GLOBAL HEALTH & MEDICINE

ISSN / eISSN: 2434-9186 / 2434-9194

Volume 08, Issue 06.

https://ghsjournal.com/

FREQUENCY ANALYSIS OF THYROID DISORDERS IN PATIENTS WITH TYPE II DIABETES MELLITUS

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ABSTRACT

OBJECTIVE

To determine the frequency of thyroid dysfunction in type II diabetic mellitus patients.

METHODOLOGY

This cross-sectional study was conducted in the Department of General Medicine Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkanafrom January 2025 to May 2025. A total of 162 patients with type 2 diabetes mellitus (T2DM), aged 40–70 years and with disease duration ≥5 years, were enrolled using non-probability consecutive sampling. Thyroid function was assessed using serum TSH, FT3, and FT4 levels. Data was analyzed in SPSS version 26.0, with statistical significance set at $p \leq 0.05$.

RESULTS

Among a cohort of 162 individuals diagnosed with Type 2 Diabetes Mellitus (mean age 54.2 years; 62.3% female), thyroid dysfunction was identified in 27.2% of the subjects.Subclinical hypothyroidism (38.6%) was the most common condition followed by subclinical hyperthyroidism (22.7%), hypothyroidism (20.5%) and hyperthyroidism (18.2%). No statistically significant associations were identified between thyroid dysfunction and variables of age, gender, or family history of diabetes ($P > 0.05$).

CONCLUSION

The current findings have shown that thyroid dysfunction is a prevalent comorbidity in individuals with Type 2 Diabetes Mellitus, and subclinical conditions are also highly prevalent. The results demonstrate that timely screening of thyroid in diabetic care is necessary as early diagnosis and prompt intervention can maximize metabolic control, minimize complications, and eventually elevate the quality of life of the patients in question.

Health Affairs ISSN - 0278-2715 Volume 13 ISSUE 9 page 4494-4504
Journal link: https://health-affairs.com/
Abstract Link: https://health-affairs.com/13-9-494-4504/
Submission 14 April 2025
Acceptance 22 July 2025
Publication 18 September 2025

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

KEYWORDS
Thyroid dysfunction, Type 2 diabetes mellitus, Thyroid dysfunction, Subclinical hypothyroidism

INTRODUCTION

The prevalence of Type 2 Diabetes Mellitus (T2DM) is rising sharply in emerging countries, largely driven by lifestyle changes and increasing rates of obesity [1]. In Pakistan, T2DM affects approximately 30.8% of individuals aged 16–80 years, with a higher burden reported in urban compared to rural populations [2–4]. Thyroid dysfunction (TD) is also common in low- and middle-income countries, with population-based studies reporting prevalence rates between 6.6% and 13.4%, while rates are even higher in patients with T2DM, ranging from 10% to 24% [5,6].

Both genetic and environmental factors contribute to the development of T2DM and TD. For example, polymorphisms in the TCF7L2 gene have been associated with increased risk of T2DM, whereas variations in the TPO gene predispose individuals to thyroid dysfunction [7,8]. Environmental determinants such as iodine deficiency, chemical exposure, and psychosocial stress have also been implicated, with evidence showing that individuals living in iodine-deprived regions are more susceptible to TD, particularly when diabetes coexists [8,9].

Several studies have examined the coexistence of TD and T2DM, but their findings are inconsistent. Ogbonna et al. reported a TD prevalence of 12.4% among T2DM patients, with hypothyroidism accounting for 11.6% and hyperthyroidism for 0.8% [11]. By contrast, Elgazar et al. identified a higher prevalence of 29%, comprising hypothyroidism (7%), subclinical hypothyroidism (13%), hyperthyroidism (3%), and subclinical hyperthyroidism (6%) [12]. Such variation likely reflects methodological differences, including whether subclinical cases were included in prevalence estimates.

The coexistence of TD and T2DM carries important clinical implications. Thyroid dysfunction increases the risk of cardiovascular complications, partly through its effects on lipid metabolism. Both hypo- and hyperthyroidism are associated with elevated LDL cholesterol and triglycerides, which are established risk factors for cardiovascular disease [13,14]. Blood pressure regulation may also be impaired, leading to vascular stiffness and endothelial dysfunction [15]. Additionally, thyroid abnormalities disrupt insulin sensitivity and glucose metabolism, thereby worsening insulin resistance and impairing glycemic control [16]. Since thyroid hormones regulate basal metabolic rate, disturbances in thyroid activity may contribute to weight gain in diabetic patients, further aggravating insulin resistance and poor glycemic outcomes [17].

Given these interrelations, the coexistence of T2DM and TD has become an important clinical

Health Affairs ISSN - 0278-2715 Volume 13 ISSUE 9 page 4494-4504
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ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

concern, as both are common endocrine disorders that influence each other's course and complicated management. Evidence suggests that a diabetes duration exceeding five years significantly increases the likelihood of developing thyroid dysfunction [11]. Identifying the prevalence and pattern of TD among diabetic patients is therefore critical to improving clinical management, guiding public health strategies, and informing evidence-based screening protocols. The present study seeks to address gaps in knowledge and provide new insights into the interplay of these two conditions, with the aim of enhancing health outcomes and quality of life for affected individuals.

METHODOLOGY

This cross-sectional study was conducted in the Department of General Medicine, Chandka Medical College Hospital (CMCH), Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkana, between January and May 2025. Patients were selected using a non-probability consecutive sampling method, ensuring that every eligible patient presenting during the study period was included until the desired sample size was reached. The sample size was calculated using the WHO sample size calculator, based on a thyroid dysfunction frequency of (29.0%)[12], a 7% margin of error, and a 95% confidence level, yielding an estimated sample size of 162. Patients aged 40 to 70 years, of either gender, with a confirmed diagnosis of type II diabetes mellitus for at least five years, including both inpatients and outpatients, were included. Both controlled and uncontrolled diabetic patients, regardless of their use of antidiabetic medications, were eligible for inclusion. Patients with type I diabetes mellitus, a history of thyroid surgery or radioactive iodine treatment, pre-existing thyroid disorders (e.g., hypothyroidism, hyperthyroidism), prior use of thyroid-altering drugs (e.g., lithium, amiodarone), chronic kidney disease, or those who were pregnant or lactating were excluded. A 3cc blood sample was collected from each participant using a disposable syringe and sent to the hospital laboratory for the evaluation of thyroid function through TSH, FT3, and FT4 levels. Thyroid dysfunction was defined as follows: hypothyroidism (TSH > 5 mIU/L, FT3 < 2.3 pg/ml, FT4 < 0.89 ng/dl), subclinical hypothyroidism (TSH > 5 mIU/L with normal FT3 and FT4), hyperthyroidism (TSH < 5 mIU/L, FT3 > 4.2 pg/ml, FT4 > 1.76 ng/dl), and subclinical hyperthyroidism (TSH < 5 mIU/L with normal FT3 and FT4). All collected data were securely stored to ensure patient confidentiality and data integrity. Data analysis was performed using SPSS version 26.0. Descriptive statistics were used for both qualitative and quantitative variables, while chi-square tests were applied to assess associations, with a p-value ≤ 0.05 considered statistically significant.

Health Affairs ISSN - 0278-2715 Volume 13 ISSUE 9 page 4494-4504
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https://ghsjournal.com/

RESULTS

The study enrolled 162 participants, with a mean age of 54.21 ± 6.40 years (95% CI: 53.22–55.20). The mean Body Mass Index (BMI) was 25.73 ± 3.53 kg/m² (95% CI: 25.18–26.28).The mean fasting blood glucose concentration was recorded at 144.20 ± 18.35 mg/dl (95% CI: 141.35–147.04), accompanied by a mean HbA1c level of 7.71 ± 0.86% (95% CI: 7.58–7.85). The mean alanine aminotransferase (ALT) level was **34.58 ± 7.47 IU/L** (95% CI: 33.42–35.74), while the mean aspartate aminotransferase (AST) level was **42.99 ± 8.75 IU/L** (95% CI: 41.64–44.35). Serum urea and creatinine concentrations averaged 18.22 ± 3.99 mg/dl (95% CI: 17.60–18.84) and 1.10 ± 0.38 mg/dl (95% CI: 1.04–1.16), respectively. The mean total cholesterol level was measured at 257.14 ± 29.56 mg/dl (95% CI: 252.55–261.72), while triglyceride levels were observed to average 150.59 ± 18.28 mg/dl (95% CI: 147.75–153.42). The average serum insulin concentration was determined to be 11.14 ± 2.35 mIU/L (95% CI: 10.77–11.50).Thyroid hormone assays revealed a mean FT3 of 2.96 ± 0.40 pg/ml (95% CI: 2.90–3.02), FT4 of 1.06 ± 0.16 ng/dl (95% CI: 1.03–1.08), and TSH of 2.89 ± 0.83 mIU/L (95% CI: 2.76–3.01). In the cohort of participants, a total of 61 individuals (37.7%) were categorized as male, whereas 101 individuals (62.3%) were delineated as female. A positive familial history of diabetes mellitus was noted in 53 (32.7%) individuals, in contrast to 109 (67.3%) who did not possess such a history. Thyroid dysfunction was identified in 44 (27.2%) participants, whereas 118 (72.8%) exhibited normal thyroid function, as detailed in **TABLE I.**

The analysis of the frequency distribution pertaining to thyroid dysfunction among the cohort of 44 participants indicated that the predominant condition was subclinical hypothyroidism, which was identified in 17 individuals (38.6%). This finding was succeeded by subclinical hyperthyroidism, present in 10 participants (22.7%), hypothyroidism observed in 9 participants (20.5%), and hyperthyroidism affecting 8 participants (18.2%). These results suggest that subclinical manifestations of thyroid dysfunction were more prevalent than overt thyroid disorders within the studied population, as illustrated in **TABLE II.**

The analysis of participant characteristics in relation to thyroid dysfunction among a cohort of 162 individuals did not yield any statistically significant correlations. Individuals exhibiting thyroid dysfunction presented with a marginally elevated mean age (55.66 ± 6.89 years) in contrast to their counterparts without thyroid dysfunction (53.67 ± 6.15 years), although this disparity did not achieve statistical significance (p=0.079; 95% CI: -0.229 to 4.209). The distribution of gender was comparable across the groups, with 34.1% of males and 65.9% of females identified in the thyroid dysfunction cohort, as opposed to 39.0% of males and 61.0% of

Health Affairs ISSN - 0278-2715 Volume 13 ISSUE 9 page 4494-4504
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ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

females in the non-dysfunction cohort (p=0.568; 95% CI: 0.392 to 1.671). A reported positive family history of diabetes mellitus was noted in 43.2% of participants with thyroid dysfunction, compared to 28.8% among those without, a difference that neared but did not attain statistical significance (p=0.083; 95% CI: 0.916 to 3.847) **TABLE III.**

DISCUSSION

Thyroid disorder is a known comorbidity among patients with Type 2 Diabetes Mellitus (T2DM), which leads to poor metabolism regulation and difficulties in glycemic regulation and increased cardiovascular risk. Thyroid dysfunction was identified in a significant percentage of the participants in the current study with subclinical hypothyroidism was being the most common type (38.6%), followed by subclinical hyperthyroidism (22.7%), hypothyroidism (20.5%), and hyperthyroidism (18.2%).

Subclinical presentation of abnormalities demonstrates the prevalence of the hidden burden of thyroid dysfunction in diabetic patients and shows the importance of proactive screening as these cases are often asymptomatic but have a significant clinical outcome.

Our findings align with numerous prior investigations that have been disseminated in the published literature. Our results are consistent with many other studies that have been published earlier. According to the literature, Elgazar et al. reported a prevalence rate of 29% of thyroid dysfunction in people diagnosed with Type 2 Diabetes Mellitus (T2DM) and clarified a similar distribution of the subtypes of thyroid disorder [12]. Similarly, Bukhari et al. determined that there was subclinical hypothyroidism (17.4%), hypothyroidism (8.5%), hyperthyroidism (6.0%), and subclinical hyperthyroidism (5.0%) among a Pakistani cohort [15]. Whereas their absolute prevalence was slightly lower than those in our study, the proportional distribution is consistent with our findings, which confirms the prevalence of subclinical hypothyroidism as the most common thyroid disease in diabetic groups.Collectively, such corroborative research illustrates a prevailing trend across diverse demographic populations.

In contrast, Ogbonna and Ezeani documented a much lower prevalence of 12.4%, comprising hypothyroidism (11.6%) and hyperthyroidism (0.8%), while excluding subclinical cases from their analysis [11]. This methodological limitation likely accounts for the lower prevalence they reported and highlights the necessity of incorporating both overt and subclinical forms in prevalence assessments. In our study, subclinical abnormalities accounted for over 60% of all thyroid dysfunction cases, indicating that exclusion of these conditions underestimates the true burden and may delay timely intervention. Thus, our findings add weight to the argument that comprehensive screening strategies, inclusive of subclinical states, are essential for accurate

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ISSN / eISSN: 2434-9186 / 2434-9194
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disease surveillance and management.

Further evidence supporting our results comes from studies conducted by Barmpari et al. and Bheemasenachari, both of which emphasized the frequent occurrence and clinical significance of thyroid dysfunction in diabetic populations [16,17]. These investigators, like us, advocate for routine thyroid screening in diabetes care pathways. The physiological rationale for such screening is well established: thyroid hormones influence glucose metabolism, lipid regulation, and insulin sensitivity. Dysregulation may worsen insulin resistance, impair glycemic control, elevate LDL cholesterol and triglycerides, and increase cardiovascular risk [13,14]. Considering that T2DM patients are already predisposed to cardiovascular complications, the coexistence of thyroid dysfunction represents a compounding risk factor that warrants particular attention.

Our study contributes to the growing body of literature by providing robust prevalence data from a tertiary-care setting in Pakistan, a region where both diabetes and thyroid disorders are common and often underdiagnosed. The inclusion of both overt and subclinical thyroid dysfunction provides a comprehensive assessment and offers clinically actionable insights for practitioners. The results also underscore the importance of integrating thyroid function testing into the routine management of diabetic patients, especially those with a disease duration exceeding five years, as this subgroup has been shown to carry a higher risk of thyroid dysfunction.

Despite these strengths, certain limitations merit consideration. The cross-sectional design restricts causal inference, precluding determination of whether thyroid dysfunction precedes or follows poor glycemic control. The single-center setting and non-probability sampling may limit the generalizability of our findings to the broader population. Additionally, the absence of HbA1c stratification in relation to thyroid function reduces the ability to assess how thyroid dysfunction directly affects glycemic control in this cohort. Exclusion of patients with known thyroid disease may also have led to an underrepresentation of the overall prevalence in the community.

Future research should focus on multicenter, longitudinal studies incorporating diverse populations and evaluating temporal associations between thyroid dysfunction and glycemic status. Such studies should also assess gender-specific differences, the role of diabetes duration, and environmental influences such as iodine sufficiency, all of which may refine screening protocols and guide targeted interventions.

In summary, our findings demonstrate a substantial prevalence of thyroid dysfunction among T2DM patients, with subclinical hypothyroidism emerging as the most common subtype. These

Health Affairs ISSN - 0278-2715 Volume 13 ISSUE 9 page 4494-4504
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results are broadly consistent with international and regional studies, although methodological differences across studies highlight the importance of comprehensive inclusion of subclinical cases. Routine screening for thyroid dysfunction should be considered in diabetic care to improve early detection, optimize management, and reduce associated metabolic and cardiovascular risks.

CONCLUSION

The current findings have shown that thyroid dysfunction is a prevalent comorbidity in individuals with Type 2 Diabetes Mellitus, and subclinical conditions are also highly prevalent. The results demonstrate that timely screening of thyroid in diabetic care is necessary as early diagnosis and prompt intervention can maximize metabolic control, minimize complications, and eventually elevate the quality of life of the patients in question.

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Table I: Demographic and Clinical Characteristics of Study Participants (n=162)		
Mean± Standard Deviation		**95% Confidence Interval**
Age in years = 54.21 ± 6.40		53.22----55.20
Body Mass Index in kg/m^2 = 25.73 ± 3.53		25.18----26.28
Fasting Blood Glucose in mg/dl = 144.20 ± 18.35		141.35----147.04
HbA1c in % = 7.71 ± 0.86		7.58----7.85
ALT in IU/L = 34.58 ± 7.47		33.42----35.74
AST in IU/L = 42.99 ± 8.75		41.64----44.35
Serum Urea in mg/dl = 18.22 ± 3.99		17.60----18.84
Serum creatinine in mg/dl = 1.10 ± 0.38		1.04----1.16
Total Cholesterol in mg/dl = 257.14 ± 29.56		252.55----261.72
Triglyceride in mg/dl = 150.59 ± 18.28		147.75----153.42
Serum Insulin in mIU/L = 11.14 ± 2.35		10.77----11.50
Serum FT3 in pg/ml = 2.96 ± 0.40		2.90----3.02
Serum FT4 in ng/dl = 1.06 ± 0.16		1.03----1.08
Serum TSH in mIU/L = 2.89 ± 0.83		2.76----3.01
Frequency(%)		
Gender	Male	61 (37.7)
	Female	101 (62.3)
Family History of DM	Positive	53 (32.7)
	Negative	109 (67.3)
Thyroid Dysfunction	Yes	44 (27.2)
	No	118 (72.8)

Table II: Frequency Distribution for Types of Thyroid Dysfunction (n=44)

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Hypothyroidism	9 (20.5)
Hyperthyroidism	8 (18.2)
Subclinical Hypothyroidism	17 (38.6)
Subclinical hyperthyroidism	10 (22.7)

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GLOBAL HEALTH & MEDICINE

ISSN / eISSN: 2434-9186 / 2434-9194

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Table III: Association of Patient Characteristics with Thyroid Dysfunction (n=162)					
Patient Characteristics		**Thyroid Dysfunction**		**95% C. I**	**P-Value**
		Yes (n=44)	**No (n=118)**		
Age in years		55.66 ± 6.89	53.67 ± 6.15	-0.229------4.209	0.079
Gender	Male	15 (34.1)	46 (39.0)	0.392------1.671	0.568
	Female	29 (65.9)	72 (61.0)		
Family History of DM	Positive	19 (43.2)	34 (28.8)	0.916------3.847	0.083
	Negative	25 (56.8)	84 (71.2)		

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ISSN / eISSN: 2434-9186 / 2434-9194

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