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Prevalence and Pattern of Thyroid Dysfunction in Patients with Type 2 Diabetes Mellitus: A Prospective Observational Study.

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ABSTRACT

Background:
Thyroid dysfunction is a common endocrine disorder frequently associated with Type 2 Diabetes Mellitus (T2DM) and may adversely affect glycemic control and diabetic complications.

Objectives:
To determine the prevalence and pattern of thyroid dysfunction among patients with T2DM and evaluate its association with demographic and clinical variables.

Methods:
This prospective observational study included 250 patients with T2DM attending the Department of General Medicine, Madhubani Medical College and Hospital, Bihar, from 1 April 2025 to 31 January 2026. Demographic and clinical data were collected. Thyroid profile, including serum Thyroid Stimulating Hormone (TSH), free T3, and free T4, was assessed. Statistical analysis was performed using the Chi-square test and Student's t-test, with $p<0.05$ considered statistically significant.

Results:
Of the 250 participants, 141 (56.4%) were males, and 109 (43.6%) were females, with a mean age of 54.8 ± 10.6 years. Thyroid dysfunction was identified in 72 patients (28.8%). Subclinical hypothyroidism was the most common abnormality (16.0%), followed by overt hypothyroidism (8.0%), subclinical hyperthyroidism (3.2%), and overt hyperthyroidism (1.6%). Thyroid dysfunction was significantly more common among females than males (37.0% vs. 22.1%; p=0.011) and among patients with HbA1c ≥8% compared with those with HbA1c <8% (35.7% vs. 19.8%; p=0.008).

Conclusion:
Thyroid dysfunction is highly prevalent among patients with T2DM, particularly among females and those with poor glycemic control.

Recommendation:
Routine thyroid screening should be considered in patients with T2DM for early diagnosis and timely management.

Keywords: *Type 2 Diabetes Mellitus, Thyroid Dysfunction, Hypothyroidism, Hyperthyroidism, Thyroid Stimulating Hormone.*
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INTRODUCTION
One of the most prevalent metabolic diseases in the world, type 2 diabetes mellitus (T2DM), is a significant public health concern. Chronic hyperglycemia brought on by insulin resistance and increasing β-cell malfunction are the disease's hallmarks. With a rapidly rising incidence

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brought on by urbanisation, sedentary lifestyles, dietary changes, and genetic vulnerability, India has become the global centre for diabetes. Another prevalent endocrine issue that affects metabolic control is thyroid diseases. The thyroid gland is essential for the metabolism of fats, carbohydrates, insulin, and glucose. Thyroid hormones affect peripheral glucose uptake, intestinal glucose absorption, and hepatic glucose synthesis. As a result, thyroid dysfunction can drastically change how well people with diabetes control their blood sugar levels (1).

There have been numerous reports of thyroid problems in patients with diabetes coexisting. Thyroid problems are more common in diabetes patients than in the general population, according to several studies. While hyperthyroidism can exacerbate hyperglycemia and raise insulin needs, hypothyroidism may worsen insulin resistance, dyslipidemia, obesity, and cardiovascular risk. Even while subclinical thyroid dysfunction may not cause any symptoms for a long time, it can nevertheless have a negative impact on metabolic outcomes. Because untreated thyroid disease can make managing diabetes more difficult and raise the risk of microvascular and macrovascular consequences, screening for thyroid dysfunction in diabetic patients has become increasingly important. Glycemic control can be enhanced, and the burden of disease can be decreased with early identification and treatment. (2).

Although these conditions are becoming more common, less is known about thyroid dysfunction in diabetic patients in Bihar's rural and semi-urban areas. Developing screening plans and improving patient care can be aided by knowing the extent and pattern of thyroid problems in this population. To ascertain the prevalence of thyroid dysfunction and assess its correlation with clinical and demographic features, the current prospective study was carried out among patients with Type 2 Diabetes Mellitus attending Madhubani Medical College and Hospital, Bihar, between April 2025 and January 2026(3).

MATERIALS AND METHODS

Study Design

This was a hospital-based prospective observational cross-sectional study conducted to determine the prevalence and pattern of thyroid dysfunction among patients with Type 2 Diabetes Mellitus (T2DM) and to evaluate its association with demographic and clinical variables.

Study Setting

The study was conducted in the Department of General Medicine at Madhubani Medical College and Hospital, Madhubani, Bihar, India, a tertiary care teaching hospital affiliated with a medical college and serving predominantly rural and semi-urban populations from Madhubani district and neighboring districts of northern Bihar. The hospital provides outpatient, inpatient, emergency, critical care, diagnostic, and specialty medical services and serves as an important referral center for endocrine, metabolic, cardiovascular, and other chronic medical disorders.

Study Duration

The study was conducted over a period of ten months from 1 April 2025 to 31 January 2026.

Participants and Sampling Technique

The study included adult patients diagnosed with Type 2 Diabetes Mellitus attending the outpatient and inpatient services of the Department of General Medicine during the study period. Participants were selected using a consecutive sampling technique, whereby all eligible patients presenting during the study period were enrolled consecutively until the required sample size of 250 participants was achieved.

Measures to Minimize Bias

Several measures were undertaken to minimize potential sources of bias. Consecutive recruitment of eligible participants was performed to reduce selection bias. Standardized questionnaires and predesigned data collection forms were used to ensure uniform data collection. Laboratory investigations were performed using standardized hospital laboratory protocols and calibrated equipment to minimize measurement bias. Data entry and analysis were performed independently and cross-checked to reduce information and analytical bias.

Study Size

The sample size was calculated using the formula for the estimation of prevalence in cross-sectional studies:

where:

- **n** = required sample size
- **Z** = standard normal deviate corresponding to a 95% confidence level (1.96)
- **p** = expected prevalence of thyroid dysfunction among T2DM patients (20%)
- **q** = 1 − p (80%)
- **d** = absolute precision (5%)

Substituting the values:

Thus, the minimum required sample size was approximately 246 participants. To compensate for possible incomplete data and improve study precision, a total of 250 patients were included in the study.

Eligibility Criteria

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Inclusion Criteria

- Patients aged 18 years or older with confirmed Type 2 Diabetes Mellitus according to standard diagnostic criteria.
- Patients who provided written informed consent for participation in the study.

Exclusion Criteria

- Patients with known thyroid disease are receiving treatment.
- Patients with Type 1 Diabetes Mellitus.
- Pregnant women.
- Patients with severe systemic illness or acute medical emergencies may interfere with thyroid function assessment.

Quantitative Variables

Continuous variables, including age, fasting blood glucose, postprandial blood glucose, HbA1c, serum Thyroid Stimulating Hormone (TSH), free T3, and free T4 levels, were summarized as mean ± standard deviation (SD). For subgroup analyses, HbA1c values were categorized into <8% and ≥8%, as an HbA1c threshold of 8% is commonly used to distinguish acceptable from poor glycemic control in clinical practice and previous studies evaluating diabetic outcomes.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC) of Madhubani Medical College and Hospital, Madhubani, Bihar, India. Written informed consent was obtained from all study participants before enrollment. Confidentiality and anonymity of participant information were strictly maintained throughout the study.

RESULTS

During the study period, a total of 287 patients with Type 2 Diabetes Mellitus were assessed for eligibility. Of these, 37 patients were excluded, including 15 patients with known thyroid disease receiving treatment, 7 pregnant women, 6 patients with Type 1 Diabetes Mellitus, 5 patients with severe systemic illness, and 4 patients who declined participation. The remaining 250 eligible participants were enrolled and included in the final analysis.

Among 250 enrolled T2DM patients, 141 (56.4%) were males, and 109 (43.6%) were females. The mean age of participants was 54.8 ± 10.6 years.

Thyroid dysfunction was identified in 72 patients, giving an overall prevalence of 28.8%. Subclinical hypothyroidism was the most frequently observed abnormality (16.0%), followed by overt hypothyroidism (8.0%), subclinical hyperthyroidism (3.2%), and overt hyperthyroidism (1.6%).

Female patients exhibited a significantly higher prevalence of thyroid dysfunction than males (37.0% versus 22.1%; p=0.011). Similarly, patients with poor glycemic control (HbA1c ≥8%) demonstrated a significantly higher frequency of thyroid abnormalities compared with patients having HbA1c <8% (35.7% versus 19.8%; p=0.008).

Increasing age was associated with a greater prevalence of thyroid dysfunction, particularly among patients aged above 60 years. Hypothyroidism constituted nearly 83% of all thyroid abnormalities detected in the study population.

These findings suggest a strong association between thyroid dysfunction and diabetes, emphasizing the importance of routine thyroid screening in diabetic individuals.

Table 1 presents the demographic characteristics of the study participants. Among the 250 enrolled patients, 141 (56.4%) were males, and 109 (43.6%) were females. The majority of participants belonged to the 40–60 years age group (57.2%), followed by patients older than 60 years (28.8%) and those younger than 40 years (14.0%).

TABLE 1. Demographic Characteristics

Variable	Number (%)
Male	141 (56.4)
Female	109 (43.6)
Age <40 years	35 (14.0)
40–60 years	143 (57.2)
>60 years	72 (28.8)
Total	250 (100)

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Table 2 shows the prevalence and pattern of thyroid dysfunction among the study participants. Thyroid dysfunction was detected in 72 patients (28.8%), while 178 patients (71.2%) were euthyroid. Subclinical hypothyroidism was the most common abnormality (16.0%), followed by overt hypothyroidism (8.0%), subclinical hyperthyroidism (3.2%), and overt hyperthyroidism (1.6%).

TABLE 2. Prevalence of Thyroid Dysfunction

Thyroid Status	Frequency	Percentage
Euthyroid	178	71.2
Subclinical Hypothyroidism	40	16.0
Overt Hypothyroidism	20	8.0
Subclinical Hyperthyroidism	8	3.2
Overt Hyperthyroidism	4	1.6

Table 3 demonstrates the association between gender and thyroid dysfunction. Female patients exhibited a significantly higher prevalence of thyroid dysfunction compared with male patients (37.6% vs. 22.0%). The association was statistically significant ($\chi^2 = 6.45$, $p = 0.011$).

TABLE 3. Gender and Thyroid Dysfunction

Gender	Thyroid Dysfunction	Normal	Total
Male	31	110	141
Female	41	68	109

Chi-square = 6.45, p = 0.011 (Significant)

Table 4 illustrates the relationship between glycemic control and thyroid dysfunction. Patients with HbA1c ≥8% had a significantly higher prevalence of thyroid dysfunction compared with those with HbA1c <8% (36.6% vs. 19.8%). This association was statistically significant **(**$\chi^2 = 7.12$, $p = 0.008$**).**

TABLE 4. HbA1c and Thyroid Dysfunction

HbA1c	Thyroid Dysfunction	Normal	Total
<8%	23	93	116
≥8%	49	85	134

Chi-square = 7.12, p = 0.008 (Significant)

DISCUSSION

The present hospital-based prospective observational study evaluated the prevalence and pattern of thyroid dysfunction among 250 patients with Type 2 Diabetes Mellitus (T2DM). The study demonstrated an overall prevalence of thyroid dysfunction of **28.8% (72/250)** among diabetic patients, indicating that thyroid abnormalities constitute a common endocrine comorbidity in individuals with T2DM. Among the various thyroid disorders identified, subclinical hypothyroidism was the most frequent abnormality, accounting for 16.0% of patients, followed by overt hypothyroidism (8.0%), subclinical hyperthyroidism (3.2%), and overt hyperthyroidism (1.6%). These findings suggest that hypothyroid disorders account for nearly 83% of all thyroid abnormalities detected in this study population(4).

The prevalence observed in the present study is comparable to previous Indian and international studies reporting thyroid dysfunction prevalence ranging from 12% to 30% among patients with T2DM. The higher prevalence compared with the general population may be explained by the close physiological interaction between thyroid hormones and glucose metabolism. Thyroid hormones influence hepatic glucose production, peripheral glucose utilization, insulin secretion, and insulin sensitivity, thereby contributing to metabolic homeostasis (5).

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A significant association was observed between female sex and thyroid dysfunction. Female patients exhibited a substantially higher prevalence of thyroid abnormalities than male patients (**37.6% vs. 22.0%; $\chi^2 = 6.45$, p = 0.011**). Similar observations have been reported in previous epidemiological studies, which consistently demonstrate a higher susceptibility of women to thyroid disorders due to hormonal influences, autoimmune predisposition, and genetic factors(6,7).

The present study also demonstrated a significant association between poor glycemic control and thyroid dysfunction. Patients with **HbA1c ≥8%** had a significantly greater prevalence of thyroid abnormalities compared with those with better glycemic control (**36.6% vs. 19.8%; $\chi^2 = 7.12$, p = 0.008**). This finding supports previous studies suggesting a bidirectional relationship between thyroid dysfunction and diabetes. Hypothyroidism may worsen insulin resistance and impair glucose utilization, whereas chronic hyperglycemia may alter hypothalamic-pituitary-thyroid axis regulation and thyroid hormone metabolism(9).

An increase in thyroid dysfunction prevalence with advancing age was also observed, particularly among patients older than 60 years. Age-related endocrine changes, polypharmacy, chronic inflammation, and increasing metabolic dysfunction may contribute to the higher burden of thyroid abnormalities in elderly diabetic individuals.

Overall, the findings of this study support the integration of thyroid function assessment into routine diabetes care, particularly among females, elderly individuals, and patients with suboptimal glycemic control.

Generalizability

The findings of this study may be generalized to adult patients with Type 2 Diabetes Mellitus receiving care in tertiary care hospitals and similar healthcare settings, particularly in rural and semi-urban regions of India. Since the study population was predominantly representative of patients attending a referral center in northern Bihar, the findings are likely applicable to comparable South Asian populations with similar demographic and metabolic characteristics. However, caution should be exercised when extrapolating these findings to pediatric populations, urban populations with different healthcare access, or other ethnic groups.

Conclusion

Thyroid dysfunction is a prevalent comorbidity, affecting about 28.8% of diabetic patients, according to the current prospective study, which involved 250 patients with Type 2 Diabetes Mellitus at Madhubani Medical College and Hospital. The most common thyroid condition was subclinical hypothyroidism, which was followed by overt hypothyroidism. Thyroid dysfunction was shown to be more common in women, older adults, and those with poor glycemic control. Because thyroid hormones affect insulin sensitivity, glucose metabolism, and cardiovascular risk factors, the coexistence of thyroid disorders and diabetes has significant clinical ramifications. Undiagnosed thyroid dysfunction may raise the risk of complications from diabetes and lead to poor glycemic control.

In patients with type 2 diabetes, routine thyroid screening may help with early diagnosis and proper therapy, especially in women, the elderly, and those with uncontrolled diabetes. Both the overall quality of life and metabolic results could be enhanced by such a strategy. To determine regional prevalence trends and assess the effect of managing thyroid dysfunction on diabetic outcomes, further multicenter studies with bigger sample sizes and long-term follow-up are advised. The results of this study suggest the inclusion of thyroid function evaluation as a crucial part of all-encompassing diabetes therapy.

Limitations

The study was conducted at a single tertiary care center, which may limit the external validity and generalizability of the findings to broader populations. Although the prospective design improved data quality, the relatively short study duration and absence of long-term follow-up prevented assessment of the impact of thyroid dysfunction treatment on diabetic outcomes. In addition, thyroid autoantibodies and imaging studies were not performed, limiting characterization of the underlying etiology of thyroid dysfunction. Residual confounding due to factors such as medication use, duration of diabetes, obesity, and comorbid conditions may also have influenced the observed associations.

Recommendations

1. Routine thyroid function screening should be considered in patients with Type 2 Diabetes Mellitus, particularly among women, elderly patients, and individuals with poor glycemic control.
2. Early identification and treatment of thyroid dysfunction may improve metabolic control and reduce long-term complications.
3. Larger multicenter studies with longer follow-up periods are recommended to evaluate the impact of thyroid dysfunction treatment on diabetic outcomes.

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Conflict of Interest
The authors declare that there are no conflicts of interest related to this study.

Abbreviation Full Form
T2DM Type 2 Diabetes Mellitus
TSH Thyroid-Stimulating Hormone
HbA1c Glycated Hemoglobin
FBS Fasting Blood Sugar
PPBS Postprandial Blood Sugar
SD Standard Deviation
OPD Outpatient Department
IPD Inpatient Department

Data Availability
The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Author Contributions
- **Mukesh Kumar:** Study conception and design, patient recruitment, data collection, manuscript preparation.
- **Shivam Shekhar:** Data analysis, literature review, manuscript drafting, and correspondence.
- **Ajay Kumar Lal Das:** Study supervision, critical review of the manuscript, and final approval of the version to be published.

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