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FREQUENCY OF THYROID DYSFUNCTION AND ITS ASSOCIATION WITH GLYCEMIC CONTROL AMONG PATIENTS WITH TYPE 2 DIABETES MELLITUS ATTENDING TERTIARY CARE HOSPITALS IN LAHORE

Original Research (ID: 1704)

Dr Sohaib Akbar[1]*, Dr. Kashif Aziz Ahmad[2], Dr Ambreen Asif[3], Dr Rabea Rashed[4], Dr Umair Ahmad Siddiqui[1], Dr Huma Iqbal[5]
[1]Fellow Endocrinology Services Hospital Lahore
[2]Associate Professor Medicine Lahore General Hospital. Lahore
[3]Senior Registrar Medicine Lahore General Hospital Lahore
[4]Senior Registrar Cardiology Punjab Institute of Cardiology Lahore
[5]Fellow Neonatology Children Hospital Lahore
Corresponding Author: Dr Sohaib Akbar, akbarsohaib37@gmail.com, Fellow Endocrinology Services Hospital Lahore
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ABSTRACT

Background: Thyroid dysfunction and type 2 diabetes mellitus are common endocrine disorders that may coexist and influence metabolic control. Altered thyroid hormone status can affect insulin sensitivity, hepatic glucose output and peripheral glucose utilization, making thyroid dysfunction clinically relevant in diabetic patients with poor glycemic control.

Objective: This study aimed to determine the frequency of thyroid dysfunction and assess its association with glycemic control among patients with type 2 diabetes mellitus attending tertiary care hospitals in Lahore.

Methods: A cross-sectional analytical study was conducted over six months, from October 2025 to March 2026, at selected tertiary care hospitals in Lahore. A total of 275 adult patients with type 2 diabetes mellitus were enrolled through consecutive non-probability sampling. Demographic and clinical data were recorded using a structured proforma. Glycemic control was assessed by HbA1c and categorized as good control when HbA1c was <7.0% and poor control when HbA1c was ≥7.0%. Thyroid function was evaluated using serum TSH, free T4 and free T3. Data were analyzed using SPSS version 26. Chi-square test, independent sample t-test, one-way ANOVA, Pearson correlation and binary logistic regression were applied, with $p<0.05$ considered significant.

Results: The mean age of participants was 52.84 ± 9.61 years, and 153 (55.6%) were female. Overall thyroid dysfunction was found in 72 (26.2%) patients. Subclinical hypothyroidism was the most common abnormality, observed in 39 (14.2%) patients, followed by overt hypothyroidism in 18 (6.5%). Poor glycemic control was present in 197 (71.6%) patients. Thyroid dysfunction was significantly more frequent among patients with poor glycemic control than those with good control (83.3% vs. 16.7%; p=0.011). Mean HbA1c was higher among patients with thyroid dysfunction than euthyroid patients (9.10 ± 1.61% vs. 7.96 ± 1.37%; $p<0.001$). TSH showed a positive correlation with HbA1c ($r=0.33$; $p<0.001$). After adjustment, thyroid dysfunction remained significantly associated with poor glycemic control (AOR=2.34; 95% CI: 1.16–4.71; p=0.018).

Conclusion: Thyroid dysfunction was frequent among patients with type 2 diabetes mellitus, with subclinical hypothyroidism being the predominant abnormality. Its significant association with poor glycemic control supports timely thyroid function assessment in diabetic patients, particularly those with uncontrolled HbA1c.

Keywords: Cross-Sectional Studies; Diabetes Mellitus, Type 2; Glycated Hemoglobin; Glycemic Control; Pakistan; Thyroid Diseases; Thyroid Function Tests.

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INTRODUCTION

Type 2 diabetes mellitus is one of the most important chronic metabolic disorders affecting adult populations worldwide, and its burden is particularly high in South Asian countries where urbanization, sedentary lifestyle, dietary transition and genetic susceptibility have contributed to a rapid rise in disease frequency. Pakistan has emerged as one of the countries with the highest proportional burden of diabetes, making diabetes-related metabolic and endocrine complications an increasingly important concern for tertiary care hospitals(1). Although the routine management of type 2 diabetes mellitus mainly focuses on blood glucose, blood pressure, lipid profile and end-organ complications, coexisting endocrine disorders may silently interfere with metabolic control and reduce the effectiveness of standard diabetic care. Among these, thyroid dysfunction has gained particular clinical importance because both diabetes and thyroid disease are common, long-standing and often overlapping endocrine conditions(2, 3). The thyroid gland plays a central role in regulating basal metabolic rate, carbohydrate metabolism, lipid utilization, thermogenesis and cardiovascular function. Even mild changes in thyroid hormone activity can influence insulin sensitivity, hepatic glucose production, intestinal glucose absorption and peripheral glucose uptake. Hypothyroidism is commonly associated with weight gain, dyslipidemia, reduced glucose disposal and increased insulin resistance, while hyperthyroidism may worsen glycemic variability through increased hepatic glucose output and accelerated insulin degradation(4). These metabolic effects are clinically relevant in patients with type 2 diabetes mellitus because poor glycemic control is already driven by insulin resistance and progressive beta-cell dysfunction. When thyroid dysfunction coexists, the patient may experience more difficulty in achieving target HbA1c levels despite adherence to antidiabetic therapy(5, 6).

Several international studies have reported that thyroid dysfunction is more frequent among patients with type 2 diabetes mellitus than in the general population. A recent systematic review and meta-analysis found that approximately one-fifth of adults with type 2 diabetes had some form of thyroid dysfunction, with subclinical hypothyroidism and overt hypothyroidism being the most frequently reported abnormalities(7). The same review highlighted that thyroid dysfunction was associated with female gender, longer duration of diabetes, central obesity, diabetic complications and HbA1c levels of 7% or higher. These findings suggest that thyroid abnormalities in diabetic patients are not merely coincidental but may be linked with the broader metabolic disturbance of type 2 diabetes mellitus(8, 9). The relationship between thyroid dysfunction and glycemic control is clinically meaningful because HbA1c remains the most widely used marker of long-term glucose regulation and treatment adequacy. Previous studies have shown that thyroid dysfunction tends to be more common among diabetic patients with higher HbA1c levels, and that increasing TSH may correlate with poorer glycemic status(10). This association may be explained by chronic hyperglycemia affecting the hypothalamic-pituitary-thyroid axis, while thyroid hormone imbalance may further aggravate insulin resistance and lipid abnormalities. Therefore, unrecognized thyroid dysfunction may contribute to persistent poor glycemic control, treatment intensification, increased medication burden and higher risk of diabetes-related complications(11, 12).

In Pakistan, the clinical relevance of this problem is even greater because diabetes is highly prevalent and many patients present to tertiary care hospitals with long disease duration, suboptimal glycemic control and established complications. Local studies have also reported a considerable frequency of thyroid dysfunction among patients with type 2 diabetes mellitus, with hypothyroidism being a common pattern and females appearing to be more frequently affected. A recent Lahore-based tertiary care study found that hypothyroidism and subclinical hypothyroidism were frequent among patients with type 2 diabetes, and that thyroid-stimulating hormone showed a positive correlation with HbA1c, duration of diabetes and body mass index. However, despite growing evidence, thyroid screening is not always performed routinely in diabetic clinics, particularly when patients do not report classical symptoms of thyroid disease. This is important because symptoms such as fatigue, weight change, constipation, neuropathic complaints and mood disturbance may be wrongly attributed to diabetes itself, allowing thyroid dysfunction to remain undetected(13). There remains a need for hospital-based evidence from Lahore to clarify the frequency of thyroid dysfunction among patients with type 2 diabetes mellitus and to determine whether thyroid abnormalities are significantly associated with glycemic control in the local clinical population. Such evidence may help clinicians identify high-risk diabetic patients who could benefit from thyroid function assessment and more integrated endocrine care. Therefore, the present study was designed to determine the frequency of thyroid dysfunction among patients with type 2 diabetes mellitus attending tertiary care hospitals in Lahore and to evaluate its association with glycemic control, as assessed by HbA1c levels. The study further aims to describe the pattern of thyroid dysfunction in this population and provide clinically useful evidence for improving diabetes management through timely recognition of coexisting thyroid abnormalities.

METHODS

This cross-sectional analytical study was conducted at the medical outpatient and endocrinology departments of selected tertiary care hospitals in Lahore, Pakistan. The study was carried out over a period of six months, from October 2025 to March 2026. The purpose of the study was to determine the frequency of thyroid dysfunction among patients with type 2 diabetes mellitus and to assess its association with glycemic control. A hospital-based cross-sectional design was considered appropriate because it allowed estimation of the burden of thyroid dysfunction at a single point of clinical assessment and enabled comparison of thyroid status across different levels of glycemic control(14). The sample size was calculated by using the single population proportion formula, $n = Z^2p(1-p)/d^2$, where Z was taken as 1.96 at 95% confidence level, p was taken as 20.24% based on previously reported pooled prevalence of thyroid dysfunction among adults with type 2 diabetes mellitus, and d was kept at 5% margin of error. The calculated minimum sample size was 248

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INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

participants. After adding approximately 10% to compensate for non-response, incomplete laboratory reports or missing clinical information, the final required sample size was rounded to 275 patients. Participants were enrolled through a consecutive non-probability sampling technique until the required sample size was achieved(15-17).

Adult patients of either gender, aged 30 to 75 years, with a confirmed diagnosis of type 2 diabetes mellitus for at least six months were included in the study. Diagnosis of type 2 diabetes mellitus was accepted on the basis of previous medical records, use of oral hypoglycemic agents or insulin for type 2 diabetes, or documented physician diagnosis in the hospital file. Patients were excluded if they had type 1 diabetes mellitus, gestational diabetes, known thyroid malignancy, previous thyroidectomy, radioactive iodine treatment, current use of antithyroid drugs or thyroxine therapy, chronic kidney disease stage 4 or 5, chronic liver disease, acute severe illness, pregnancy, or use of medications known to significantly alter thyroid function, such as amiodarone, lithium, systemic glucocorticoids or interferon. Patients with incomplete laboratory data for HbA1c or thyroid profile were also excluded to maintain consistency in analysis(17). Data were collected after obtaining ethical approval from the Institutional Review Board/Ethical Review Committee of the concerned institution, Lahore, Pakistan. Written informed consent was obtained from all participants before enrollment. The participants were informed about the purpose of the study, voluntary nature of participation, confidentiality of information and their right to withdraw at any stage without any effect on their medical care. No personal identifiers were used during data entry, and each participant was assigned a unique study code.

A structured data collection proforma was used to record demographic, clinical and laboratory information. Demographic variables included age, gender and residence. Clinical variables included duration of diabetes mellitus, family history of thyroid disease, body mass index, treatment modality for diabetes, history of hypertension and presence of relevant diabetic complications as documented in the clinical record. Body mass index was calculated by dividing body weight in kilograms by height in meters squared. Glycemic control was assessed by glycated hemoglobin level. HbA1c was measured from venous blood samples using the hospital laboratory method based on standardized automated analysis. For analytical purposes, glycemic control was categorized as good control when HbA1c was below 7.0% and poor control when HbA1c was 7.0% or above(18). Thyroid function was assessed by serum thyroid-stimulating hormone, free thyroxine and free triiodothyronine levels. Venous blood samples were collected under standard aseptic precautions and analyzed in the hospital laboratory using automated chemiluminescent immunoassay. Thyroid status was classified according to laboratory reference ranges. Euthyroid status was defined as normal TSH with normal free T4 and free T3. Subclinical hypothyroidism was defined as raised TSH with normal free T4, while overt hypothyroidism was defined as raised TSH with low free T4. Subclinical hyperthyroidism was defined as low TSH with normal free T4 and free T3, whereas overt hyperthyroidism was defined as low TSH with raised free T4 and/or free T3. Overall thyroid dysfunction was recorded when any of these abnormal thyroid categories were present(19).

Data were entered and analyzed using IBM SPSS Statistics version 26. Normality of continuous variables was assessed by visual inspection of histograms and the Shapiro-Wilk test, and the data were found to be normally distributed. Continuous variables such as age, duration of diabetes, body mass index, HbA1c, TSH, free T4 and free T3 were presented as mean and standard deviation. Categorical variables such as gender, glycemic control category, thyroid status and type of thyroid dysfunction were presented as frequency and percentage. The frequency of thyroid dysfunction was calculated as the proportion of diabetic patients having abnormal thyroid function tests. The chi-square test was applied to determine the association between thyroid dysfunction and glycemic control category. Independent sample t-test was used to compare mean HbA1c between euthyroid and thyroid dysfunction groups, while one-way analysis of variance was used to compare HbA1c across different thyroid dysfunction categories. Pearson correlation was applied to assess the relationship between HbA1c and TSH levels. Binary logistic regression analysis was performed to evaluate the association of poor glycemic control with thyroid dysfunction after adjusting for age, gender, body mass index and duration of diabetes. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study included 275 patients with type 2 diabetes mellitus who attended tertiary care hospitals in Lahore during the study period. The mean age of the participants was 52.84 ± 9.61 years, and females formed a slightly larger proportion of the sample. The mean duration of diabetes was 8.12 ± 4.18 years, while the mean body mass index was 28.43 ± 4.72 kg/m². Most participants had poor glycemic control based on HbA1c ≥7.0%, with an overall mean HbA1c of 8.26 ± 1.54%. Baseline clinical and laboratory characteristics are summarized in Table 1.

Table 1. Baseline demographic, clinical and laboratory characteristics of participants

Variable	n (%) or Mean ± SD
Total participants	275
Age, years	52.84 ± 9.61
Male	122 (44.4%)

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Female	153 (55.6%)
Duration of diabetes, years	8.12 ± 4.18
Body mass index, kg/m²	28.43 ± 4.72
HbA1c, %	8.26 ± 1.54
TSH, mIU/L	4.18 ± 3.21
Free T4, ng/dL	1.16 ± 0.29
Free T3, pg/mL	3.08 ± 0.61
Good glycemic control, HbA1c <7.0%	78 (28.4%)
Poor glycemic control, HbA1c ≥7.0%	197 (71.6%)
Diabetes managed with oral hypoglycemic agents	169 (61.5%)
Diabetes managed with insulin ± oral drugs	106 (38.5%)

Overall thyroid dysfunction was identified in 72 participants, while the remaining patients had normal thyroid function tests. Subclinical hypothyroidism was the most frequent abnormality, followed by overt hypothyroidism. Hyperthyroid-spectrum disorders were comparatively less common. Thyroid dysfunction was observed more frequently among females than males, but the primary outcome analysis focused on its association with glycemic control. The distribution of thyroid function categories is presented in Table 2 and illustrated in Figure 1.

Table 2. Frequency and pattern of thyroid dysfunction among patients with type 2 diabetes mellitus

Thyroid function category	Frequency	Percentage
Euthyroid	203	73.8%
Any thyroid dysfunction	72	26.2%
Subclinical hypothyroidism	39	14.2%
Overt hypothyroidism	18	6.5%
Subclinical hyperthyroidism	9	3.3%
Overt hyperthyroidism	6	2.2%
Hypothyroid-spectrum dysfunction	57	20.7%
Hyperthyroid-spectrum dysfunction	15	5.5%

Thyroid dysfunction showed a significant association with glycemic control. A higher proportion of participants with poor glycemic control had thyroid dysfunction compared with those having good glycemic control. Mean HbA1c was also higher among patients with thyroid dysfunction than among euthyroid patients. On comparison across thyroid function categories, overt hypothyroidism showed the highest mean HbA1c, followed by overt hyperthyroidism and subclinical hypothyroidism. Pearson correlation analysis demonstrated a significant positive correlation between HbA1c and TSH levels. These findings are presented in Table 3 and Figure 2.

Table 3. Association of thyroid dysfunction with glycemic control and thyroid-related biochemical parameters

Variable	Euthyroid	Thyroid dysfunction	Test value	p-value
Good glycemic control, HbA1c <7.0%	66 (32.5%)	12 (16.7%)	$\chi^2 = 6.53$	0.011
Poor glycemic control, HbA1c ≥7.0%	137 (67.5%)	60 (83.3%)		
Mean HbA1c, %	7.96 ± 1.37	9.10 ± 1.61	t = 5.84	<0.001
Mean TSH, mIU/L	2.18 ± 0.87	9.82 ± 4.36	t = 20.64	<0.001
Mean free T4, ng/dL	1.24 ± 0.18	0.94 ± 0.36	t = 8.93	<0.001

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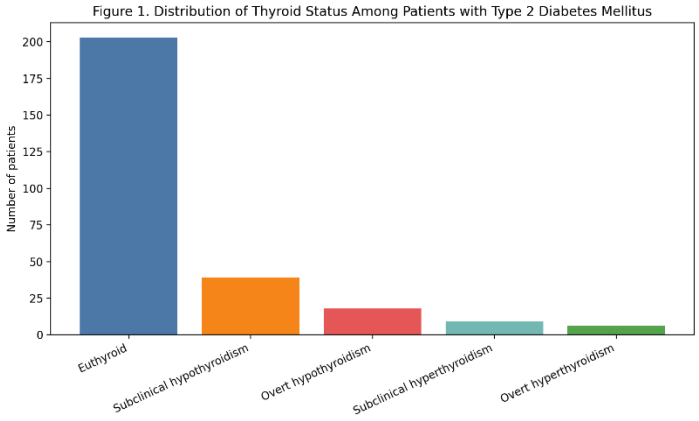
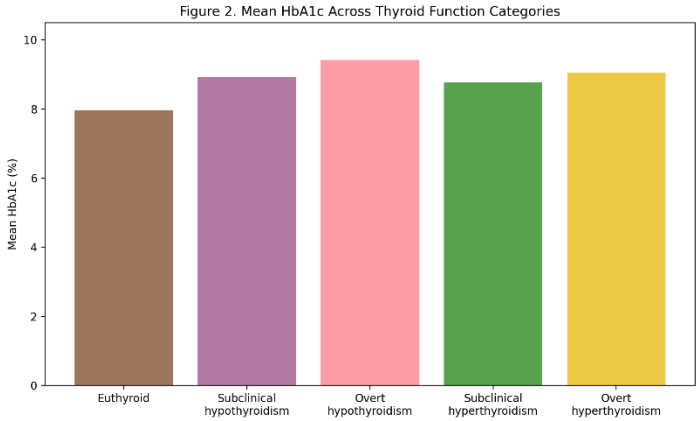
HbA1c and TSH correlation	r = 0.33			<0.001
Adjusted association of thyroid dysfunction with poor glycemic control	AOR = 2.34	95% CI: 1.16–4.71		0.018

Binary logistic regression was performed after adjusting for age, gender, body mass index and duration of diabetes. Thyroid dysfunction remained significantly associated with poor glycemic control. Longer duration of diabetes and higher body mass index were also associated with poor glycemic control, whereas age and gender did not show statistically significant independent associations in the adjusted model.





DISCUSSION

The present study demonstrated that thyroid dysfunction was a frequent finding among patients with type 2 diabetes mellitus attending tertiary care hospitals in Lahore. Overall, thyroid dysfunction was observed in 72 out of 275 participants, giving a frequency of 26.2%. The most common abnormality was subclinical hypothyroidism, which was present in 14.2% of patients, followed by overt hypothyroidism in 6.5%, subclinical hyperthyroidism in 3.3% and overt hyperthyroidism in 2.2%. This pattern indicated that hypothyroid-spectrum dysfunction accounted for the major proportion of thyroid abnormalities in the diabetic population. The findings also showed that thyroid dysfunction was significantly associated with glycemic control, as 83.3% of patients with thyroid dysfunction had HbA1c ≥7.0%, compared with 67.5% of euthyroid patients. Mean HbA1c was also higher among patients with thyroid dysfunction than among euthyroid patients, with values of 9.10 ± 1.61% and 7.96 ± 1.37%, respectively. The frequency of thyroid dysfunction in the current study was slightly higher than the pooled estimate reported in recent meta-analytic evidence, where thyroid dysfunction among adults with type 2 diabetes mellitus was reported at 20.24%. The same pooled analysis reported subclinical hypothyroidism as the most common abnormality, with a frequency of 11.87%, followed by overt hypothyroidism at 7.75%, subclinical hyperthyroidism at 2.49% and overt hyperthyroidism at 2.51%. The present findings were therefore broadly consistent with international evidence, particularly in showing the predominance of subclinical hypothyroidism, although the overall burden was somewhat higher. This difference may have been related to the hospital-based nature of the study, as tertiary care settings usually receive patients with longer disease duration, poorer metabolic control, obesity, multiple comorbidities and more advanced diabetic complications(18, 20).

The findings were also comparable with local and regional studies from Pakistan and South Asia, although some variation existed across reported frequencies. A recent Pakistani comparative study reported thyroid dysfunction in 14.5% of diabetic patients, with a higher proportion among those with uncontrolled diabetes than those with controlled diabetes. Other regional studies reported rates ranging from approximately one-fifth to one-third of diabetic patients, depending on age distribution, glycemic profile, exclusion criteria, iodine status, laboratory cutoffs and whether known thyroid disease was included or excluded. The 26.2% frequency in the present study therefore appeared clinically plausible for a tertiary care diabetic population in Lahore. The higher proportion of female participants and the relatively high mean HbA1c of 8.26 ± 1.54% may also have contributed to the observed burden, as female gender, obesity, longer diabetes duration and HbA1c ≥7.0% had repeatedly been linked with thyroid dysfunction in diabetic populations(13, 21). The association between thyroid dysfunction and poor glycemic control was an important finding of the study. Patients with thyroid dysfunction had higher mean HbA1c, and binary logistic regression showed that thyroid dysfunction remained independently associated with poor glycemic control after adjustment for age, gender, body mass index and duration of diabetes. The adjusted odds ratio of 2.34 suggested that patients with thyroid dysfunction had more than twice the odds of poor glycemic control compared with euthyroid patients. This finding supported the biological interaction between thyroid hormone imbalance and glucose metabolism. Hypothyroidism may reduce glucose utilization, worsen insulin resistance and contribute to weight gain and dyslipidemia, while hyperthyroidism may increase hepatic glucose output and accelerate insulin degradation. At the same time, chronic hyperglycemia itself may influence the

hypothalamic-pituitary-thyroid axis and alter peripheral conversion of thyroid hormones. This bidirectional relationship made it difficult to define a single causal direction, but the observed association had practical clinical importance(5, 22).

The results had direct implications for diabetic care in tertiary hospitals. Symptoms of thyroid dysfunction, such as tiredness, weight change, constipation, palpitations, mood disturbance and reduced exercise tolerance, may overlap with diabetes or its complications. Because of this overlap, thyroid dysfunction may remain unrecognized unless thyroid function testing is actively considered. The high frequency of subclinical hypothyroidism in the present study was particularly relevant because these patients may not present with obvious clinical features, yet may still have poorer metabolic parameters. The findings therefore supported a more vigilant approach to thyroid screening in patients with type 2 diabetes mellitus, especially in those with HbA1c ≥7.0%, longer duration of diabetes, obesity, female gender or unexplained difficulty in achieving glycemic targets(1, 4). The study had several strengths. It included an adequate sample size of 275 patients, used standardized biochemical markers including HbA1c, TSH, free T4 and free T3, and applied appropriate statistical tests for normally distributed data. The analysis also moved beyond simple frequency estimation by assessing the association between thyroid dysfunction and glycemic control through chi-square testing, mean comparison, correlation and adjusted logistic regression. However, certain limitations were present. The cross-sectional design prevented assessment of temporal or causal relationships between thyroid dysfunction and poor glycemic control. The study was conducted in tertiary care hospitals, which may have overrepresented patients with more complicated or poorly controlled diabetes. Thyroid autoantibodies, lipid profile, iodine status, dietary factors and medication adherence were not assessed, although these variables may have influenced thyroid status and glycemic control. Future multicenter longitudinal studies with larger community-based samples, thyroid autoantibody testing and follow-up after correction of thyroid dysfunction would provide stronger evidence regarding whether early detection and treatment of thyroid abnormalities could improve glycemic outcomes in patients with type 2 diabetes mellitus.

CONCLUSION

The study concluded that thyroid dysfunction was frequent among patients with type 2 diabetes mellitus attending tertiary care hospitals in Lahore, with subclinical hypothyroidism being the most common abnormality. Thyroid dysfunction showed a significant association with poor glycemic control, as patients with abnormal thyroid profiles had higher HbA1c levels than euthyroid patients. These findings highlight the clinical importance of timely thyroid function assessment in diabetic patients, particularly those with uncontrolled glycemia, to support more comprehensive endocrine management and improve metabolic outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Dr Sohaib Akbar	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Dr. Kashif Aziz Ahmad	Methodology, Investigation, Data Curation, Writing - Review & Editing
Dr Ambreen Asif	Investigation, Data Curation, Formal Analysis, Software
Dr Rabea Rashed	Software, Validation, Writing - Original Draft
Dr Umair Ahmad Siddiqui	Formal Analysis, Writing - Review & Editing
Dr Huma Iqbal	Writing - Review & Editing, Assistance with Data Curation

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