%

Chi-square = 4.721; p = 0.193

Thyroid dysfunction was more frequently observed in the older age groups. The prevalence increased from 25.0% among participants aged <40 years to 39.8% among those aged 60–79 years and 40.0% among those aged ≥80 years.

However, the association between age group and thyroid dysfunction did not reach statistical significance ($\chi^2=4.721$, $p=0.193$).

Table 5: Pattern of thyroid dysfunction according to sex and age group

Variable	Category	Euthyroid n (%)	Hypothyroid pattern n (%)	Hyperthyroid pattern n (%)	Any dysfunction n (%)
Sex	Male (n=106)	69 (65.1)	36 (34.0)	1 (0.9)	37 (34.9)
	Female (n=55)	39 (70.9)	14 (25.5)	2 (3.6)	16 (29.1)
Age	<40 yr (n=16)	12 (75.0)	2 (12.5)	2 (12.5)	4 (25.0)
	40–59 yr (n=52)	40 (76.9)	11 (21.2)	1 (1.9)	12 (23.1)
	60–79 yr (n=88)	53 (60.2)	35 (39.8)	0 (0.0)	35 (39.8)
	≥80 yr (n=5)	3 (60.0)	2 (40.0)	0 (0.0)	2 (40.0)
Total	n=161	108 (67.1)	50 (31.1)	3 (1.9)	53 (32.9)

Among the 161 participants with available thyroid-function results, 108 (67.1%) were euthyroid, while 53 (32.9%) had thyroid dysfunction, with hypothyroid pattern being predominant (50; 31.1%) and hyperthyroid pattern accounting for 3 (1.9%). Thyroid dysfunction was observed in 37 (34.9%) males and 16 (29.1%) females, indicating a slightly higher prevalence among males. With respect to age, thyroid dysfunction was present in 4 (25.0%) participants aged <40 years, 12 (23.1%) aged 40–59 years, 35 (39.8%) aged 60–79 years, and 2 (40.0%) aged ≥80 years, showing a tendency toward a higher prevalence of thyroid dysfunction

in older age groups. Overall, hypothyroid-pattern abnormalities constituted the major form of thyroid dysfunction across both sexes and age groups, whereas hyperthyroid-pattern abnormalities were relatively uncommon.

DISCUSSION

The present study evaluated thyroid dysfunction among patients with type 2 diabetes mellitus (T2DM) attending a Medicine OPD in Central India. Among the 161 participants with available thyroid-function results, 53 (32.9%) had thyroid dysfunction,

while 108 (67.1%) were euthyroid. Hypothyroid-pattern abnormalities constituted the majority of thyroid dysfunction (50; 31.1%), whereas hyperthyroid-pattern abnormalities were uncommon (3; 1.9%). The prevalence observed in the present study is higher than the pooled prevalence of 20.24% reported in a recent systematic review and meta-analysis of 38 studies involving adults with T2DM. The same meta-analysis reported pooled prevalences of 11.87% for subclinical hypothyroidism, 7.75% for hypothyroidism, 2.49% for subclinical hyperthyroidism and 2.51% for hyperthyroidism. The considerable variation between studies may be related to differences in population characteristics, geographical location, iodine status, diagnostic criteria and laboratory reference ranges.^[4]

The prevalence in the present study is also higher than that reported in several Indian studies. Jali et al., in a study of 713 patients with T2DM from Belagavi, reported thyroid dysfunction in 16.2%, with a significantly higher prevalence among females and individuals aged ≥ 50 years.¹² Reddy et al. reported thyroid dysfunction in 19.6% of 500 T2DM patients from South India, with subclinical hypothyroidism being the commonest abnormality.^[10] In contrast, Ahmad et al. reported a prevalence of 28% among 250 North Indian patients with T2DM, while Sinha et al. reported subclinical hypothyroidism in 23% and overt hypothyroidism in 3% of 100 patients from Eastern India.^[5,7] Thus, the prevalence of 32.9% in the present study is at the higher end of the range reported from Indian populations but remains comparable with some studies reporting a substantial thyroid disease burden.

The predominance of hypothyroid-pattern abnormalities in the present study is consistent with previous literature. In the present cohort, 31.1% had a hypothyroid pattern compared with only 1.9% with a hyperthyroid pattern. Reddy et al. found hypothyroidism to account for approximately 92% of thyroid dysfunction in their South Indian cohort, with subclinical hypothyroidism being the most frequent subtype.¹⁰ Similarly, Ahmad et al. reported subclinical hypothyroidism as the commonest thyroid disorder, accounting for 18.8% of their T2DM population.^[5] The Eastern Indian study by Sinha et al. also demonstrated a predominance of subclinical hypothyroidism, with 23% of patients affected compared with 3% having overt hypothyroidism.^[7] A retrospective study from Manipur reported 16.3% subclinical hypothyroidism and 11.4% clinical hypothyroidism, while only 3.5% had hyperthyroid disorders.^[13] The consistently greater frequency of hypothyroid abnormalities may reflect the close relationship between insulin resistance, metabolic dysfunction and thyroid hormone homeostasis.

Sex-wise distribution: In the present study, thyroid dysfunction was observed in 34.9% of males and 29.1% of females, indicating a slightly higher prevalence among males; however, this difference was not statistically significant ($p=0.570$). This finding differs from the majority of published studies, which generally report a higher prevalence of thyroid dysfunction among women. Jali et al. reported thyroid dysfunction in 25% of females compared with 10.1% of males, with the difference being statistically

significant.^[12] Ahmad et al. similarly found thyroid dysfunction to be more prevalent among females in their North Indian cohort.^[5] In another large study of 1,341 participants, Khassawneh et al. reported female sex as an independent risk factor for thyroid dysfunction, with an adjusted odds ratio of 1.757.^[14]

However, the absence of a significant sex difference in the present study is not unprecedented. Reddy et al., studying 500 patients with T2DM in South India, reported that thyroid dysfunction did not differ significantly between males and females, suggesting that T2DM itself may attenuate the usual female predominance observed with thyroid disorders.^[10] Therefore, the slightly greater prevalence among males in the present study should be interpreted cautiously, particularly because the study population consisted of more males than females and the difference was statistically non-significant.

Age-wise distribution: Age showed an apparent trend in the present study, with thyroid dysfunction increasing from 25.0% in participants aged <40 years and 23.1% in those aged 40–59 years to 39.8% among those aged 60–79 years and 40.0% among those aged ≥ 80 years. Although this trend was clinically notable, the association did not reach statistical significance ($p=0.193$). The finding of greater thyroid dysfunction in older individuals is broadly consistent with previous studies. Jali et al. reported a significantly higher prevalence of thyroid dysfunction among patients aged ≥ 50 years (19%) compared with younger age groups.^[12] Khassawneh et al. similarly identified age ≥ 50 years as an independent risk factor, with an adjusted odds ratio of 3.895.^[14] The Manipur study also reported that hypothyroidism was more frequent among older patients, with the maximum number of cases occurring in the 45–64-year age group.^[13]

The observed age-related pattern may partly reflect the increasing prevalence of thyroid abnormalities with advancing age in the general population, in addition to the longer duration of metabolic disease among older patients. A large epidemiological study of adults in eight Indian cities found that hypothyroidism was more common among older adults than younger adults and was also substantially more prevalent in females.^[15] Nevertheless, the lack of statistical significance in the present study may be related to the relatively small number of participants in the youngest and oldest age categories. Therefore, the observed increase in prevalence with age should be regarded as a trend rather than a statistically established association.

Clinical interpretation: The relatively high prevalence of thyroid dysfunction identified in the present study emphasizes the importance of considering thyroid abnormalities during evaluation of patients with T2DM. Thyroid dysfunction may adversely influence glucose and lipid metabolism and may complicate the management of diabetes. A study from South India reported an association between subclinical hypothyroidism and diabetic retinopathy, further suggesting that thyroid abnormalities may have clinical consequences beyond their biochemical diagnosis.^[10] The recent meta-analysis also found associations between thyroid dysfunction and female sex, poor glycaemic control, diabetes duration >5 years, central obesity, retinopathy and neuropathy.^[4]

The higher prevalence observed in the current study compared with several Indian reports may be explained by differences in the study population, referral patterns, age distribution, duration

of diabetes, diagnostic thresholds and availability of thyroid testing. Importantly, the present study included patients attending a Medicine OPD in Central India, providing region-specific data from a population for which comparatively limited published evidence is available.

CONCLUSION

Overall, the present study demonstrates a substantial burden of thyroid dysfunction (32.9%) among patients with T2DM, with hypothyroid-pattern abnormalities predominating. The prevalence was slightly higher among males than females, although the difference was not statistically significant. Thyroid dysfunction showed a clinically apparent increase with advancing age, but this association was also not statistically significant. The findings broadly support previous evidence that thyroid dysfunction, particularly hypothyroidism, is common among patients with T2DM and highlight the potential value of thyroid-function assessment in this population.

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Conflicts of interest

There are no conflicts of interest.

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