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PREVALENCE AND CORRELATION OF HYPOTHYROIDISM IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: A TERTIARY CARE CENTRE STUDY

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) and hypothyroidism are common endocrine disorders that often coexist, potentially worsening metabolic control and cardiovascular risk. Understanding the prevalence of thyroid dysfunction in T2DM and its demographic and clinical correlates is crucial for guiding screening and management strategies.

Objectives: To determine the prevalence of hypothyroidism (overt and subclinical) among T2DM patients, to assess demographic and clinical factors associated with hypothyroidism, and to compare prevalence with non-diabetic controls.

Methods: A cross-sectional study was conducted at a tertiary care centre, enrolling 100 T2DM patients and 100 age- and sex-matched non-diabetic controls. Anthropometry, diabetes duration, HbA1c, and lipid profiles were recorded. Thyroid function was assessed by serum TSH and free T4, with subclinical hypothyroidism defined as elevated TSH with normal free T4, and overt hypothyroidism as elevated TSH with low free T4. χ^2 tests, Student's t-test, and logistic regression were used for statistical analysis.

Results: Hypothyroidism prevalence was 22% (95% CI: 14.8–31.0%) in T2DM patients compared with 9% (95% CI: 4.3–16.2%) in controls (p=0.02). Subclinical hypothyroidism predominated (15% in T2DM vs 7% in controls). Female sex was significantly associated with hypothyroidism (68.2% vs 47.4% in males, p=0.04). Higher BMI and longer diabetes duration showed trends toward increased prevalence. Logistic regression revealed T2DM as an independent risk factor for hypothyroidism (OR 2.86, 95% CI 1.24–6.61).

Conclusion: Hypothyroidism is significantly more prevalent among T2DM patients than in non-diabetic controls, particularly in females. Screening for thyroid dysfunction in T2DM, especially in high-risk subgroups, may enable timely diagnosis and improve metabolic outcomes.

Keywords: Type 2 Diabetes Mellitus; Hypothyroidism; subclinical Hypothyroidism; Overt Hypothyroidism; Metabolic syndrome; Female patients.

INTRODUCTION

Type 2 diabetes mellitus (T2DM) and thyroid dysfunction—particularly hypothyroidism—are two common endocrine disorders whose pathophysiological effects overlap substantially. Thyroid hormones influence glucose metabolism through effects on hepatic gluconeogenesis, insulin secretion

and sensitivity, lipids, and body composition; conversely, chronic hyperglycaemia and insulin resistance may alter thyroid hormone production, metabolism, and pituitary-thyroid feedback. Because both conditions share risk factors such as age, obesity and dyslipidaemia, they often coexist in clinical practice, and their co-occurrence may worsen metabolic control and increase vascular risk. Understanding the prevalence of thyroid dysfunction among people with T2DM and the extent to which hypothyroidism predicts incident diabetes is important for clinical screening strategies and for clarifying potential causal pathways.

Multiple systematic reviews and meta-analyses indicate that thyroid dysfunction is more prevalent among people with T2DM than in the general population. A recent comprehensive systematic review and meta-analysis (studies from 2000–2022) reported a pooled prevalence of any thyroid dysfunction in adults with T2DM of about 20%, with subclinical hypothyroidism (SCH) the largest contributor (pooled SCH ≈ 11.9%) and overt hypothyroidism ≈ 7.8%. The authors noted geographic heterogeneity (higher pooled prevalence in Asia and Africa) and that female sex, obesity and older age were consistent correlates. These pooled figures support routine consideration of thyroid assessment in diabetic populations, especially where risk factors are present.[1]

Earlier meta-analytic work focused specifically on SCH and T2DM also supports an increased frequency of SCH among people with diabetes; pooled estimates from such analyses have found SCH prevalence in T2DM generally in the low-teens (commonly ~10–12%) and report approximately a near-doubling of odds for SCH in people with diabetes compared with non-diabetic controls in many aggregated datasets. Individual studies vary widely, however, reflecting differences in TSH cut-offs, assay methods, population age structure and case-mix.[2,3]

Several prospective cohort studies and a more recent meta-analysis of longitudinal data have investigated whether thyroid disease (or lower thyroid hormone levels within the reference range) predicts future dysglycaemia. Pooled results indicate that hypothyroidism and lower free T4 levels are associated with a modestly increased risk of incident T2DM (hazard ratios in pooled analyses have ranged around ~1.2–1.3 for hypothyroidism), whereas relationships for TSH within the normal range are less consistent. These prospective data suggest that low thyroid function may contribute to diabetes risk, possibly through adverse effects on insulin sensitivity, lipid metabolism and adiposity.[4]

To address causality and limit confounding, Mendelian randomization and genetic-instrument studies have been performed with mixed findings. Some Mendelian randomization analyses indicate causative links between thyroid dysfunction and certain diabetes outcomes (and diabetic microvascular complications), while others find no causal effect for T2DM specifically. These divergent results imply complex mechanisms—shared genetic determinants, pleiotropy, or confounding by obesity and lifestyle—which warrant further investigation before recommending universal screening or treatment solely for diabetes prevention.[5,6]

Cross-sectional and clinic-based studies from diverse regions frequently report higher prevalences than population surveys, with several single-country studies reporting hypothyroidism or SCH prevalence among T2DM patients in the range of ~12–25%. For example, a multicentre Indian cross-sectional study reported hypothyroidism in roughly one quarter of patients with T2DM, and large cohort data from population registries found a TD–T2DM comorbidity prevalence that varied by age, sex and metabolic risk factors. Population cohorts have also quantified the co-prevalence (both directions) and highlighted predictable correlates—female sex, older age, higher BMI, adverse lipid profile and smoking. Clinically, these findings have been used to advocate selective or routine thyroid testing in diabetic clinics, particularly in subgroups at higher risk.[7,8,9]

Summary and gaps

The accumulated evidence shows that thyroid dysfunction—mainly subclinical and overt hypothyroidism—is more common among people with T2DM than in non-diabetic populations, and that hypothyroidism or lower circulating free T4 levels may modestly increase the risk of developing T2DM. Nevertheless, heterogeneity across studies (definitions, assays, populations), residual confounding, and conflicting causal-inference results mean that important questions remain: (a)

whether treating subclinical hypothyroidism improves glycaemic outcomes or reduces diabetes incidence; (b) the optimal screening strategy (who to test and when); and (c) the biological mechanisms linking mild thyroid impairment to insulin resistance. High-quality prospective studies (including randomized trials where ethical and feasible) and mechanistic work are needed to resolve these questions and to inform guideline recommendations.

AIMS & OBJECTIVES

1. To estimate the prevalence of hypothyroidism (overt and subclinical) in patients with T2DM.
2. To evaluate demographic and clinical factors (age, sex, BMI, duration of diabetes, glycaemic control, lipid profile) associated with hypothyroidism in T2DM patients.
3. To compare the prevalence of hypothyroidism in T2DM patients with that in the non-diabetic population (if a control group is included).

METHODOLOGY

Study design

This was a cross-sectional, hospital-based study conducted in the Department of Physiology in collaboration with Department of Endocrinology at a tertiary care centre over a period of one year from May 2019- April 2020.

Study population

A total of 200 adult participants were enrolled, comprising 100 patients with type 2 diabetes mellitus (T2DM) and 100 age- and sex-matched non-diabetic individuals (control group)

Inclusion criteria

- **Cases:** Patients ≥18 years with an established diagnosis of T2DM as per American Diabetes Association criteria.
- **Controls:** Individuals ≥18 years with fasting plasma glucose <126 mg/dL and HbA1c <6.5%, and no history of diabetes.

Exclusion criteria

- Prior history of thyroid disease or ongoing thyroid hormone replacement/antithyroid therapy.
- Pregnancy or lactation.
- Use of drugs known to interfere with thyroid function (e.g., amiodarone, lithium, glucocorticoids).
- Severe intercurrent illness or systemic diseases affecting thyroid function.

Data collection

Structured proforma was used to record:

- **Demographic details:** age, sex.
- **Anthropometry:** weight, height, BMI.
- **Clinical history:** duration of diabetes, medications, comorbidities, family history.
- **Laboratory investigations:** fasting plasma glucose, HbA1c, lipid profile, serum TSH and free T4 (FT4).

Thyroid function was measured using standard chemiluminescent immunoassay. Reference ranges of the institutional laboratory were: TSH 0.4–4.0 mIU/L, FT4 0.8–1.8 ng/dL.

Definitions

- **Euthyroid:** Normal TSH and FT4.
- **Subclinical hypothyroidism (SCH):** TSH >4.0 mIU/L with normal FT4.
- **Overt hypothyroidism:** TSH >4.0 mIU/L with FT4 <0.8 ng/dL.

Statistical analysis

Data were analysed using SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean ± SD and compared using Student's t-test. Categorical variables were expressed as frequencies and percentages, compared using χ^2 test. Prevalence of hypothyroidism in each group was expressed with 95% confidence intervals (CI). Odds ratios (OR) with 95% CI were calculated to assess association. A p-value <0.05 was considered statistically significant.

RESULTS

Participant characteristics

A total of 200 participants were included, comprising 100 patients with type 2 diabetes mellitus (T2DM) and 100 age- and sex-matched controls. The mean age of the T2DM group was 56.8 ± 9.4 years compared to 55.6 ± 8.8 years in controls (p = 0.42). Females constituted 52% of the T2DM group and 50% of controls. The mean BMI was significantly higher in the T2DM group (28.4 ± 4.6 kg/m²) than in controls (25.7 ± 3.9 kg/m², p < 0.001). The mean HbA1c among T2DM patients was 8.2 ± 1.6%. (**Table 1)**

Table 1. Baseline characteristics of study population

Variable	T2DM (n=100)	Controls (n=100)	p-value
Age (years, mean ± SD)	56.8 ± 9.4	55.6 ± 8.8	0.42
Female sex, n (%)	52 (52%)	50 (50%)	0.77
BMI (kg/m², mean ± SD)	28.4 ± 4.6	25.7 ± 3.9	<0.001
HbA1c (%)	8.2 ± 1.6	–	–
Total cholesterol (mg/dL)	204 ± 36	191 ± 32	0.01
LDL cholesterol (mg/dL)	128 ± 28	116 ± 26	0.004
HDL cholesterol (mg/dL)	41 ± 9	46 ± 10	0.002
Triglycerides (mg/dL)	178 ± 62	151 ± 58	0.006

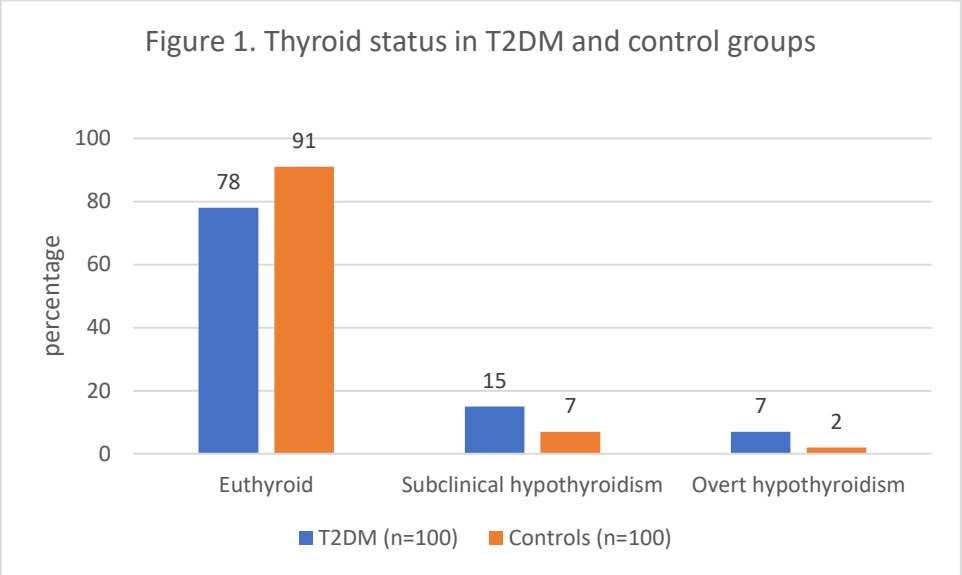
Prevalence of hypothyroidism

The prevalence of hypothyroidism (overt + subclinical) was 22% (95% CI: 14.8–31.0%) in the T2DM group, compared with 9% (95% CI: 4.3–16.2%) among controls (p = 0.02). Subclinical hypothyroidism was more common than overt hypothyroidism in both groups. **(Table 2, Figure 1)**

Table 2. Thyroid status in T2DM and control groups

Thyroid status	T2DM (n=100)	Controls (n=100)	p-value
Euthyroid	78 (78%)	91 (91%)	–
Subclinical hypothyroidism	15 (15%)	7 (7%)	–
Overt hypothyroidism	7 (7%)	2 (2%)	–
Total hypothyroidism	**22 (22%)**	**9 (9%)**	0.02

Odds ratio for hypothyroidism in T2DM compared with controls was **2.86 (95% CI: 1.24–6.61, p = 0.01)**.

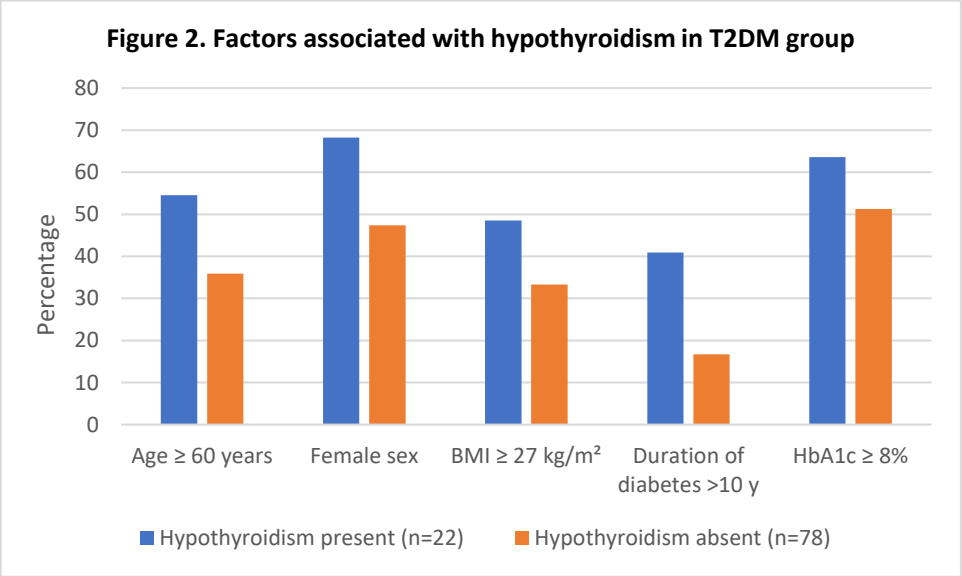


Association with demographic and clinical variables

Hypothyroidism was significantly more prevalent in females than males in both groups (28.8% vs 14.6%, p = 0.04). Among T2DM patients, hypothyroidism prevalence was higher in those with BMI ≥ 27 kg/m² (27.8%) compared with those with BMI < 27 kg/m² (16.0%, p = 0.12), though not statistically significant. Longer duration of diabetes (>10 years) was associated with higher prevalence of hypothyroidism (30.0% vs 16.7%, p = 0.08). **(Table 3, Figure 2)**

Table 3. Factors associated with hypothyroidism in T2DM group

Variable	Hypothyroidism present (n=22)	Hypothyroidism absent (n=78)	p-value
Age ≥ 60 years	12 (54.5%)	28 (35.9%)	0.12
Female sex	15 (68.2%)	37 (47.4%)	0.04
BMI ≥ 27 kg/m²	10 (45.5%)	26 (33.3%)	0.12
Duration of diabetes >10 y	9 (40.9%)	13 (16.7%)	0.08
HbA1c ≥ 8%	14 (63.6%)	40 (51.3%)	0.28



DISCUSSION

In this tertiary care centre-based study, the prevalence of hypothyroidism among patients with type 2 diabetes mellitus (T2DM) was 22%, significantly higher than the 9% observed in non-diabetic controls. Subclinical hypothyroidism accounted for the majority of cases, consistent with previous studies showing a predominance of subclinical forms among diabetic populations.[1] The odds of having hypothyroidism were nearly threefold higher in T2DM compared to controls (OR 2.86, 95% CI 1.24–6.61), confirming a strong association between diabetes and thyroid dysfunction.

Comparison with previous literature

Multiple studies and meta-analyses have reported a prevalence of hypothyroidism in T2DM ranging from 10–25%, largely due to subclinical hypothyroidism[3-5]. Han et al. (2015) reported a pooled prevalence of 10.2% for subclinical hypothyroidism in T2DM, with overt hypothyroidism being less common (2–5%)[3]. Similar to our findings, these studies highlighted higher prevalence among female patients and older adults. Roa Dueñas et al. (2022) observed that lower free T4 levels and higher TSH were associated with a modestly increased risk of developing T2DM and suggested bidirectional relationships between thyroid function and glucose metabolism[2]. Regional studies from India and other Asian populations have reported higher prevalence estimates (20–25%), likely reflecting demographic and metabolic differences[6,7].

Factors associated with hypothyroidism

In our study, hypothyroidism was significantly more common among females, aligning with established evidence that autoimmune thyroid disorders and subclinical hypothyroidism are more prevalent in women[8,9]. Longer duration of diabetes and higher BMI showed trends toward higher hypothyroidism prevalence, although these did not reach statistical significance in this sample. These trends are supported by prior studies reporting associations between insulin resistance, obesity, and altered thyroid function in diabetic patients[4,5]. Elevated BMI may contribute to thyroid hormone resistance or altered peripheral metabolism, while chronic hyperglycaemia may modulate hypothalamic-pituitary-thyroid axis function[2,10].

Clinical implications

The coexistence of hypothyroidism and T2DM has important clinical implications. Hypothyroidism can exacerbate dyslipidaemia, insulin resistance, and weight gain, potentially worsening glycaemic control and increasing cardiovascular risk[1,2,5]. Subclinical hypothyroidism, although often asymptomatic, may progress to overt hypothyroidism and should be considered for screening, particularly in female patients and those with long-standing diabetes or poor metabolic control. Our findings support targeted thyroid function testing in diabetic clinics to enable early detection and management.

Strengths and limitations

The study's strengths include a well-defined tertiary care population and inclusion of an age- and sex-matched control group. Standardized laboratory methods for TSH and FT4 were used, and prevalence estimates were accompanied by 95% confidence intervals. Limitations include the relatively small sample size (100 per group), which may limit power for subgroup analyses, and the cross-sectional design, which precludes causal inference. Additionally, selection bias is possible, as patients attending a tertiary care centre may differ from the general population.

Future directions

Further large-scale, prospective studies are needed to explore longitudinal relationships between thyroid dysfunction and T2DM progression, the impact of thyroid hormone replacement on glycaemic control, and potential mechanisms linking thyroid and glucose metabolism. Evaluating regional

differences and genetic or lifestyle determinants may also provide insights for population-specific screening guidelines.

Conclusion

In this study, hypothyroidism was significantly more prevalent among patients with T2DM compared with non-diabetic controls. Female sex and trends toward longer diabetes duration and higher BMI were associated with higher prevalence. These findings highlight the importance of thyroid function screening in T2DM patients, particularly among high-risk subgroups, to improve metabolic outcomes and prevent complications.

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REFERENCES

1. Hadgu R, Worede A, Ambachew S. Prevalence of thyroid dysfunction and associated factors among adult type 2 diabetes mellitus patients, 2000–2022: a systematic review and meta-analysis. Syst Rev. 2024;13:119. doi:10.1186/s13643-024-02527-y.
2. Roa Dueñas OH, van der Burgh AC, Ittermann T, Ligthart S, Ikram MA, Peeters R, Chaker L. Thyroid function and the risk of prediabetes and type 2 diabetes. J Clin Endocrinol Metab. 2022;107(6):1789–1798. doi:10.1210/clinem/dgac006.
3. Han C, He X, Xia X, Li Y, Shi X, Shan Z, et al. Subclinical hypothyroidism and type 2 diabetes: a systematic review and meta-analysis. PLoS One. 2015;10(8):e0135233. doi:10.1371/journal.pone.0135233.
4. Fang T, Deng X, Wang J, Han F, Liu X, Liu Y, et al. The effect of hypothyroidism on the risk of diabetes and its microvascular complications: a Mendelian randomization study. Front Endocrinol (Lausanne). 2023;14:1288284. doi:10.3389/fendo.2023.1288284.
5. Talwalkar P, Deshmukh V, Bhole M. Prevalence of hypothyroidism in patients with type 2 diabetes mellitus and hypertension in India: a cross-sectional observational study. Diabetes Metab Syndr Obes. 2019;12:369–376. doi:10.2147/DMSO.S181470.
6. Moosazadeh M, Khakhki S, Bahar A, et al. The prevalence and determinants of diabetes mellitus and thyroid disorder comorbidity in Tabari cohort population. Sci Rep. 2024;14:17577. doi:10.1038/s41598-024-68569-3.
7. Chen W, Lu Y, Xie X, Li H, Xu W. Thyroid dysfunction in Chinese patients with type 2 diabetes: prevalence and risk factors. Endocr Connect. 2020;9:755–764. doi:10.1530/EC-20-0152.
8. Akintola AA, Noordam R, Westendorp RGJ. Thyroid function and type 2 diabetes mellitus: a systematic review. Front Endocrinol (Lausanne). 2015;6:130. doi:10.3389/fendo.2015.00130.
9. Siddiqui K, Khan N, Hashmi S. Prevalence of thyroid disorders in type 2 diabetes mellitus patients: a cross-sectional study. Cureus. 2021;13:e14187. doi:10.7759/cureus.14187.
10. Al-Saadi A, Al-Rashidi S, Al-Humaidan H, et al. Thyroid dysfunction in type 2 diabetes mellitus: a Saudi Arabian cohort study. J Endocrinol Invest. 2022;45:2097–2105. doi:10.1007/s40618-021-01676-4.
11. Moura Neto A, Gadelha MR, Silva CM, et al. Prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus in Brazil: a multicenter study. Arq Bras Endocrinol Metabol. 2020;64(4):326–334. doi:10.1590/0004-2730000003671.