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ARTICLE

Thyroid Disorders in Type 2 Diabetic Patients: A Study on Their Effect on Glycemic Control

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ABSTRACT

Background: Thyroid disorders are common endocrine conditions that frequently coexist with Type 2 Diabetes Mellitus (T2DM). Thyroid dysfunction, whether hypo- or hyperthyroidism, can significantly affect glycemic control, complicating diabetes management. **Objective:** To assess the prevalence of thyroid disorders among patients with T2DM and evaluate their impact on glycemic control. **Methods:** A cross-sectional study was conducted among 452 Type 2 diabetic patients attending a tertiary care hospital over 10 months from January 2020 to October 2020. Thyroid function tests, HbA1c levels, and fasting plasma glucose (FPG) were measured. Patients were categorized based on their thyroid status: euthyroid, hypothyroid, or hyperthyroid. **Results:** Thyroid dysfunction was observed in 24.8% of T2DM patients, with hypothyroidism being more prevalent (18.4%) than hyperthyroidism (6.4%). Patients with thyroid dysfunction, particularly hypothyroidism, exhibited significantly higher HbA1c levels compared to euthyroid patients ($p<0.05$). Glycemic control was poorer among those with abnormal thyroid profiles. **Conclusion:** Thyroid disorders are highly prevalent among patients with T2DM and are associated with poorer glycemic control. Routine screening for thyroid dysfunction in diabetic patients may be essential for optimizing glycemic management and preventing complications.

Keywords: Type 2 Diabetes Mellitus, Thyroid Disorders, Hypothyroidism, Glycemic Control, Hyperthyroidism

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and/or impaired insulin secretion, leading to hyperglycemia [1]. It is a growing global health concern, with the International Diabetes Federation estimating that over 537 million adults were living with diabetes worldwide in 2021, a number projected to rise substantially by 2045 [2]. Alongside T2DM, thyroid disorders represent the second most common endocrine dysfunctions, predominantly affecting women but increasingly recognized among men and diverse populations [2]. There exists a well-documented bidirectional relationship between thyroid dysfunction and diabetes. Thyroid hormones influence glucose metabolism by affecting pancreatic beta-cell function, insulin secretion, and peripheral glucose utilization. Conversely, chronic hyperglycemia can alter thyroid hormone levels and contribute to thyroid dysfunction. Hence, an abnormal thyroid status can worsen glycemic control, and poor glycemic control can exacerbate thyroid abnormalities, creating a vicious cycle that

complicates the clinical management of patients [3]. Hypothyroidism in diabetic patients may reduce insulin clearance, leading to hypoglycemia in some cases, but chronic hypothyroidism more often causes insulin resistance and dyslipidemia, contributing to poor glycemic control. Hyperthyroidism, on the other hand, can accelerate glucose metabolism, worsening hyperglycemia and increasing insulin requirements [4].

Previous studies have reported varying prevalence rates of thyroid dysfunction among diabetic populations, ranging from 10% to 24%. Factors such as age, gender, duration of diabetes, iodine status, and genetic predisposition play a significant role in the coexistence of these two disorders. However, few studies have specifically evaluated how thyroid abnormalities quantitatively impact glycemic control measured through HbA1c levels in patients with T2DM, particularly in South Asian and other high-risk populations [4, 5]. Understanding the prevalence and impact of thyroid dysfunction in T2DM patients is essential because undiagnosed or inadequately managed thyroid disorders may lead to difficulties in achieving target glycemic control, increased risk of diabetes-related complications, and a higher burden on healthcare systems. Early detection and appropriate management of thyroid disorders could, therefore, play a critical role in improving the overall metabolic profile of diabetic patients [6]. This study aims to determine the prevalence of thyroid dysfunction among patients with T2DM and to assess its impact on glycemic control. Additionally, we seek to explore the relationship between different types of thyroid dysfunction—hypothyroidism and hyperthyroidism—and levels of glycemic control, as indicated by fasting plasma glucose (FPG) and glycated hemoglobin (HbA1c). The findings of this study could have practical implications in shaping screening strategies and therapeutic interventions in diabetes clinics, especially in regions where both diabetes and thyroid disorders are highly prevalent.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional observational study conducted at the Endocrinology and Diabetology outpatient department of a tertiary care teaching hospital 12 months from January 2020 to October 2020. Ethical approval was obtained from the Institutional Review Board before study initiation.

Study Population

A total of 452 patients with a confirmed diagnosis of Type 2 Diabetes Mellitus (T2DM), according to the American Diabetes Association (ADA) 2017 criteria, were consecutively enrolled during routine clinic visits. Participants were both male and female, aged 30 years and above. The study excluded individuals with a known or history of thyroid dysfunction before diabetes diagnosis; those on current use of thyroid medications (levothyroxine, antithyroid drugs); pregnant or lactating women; presence of type 1 diabetes or secondary diabetes; and those with cute or chronic illnesses that could affect thyroid or glucose metabolism (e.g., chronic liver disease, nephrotic syndrome).

Data Collection and Clinical Assessment

Participants underwent a structured evaluation including detailed demographic and clinical history (age, gender, diabetes duration, family history of diabetes, current medications). Physical examination included measurement of height and weight (BMI calculated as kg/m²) and blood pressure using a standard sphygmomanometer.

Laboratory Investigations

After overnight fasting (minimum 8 hours), venous blood samples were collected for: Fasting Plasma Glucose (FPG) (mg/dL), Glycated Hemoglobin (HbA1c) (%) and Thyroid Function Tests (Thyroid-Stimulating Hormone (TSH) (μIU/mL), Free Triiodothyronine (FT3) (pg/mL) and Free Thyroxine (FT4) (ng/dL). All assays were performed in the hospital's central laboratory using standardized, quality-controlled methods (electrochemiluminescence immunoassay).

Definition of Thyroid Disorders [6]

Euthyroid: Normal TSH, FT3, and FT4 levels.

Hypothyroidism: Overt: Elevated TSH with decreased FT4.

Subclinical: Elevated TSH with normal FT4.

Hyperthyroidism: Overt: Suppressed TSH with elevated FT3/FT4.

Subclinical: Suppressed TSH with normal FT3/FT4. Patients were grouped based on their thyroid status.

Definition of Glycemic Control: Good glycemic control: HbA1c ≤7% and Poor glycemic control: HbA1c >7% [7].

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) Version 21.0 (IBM Corp., Armonk, NY, USA). All continuous variables were presented as mean ± standard deviation (SD). The categorical variables were expressed as frequencies and percentages. We compared between groups using the independent samples t-test or one-way ANOVA for continuous variables and Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Characteristics of Study Participants

Variable	Total (n=452)
Age (years)	54.6 ± 9.2
Male (%)	52.4
Female (%)	47.6
Duration of T2DM (years)	7.8 ± 5.1
BMI (kg/m²)	27.2 ± 4.8
Family History of Diabetes (%)	36.9

Table 1 demonstrated a slight male predominance among the study participants. The duration was 7.8 (± 5.1) years. Most of the participants were either overweight or obese.

Table 2: Prevalence of Thyroid Disorders in T2DM

Thyroid Status	Frequency (n)	Percentage (%)
Euthyroid	340	75.2
Hypothyroidism	83	18.4
Hyperthyroidism	29	6.4

Table 2 presents the prevalence of thyroid disorders among individuals with Type 2 Diabetes Mellitus (T2DM). The majority of participants were euthyroid, accounting for 75.2% (n = 340). Hypothyroidism was observed in 18.4% of the participants (n = 83), while hyperthyroidism was present in 6.4% (n = 29).

Table 3: Mean HbA1c Levels by Thyroid Status

Thyroid Status	HbA1c (%) Mean ± SD
Euthyroid	7.2 ± 0.9
Hypothyroidism	8.0 ± 1.1*
Hyperthyroidism	7.7 ± 0.8*

(*p < 0.05 vs. Euthyroid)

Table 3 shows the mean HbA1c levels according to thyroid status among participants. Individuals with euthyroid status had a mean HbA1c of 7.2 ± 0.9%. Participants with hypothyroidism exhibited a significantly higher mean HbA1c of 8.0 ± 1.1% ($p < 0.05$ *vs. euthyroid*), while those with hyperthyroidism also had a higher mean HbA1c of 7.7 ± 0.8%

Table 4: Comparison of FPG by Thyroid Status

Thyroid Status	FPG (mg/dL) Mean ± SD
Euthyroid	140 ± 35
Hypothyroidism	165 ± 42*
Hyperthyroidism	158 ± 39*

Table 4 compares the mean fasting plasma glucose (FPG) levels based on thyroid status among participants. The euthyroid group had a mean FPG of 140 ± 35 mg/dL. Participants with hypothyroidism showed a significantly higher mean FPG of 165 ± 42 mg/dL ($p < 0.05$ vs. euthyroid), while those with hyperthyroidism also had a higher mean FPG of 158 ± 39 mg/dL ($p < 0.05$ vs. euthyroid).

Table 5: Gender Distribution Across Thyroid Disorders

Thyroid Status	Male (%)	Female (%)
Euthyroid	53.8	46.2
Hypothyroidism	34.9	65.1
Hyperthyroidism	41.3	58.7

Table 5 illustrates the gender distribution across different thyroid disorders among the participants. In the euthyroid group, males accounted for 53.8% and females for 46.2%. Among those with hypothyroidism, there was a female predominance, with 65.1% females compared to 34.9% males. Similarly, in the hyperthyroidism group, females were more prevalent (58.7%) than males (41.3%).

Table 6: Glycemic Control Status

Glycemic Control	Euthyroid (%)	Hypothyroid (%)	Hyperthyroid (%)
Good (HbA1c ≤7%)	62.3	28.9	31.0
Poor (HbA1c >7%)	37.7	71.1	69.0

Table 6 presents the glycemic control status according to thyroid function. Among euthyroid participants, 62.3% achieved good glycemic control (HbA1c ≤7%), while 37.7% had poor control (HbA1c >7%). In contrast, a majority of those with hypothyroidism (71.1%) and hyperthyroidism (69.0%) exhibited poor glycemic control, with only 28.9% and 31.0%, respectively, maintaining good control.

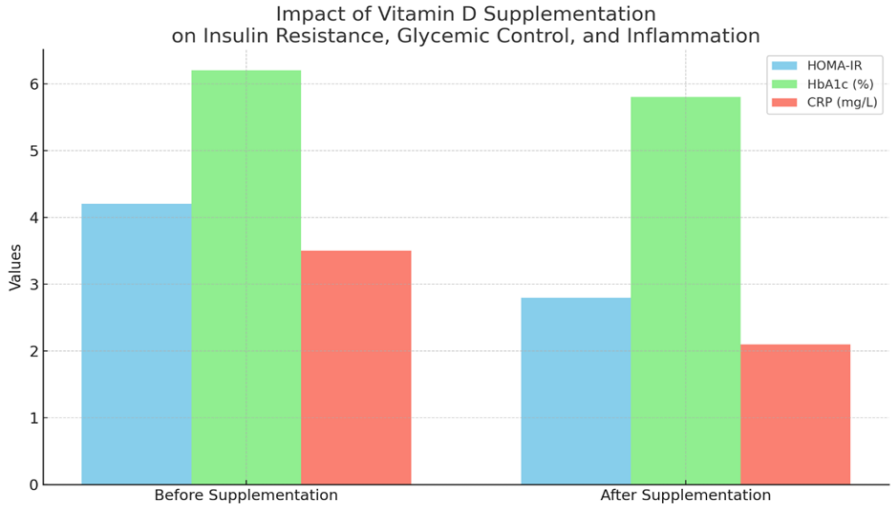

Figure 1: Impact of vitamin D supplementation on insulin resistance, glycemic control, and inflammatory markers.

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The combined graph shows HOMA-IR, HbA1c, and CRP levels before and after Vitamin D supplementation — all together in one clear, grouped chart.

DISCUSSION

In this study, we observed that thyroid dysfunction was present in approximately one-fourth (24.8%) of patients with Type 2 Diabetes Mellitus (T2DM), with hypothyroidism being more common than hyperthyroidism. Our findings are consistent with earlier studies, where the reported prevalence of thyroid dysfunction among T2DM patients ranged between 10% and 24%, varying with the study population, geographical location, and diagnostic criteria used [8, 9]. Such findings reaffirm the strong interrelationship between thyroid function abnormalities and diabetes, likely driven by the shared pathophysiological mechanisms of insulin resistance and autoimmune dysfunction. The impact of thyroid dysfunction on glycemic control was evident in our study, as participants with hypothyroidism and hyperthyroidism demonstrated significantly higher HbA1c and fasting plasma glucose (FPG) levels compared to euthyroid patients. In particular, those with hypothyroidism exhibited the highest mean HbA1c levels, suggesting that thyroid hormone deficiency exacerbates insulin resistance, impairs peripheral glucose utilization, and worsens glycemic control [10]. Hyperthyroidism, although also associated with higher glucose levels, had a slightly less severe impact in comparison to hypothyroidism in our cohort.

Gender distribution analysis revealed that female patients were disproportionately affected by thyroid disorders, particularly hypothyroidism. This observation is consistent with existing literature, where women are reported to have a two- to tenfold increased risk of developing thyroid disease compared to men [11, 12]. This gender disparity is often attributed to a greater predisposition to autoimmune thyroiditis among females, possibly influenced by hormonal and genetic factors. The physiological mechanisms underlying these associations are multifactorial. In hypothyroidism, reduced thyroid hormone levels decrease basal metabolic rate and impair glucose disposal by peripheral tissues, leading to decreased insulin sensitivity and a tendency toward hyperglycemia [13, 14]. In contrast, hyperthyroidism enhances gastrointestinal glucose absorption and increases hepatic gluconeogenesis and glycogenolysis, thereby elevating plasma glucose levels [15]. Despite both conditions adversely affecting glucose metabolism, our data suggest that hypothyroidism exerts a stronger detrimental effect on glycemic control within the diabetic population.

Importantly, the majority of patients with thyroid dysfunction in this study demonstrated poor glycemic control, defined as HbA1c >7%. This finding emphasizes the critical role of routine thyroid screening in T2DM patients, particularly for those who exhibit unexpectedly poor glycemic control despite adherence to standard diabetic management protocols. Previous studies have also recommended incorporating thyroid function testing as a routine part of diabetes care to ensure timely diagnosis and treatment [16, 17]. Our results advocate for an integrated, multidisciplinary approach to T2DM management, wherein endocrine evaluation is recognized as an essential component. Early identification and correction of thyroid dysfunction not only may improve insulin sensitivity and glycemic control but also could help prevent chronic diabetes complications such as cardiovascular disease, neuropathy, and nephropathy [18, 19]. However, it is important to acknowledge the limitations of our study. The cross-sectional design precludes the establishment of a causal relationship between thyroid dysfunction and poor glycemic control. Longitudinal, prospective studies are necessary to better delineate the temporal sequence and to determine whether early treatment of thyroid dysfunction in diabetic patients can indeed improve long-term glycemic outcomes and reduce diabetes-related morbidity and mortality.

Limitations

This single-center study lacks generalizability. The cross-sectional design prevents the determination of causality, and it does not differentiate between subclinical and overt thyroid dysfunction separately. Possible confounders like obesity, dyslipidemia, and medication use were not fully adjusted.

CONCLUSION

Thyroid disorders are highly prevalent among

individuals with Type 2 Diabetes Mellitus and significantly influence glycemic control. Routine thyroid screening should be considered a key component of diabetes care, particularly for patients with suboptimal glucose management. Early diagnosis and targeted treatment of thyroid abnormalities could enhance diabetic control and reduce complications.

Recommendations

From the evidence and experience of the study, the authors recommend

Multicenter, longitudinal studies should validate these findings.

Routine thyroid function testing should be incorporated into diabetes management guidelines.

Greater awareness among clinicians about the interplay between thyroid function and glycemic control is essential.

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Conflict of interest: None declared

REFERENCES

1. Młynarska, E., Czarnik, W., Dzieża, N., Jędraszak, W., Majchrowicz, G., Prusinowski, F., ... & Franczyk, B. (2019). Type 2 Diabetes Mellitus: New Pathogenetic Mechanisms, Treatment and the Most Important Complications. International Journal of Molecular Sciences, 26(3), 1094.
2. Ogurtsova, K., Guariguata, L., Barengo, N. C., Ruiz, P. L. D., Sacre, J. W., Karuranga, S., ... & Magliano, D. J. (2019). IDF diabetes Atlas: Global estimates of undiagnosed diabetes in adults for 2021. Diabetes research and clinical practice, 183, 109118.
3. Rong, F., Dai, H., Wu, Y., Li, J., Liu, G., Chen, H., & Zhang, X. (2019). Association between thyroid dysfunction and type 2 diabetes: a meta-analysis of prospective observational studies. BMC medicine, 19, 1-13.
4. Biondi, B., Kahaly, G. J., & Robertson, R. P. (2019). Thyroid dysfunction and diabetes mellitus: two closely associated disorders. Endocrine reviews, 40(3), 789-824.
5. Pramanik, S., Ghosh, S., Mukhopadhyay, P., Bhattacharjee, R., Mukherjee, B., Mondal, S. A., ... & Chowdhury, S. (2018). Thyroid status in patients with type 2 diabetes attending a tertiary care hospital in Eastern India. Indian journal of endocrinology and metabolism, 22(1), 112-115.
6. Khassawneh, A. H., Al-Mistarehi, A. H., Zein Alaabdin, A. M., Khasawneh, L., AlQuran, T. M., Kheirallah, K. A., ... & Obeidat, N. (2019). Prevalence and predictors of thyroid dysfunction among type 2 diabetic patients: A case–control study. International Journal of General Medicine, 803-816.
7. American Diabetes Association. (2017). Standards of medical care in diabetes—2017 abridged for primary care providers. Clinical diabetes: a publication of the American Diabetes Association, 35(1), 5.
8. Brenta, G. (2011). Why can insulin resistance be a natural consequence of thyroid dysfunction?. Journal of Thyroid Research, 2011(1), 152850.
9. Iacobellis, G., Cristina Ribaudo, M., Zappaterreno, A., Valeria Iannucci, C., & Leonetti, F. (2005). Relationship of thyroid function with body mass index, leptin, insulin sensitivity and adiponectin in euthyroid obese women. Clinical endocrinology, 62(4), 487-491.
10. Díez, J. J., & Iglesias, P. (2012). An analysis of the relative risk for hypothyroidism in patients with Type 2 diabetes. Diabetic Medicine, 29(12), 1510-1514.
11. Diez, J. J., Sánchez, P., & Iglesias, P. (2011). Prevalence of thyroid dysfunction in patients with type 2 diabetes. Experimental and Clinical Endocrinology & Diabetes, 119(04), 201-207.
12. Duntas, L. H., Orgiazzi, J., & Brabant, G. (2011). The interface between thyroid and diabetes mellitus. Clinical endocrinology, 75(1), 1-9.
13. Hollowell, J. G., Staehling, N. W., Flanders, W. D., Hannon, W. H., Gunter, E. W., Spencer, C. A., & Braverman, L. E. (2002). Serum TSH, T4, and thyroid antibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). The Journal of Clinical Endocrinology & Metabolism, 87(2), 489-499.
14. Kalra, S., Aggarwal, S., & Khandelwal, D. (2019). Thyroid dysfunction and type 2 diabetes mellitus: screening strategies and implications for management. Diabetes Therapy, 10(6), 2035-2044.
15. Kim, B. Y., Kim, C. H., Jung, C. H., Mok, J. O., Suh, K. I., & Kang, S. K. (2011). Association between subclinical hypothyroidism and severe diabetic retinopathy in Korean patients with type 2 diabetes. Endocrine journal, 58(12), 1065-1070.

16. Rizos, C. V., Elisaf, M. S., & Liberopoulos, E. N. (2011). Effects of thyroid dysfunction on lipid profile. The open cardiovascular medicine journal, 5, 76.
17. Smithson, M. J. (1998). Screening for thyroid dysfunction in a community population of diabetic patients. Diabetic medicine, 15(2), 148-150.
18. Udiong, C. E. J., Udoh, A. E., & Etukudoh, M. E. (2007). Evaluation of thyroid function in diabetes mellitus in Calabar, Nigeria. *Indian journal of clinical biochemistry*, *22*, 74-78.
19. Vanderpump, M. P. (2011). The epidemiology of thyroid disease. British medical bulletin, 99(1).