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(RESEARCH ARTICLE)

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A study on prevalence of hypothyroidism in Type-II diabetes mellitus and correlation of Hba1c levels with TSH levels

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Abstract

Background: Thyroid diseases and Diabetes Mellitus are the two most common endocrine disorders encountered in clinical practice. Diabetes and Thyroid disorders have been shown to mutually influence each other and an association between both conditions has been reported in literature. This study aims to estimate the prevalence of Thyroid dysfunction among patients with TYPE-II Diabetes Mellitus and correlation of HbA1C levels with TSH levels.

Methods: 55 Patients coming with history of type 2 Diabetes Mellitus with or without history of hypothyroidism of more than 3 years duration or patients on treatment for hypothyroidism with history of diabetes mellitus presenting to OPDs or admitted in wards from May 2023 to December 2024 are included in the study. Patients are subjected to symptom analysis, clinical examination, blood investigations including HbA1C and TSH levels.

Results: The study found that the prevalence of hypothyroidism in diabetes patients was 12.7%. Specifically, 48 out of 55 diabetes patients were found to be non-hypothyroid, also known as euthyroid, representing 87.3% of the total sample. The study demonstrates a significant association between hypothyroidism and poor glycemic control in patients with T2DM. Hypothyroid patients had higher FBS, PPBS, and HbA1c levels, indicating a potential impact of thyroid dysfunction on diabetes management. The study also confirms that thyroxine treatment improves metabolic parameters in hypothyroid patients, emphasizing the need for integrated thyroid and diabetes care.

Conclusion: The study demonstrates that individuals with hypothyroidism tend to have higher average TSH-after thyroxine levels compared to those with normal thyroid function, consistent with several previous studies. These findings underscore the challenges in managing thyroid dysfunction in patients with T2DM and highlight the need for individualized treatment strategies to achieve optimal thyroid function and glycemic control. Further research is needed to explore the factors contributing to elevated TSH-after thyroxine levels in hypothyroid patients and to evaluate the impact of optimized thyroid hormone replacement on metabolic outcomes in this population.

Keywords: Type 2 Diabetes Mellitus(T2DM); Glycated Hemoglobin A(HbA1C); Thyroid Stimulating Hormone (TSH)

1. Introduction

Hypothyroidism and Type 2 Diabetes Mellitus (T2DM) are common endocrine disorders that have a significant impact on global health. These conditions impose a substantial burden on individuals and healthcare systems, making their association a topic of increasing interest among researchers and clinicians. The complex relationship between thyroid function and glucose metabolism has been the subject of numerous studies, with emerging evidence indicating a bidirectional link between hypothyroidism and T2DM.[1,2]

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The coexistence of hypothyroidism and type 2 diabetes mellitus (T2DM) presents distinct challenges in clinical management. These conditions share common risk factors and can impact each other's pathophysiology. Hypothyroidism, marked by insufficient production of thyroid hormones, can disrupt glucose homeostasis, increase insulin resistance, and impair insulin secretion. Conversely, T2DM, characterized by insulin resistance and impaired insulin secretion, can also affect thyroid function. This interplay between hypothyroidism and T2DM underscores the importance of comprehensive and integrated care to effectively manage both conditions.[3,4]

Aims and objectives

- To study the prevanalce of Hypothyroidism (Clinical/Subclinical) in Diabetic patients.
- To study the correlation of HbA1C levels with TSH levels.

2. Materials and Methods

A Cross sectional study was done on 55 patients with Type-2 Diabetes Mellitus for a period of 18 months. Patients coming with history of type 2 diabetes mellitus with or without history of hypothyroidism of more than 3 years duration or patients on treatment for hypothyroidism with history of diabetes mellitus presenting to OPDs or admitted in wards from July 2023 to December 2024 were included in the study. Patients were subjected to symptom analysis, clinical examination, blood investigations including HBA1C and TSH levels. The newly diagnosed patients of hypothyroidism in diabetes were treated with thyroxine for three months and followed up with TSH and HbA1c levels. The final analysis was be made at the end of the study.

2.1. Statistical Analysis

The data obtained was entered in a Microsoft Excel sheet, and statistical analysis was performed using statistical package for the social sciences (version 20). Descriptive analysis was performed using frequency and percentages.

3. Results

Table 1 Prevalence of hypothyroidism in diabetic patients

DM patients	Number of patients	Percentages
Hypothyroid	7	12.7
Euthyroid (non- hypothyroid)	48	87.3
Total	55	100.0

Table 1 illustrates that the prevalence of hypothyroidism in diabetes patients was 12.7%. Specifically, 48 out of 55 diabetes patients were found to be non-hypothyroid, also known as euthyroid, representing 87.3% of the total sample.

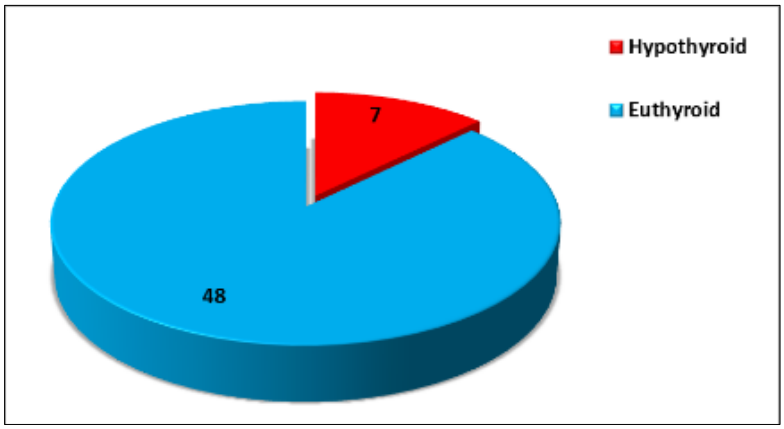

Figure 1 Prevalence of hypothyroidism in diabetic patients

Table 2 Association of duration of diabetes with Euthyroid and Hypothyroid patients

Duration of DM	Euthyroid		Hypothyroid		Total	
	No.	%	No.	%	No	%
≤ 5 years	8	16.7	0	0.0	8	14.5
6—10 years	28	58.3	2	28.6	30	54.5
> 10 years	12	25.0	5	71.4	17	31.0
Total	48	100.0	7	100.0	55	100.0
Mean ± SD	8.68 ± 2.94		11.42 ± 3.59		9.03 ± 3.13	
X^2-test, P-value	X^2 = 6.419 P = 0.040, S					

NS= not significant, S=significant, HS=highly significant

The data presented in Table 2 demonstrates a statistically significant association between the duration of diabetes mellitus and the occurrence of hypothyroidism in both Euthyroid and hypothyroid patients (P<0.05). This suggests that there is a higher prevalence of hypothyroidism in the early stages of diabetes mellitus. Furthermore, our findings indicate that individuals with diabetes mellitus are at an increased risk of developing hypothyroidism as a complication within the first five years of diagnosis.

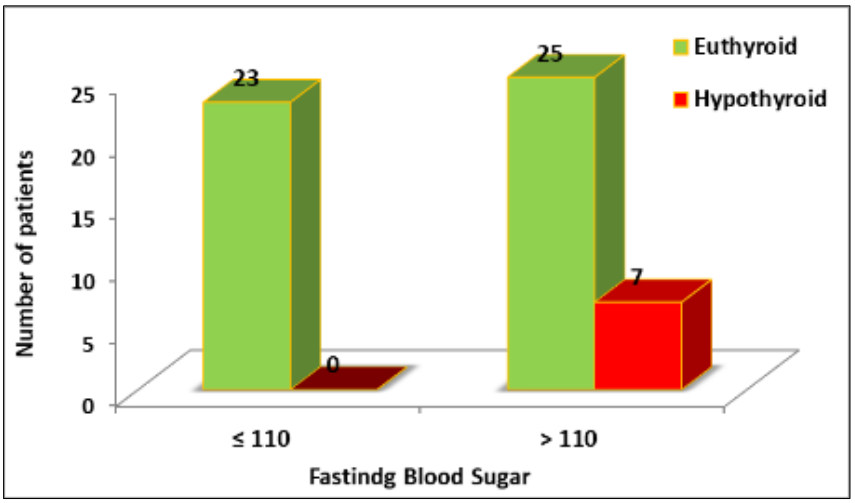

Figure 2 Association of duration of diabetes with Euthyroid and Hypothyroid patients

Table 3 Association of FBS with Euthyroid and Hypothyroid patients

Post prandial blood sugar	Euthyroid		Hypothyroid		Total	
	No.	%	No.	%	No	%
≤ 150	1	2.1	0	0.0	1	1.8
150—200	43	89.6	4	57.1	47	85.5
>200	4	8.3	3	42.9	7	12.7
Total	48	100.0	7	100.0	55	100.0
Mean ± SD	178.93 ± 17.81		197.14 ± 10.88		181.25 ± 18.08	
X^2-test, P-value	X^2 = 6.619 P = 0.036, S					

NS= not significant, S=significant, HS=highly significant

Table 3 displays the findings regarding the mean fasting blood sugar (FBS) levels in euthyroid and hypothyroid patients. The results indicate that the mean FBS in euthyroid patients was 117.75, while in hypothyroid patients it was 129.0. A statistically significant association was observed between FBS levels in euthyroid and hypothyroid patients (P<0.05).It can be concluded that there is a higher frequency of elevated fasting glucose levels in hypothyroid patients. This study highlights that individuals with hypothyroidism tend to have higher average fasting glucose levels compared to those with normal thyroid function.

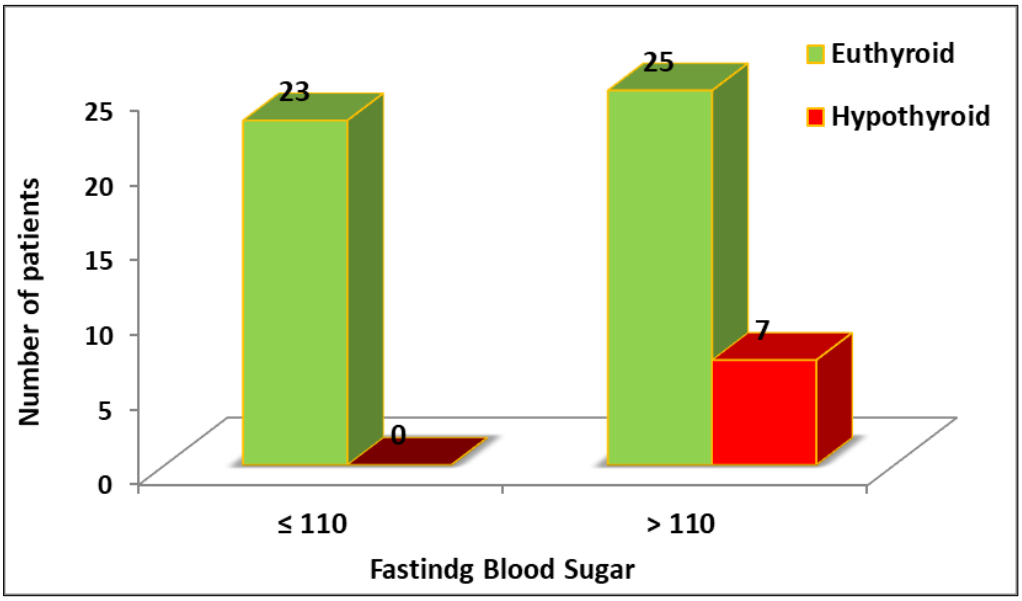

Figure 3 Association of FBS with Euthyroid and Hypothyroid patients

Table 4 Association of PPBS with Euthyroid and Hypothyroid patients

Post prandial blood sugar	Euthyroid		Hypothyroid		Total	
	No.	%	No.	%	No	%
≤ 150	1	2.1	0	0.0	1	1.8
150—200	43	89.6	4	57.1	47	85.5
>200	4	8.3	3	42.9	7	12.7
Total	48	100.0	7	100.0	55	100.0
Mean ± SD	178.93 ± 17.81		197.14 ± 10.88		181.25 ± 18.08	
X^2-test, P-value	X^2 = 6.619 P = 0.036, S					

NS= not significant, S=significant, HS=highly significant

Table 4 displays the average postprandial blood sugar (PPBS) levels in euthyroid and hypothyroid patients. The mean PPBS was 178.93 in euthyroid patients and 197.14 in hypothyroid patients. A statistically significant association was found between PPBS levels in euthyroid and hypothyroid patients (P<0.05). This suggests that hypothyroid patients have a higher frequency of elevated postprandial glucose levels.

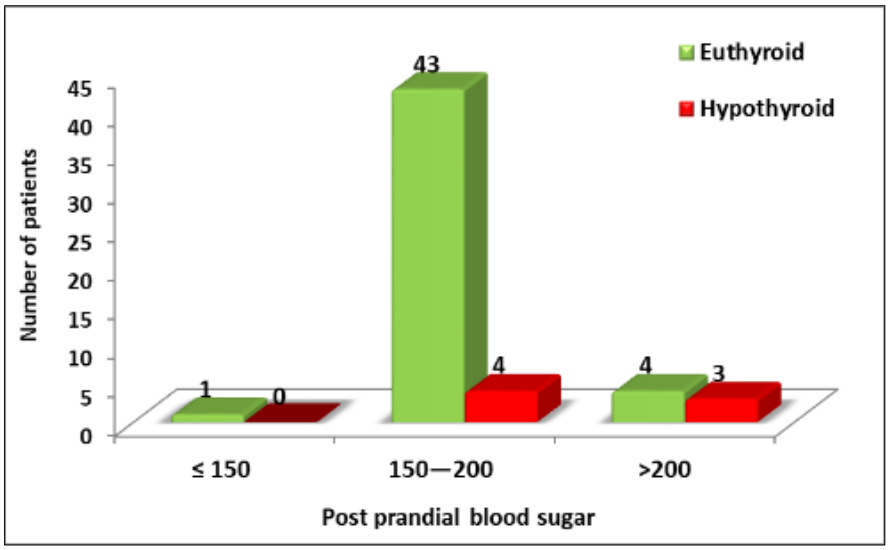

Figure 4 Association of FBS with Euthyroid and Hypothyroid patients

Table 5 Association of HbA1c-fasting with Euthyroid and Hypothyroid patients

HbA1c fasting	Euthyroid		Hypothyroid		Total	
	No.	%	No.	%	No	%
≤ 6%	6	12.5	0	0.0	6	10.9
6.1—8.0%	39	81.2	3	42.9	42	76.4
> 8%	3	6.3	4	57.1	7	12.7
Total	48	100.0	7	100.0	55	100.0
Mean ± SD	7.08 ± 0.63		8.12 ± 0.29		7.21 ± 0.69	
X^2-test, P-value	X^2 = 14.485 P = 0.0007, HS					

NS= not significant, S=significant, HS=highly significant

The data presented in Table 5 indicates that the average HbA1c-fasting level in euthyroid patients was 7.08, while in hypothyroid patients it was 8.12. A statistically significant association was found between HbA1c-fasting levels in euthyroid and hypothyroid patients (P<0.001). This suggests that hypothyroid patients tend to have higher HbA1c-fasting values compared to euthyroid patients.

In conclusion, there is a higher frequency of elevated HbA1c-fasting levels in hypothyroid patients. This study highlights the impact of hypothyroidism on HbA1c-fasting levels, indicating that individuals with hypothyroidism are likely to have higher average HbA1c-fasting values than those with normal thyroid function.

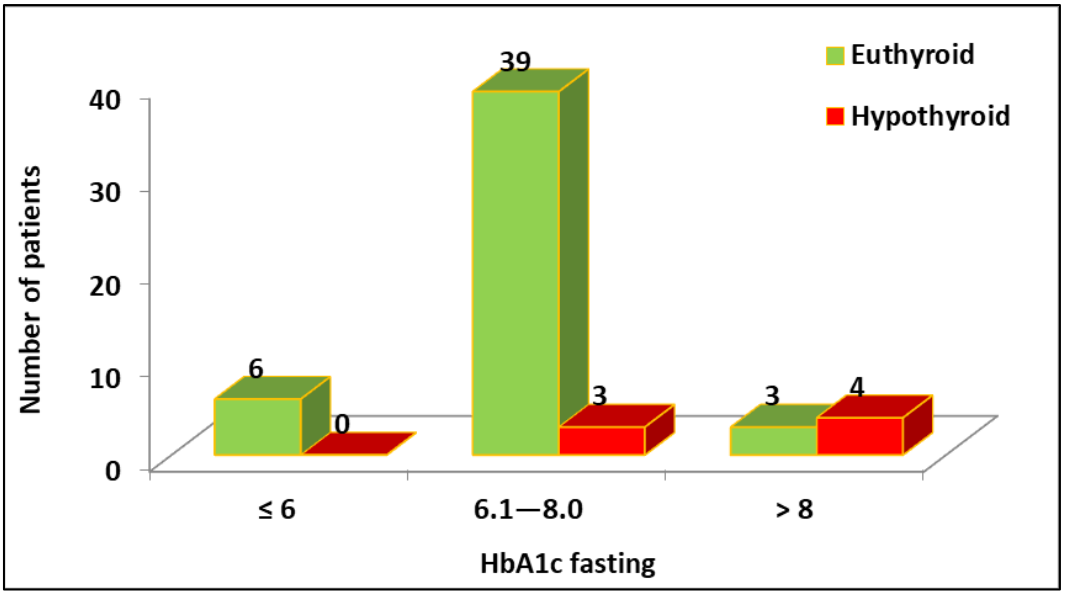

Figure 5 Association of HbA1c fasting with Euthyroid and Hypothyroid patients

Table 6 Association of HbA1c-after thyroxine with Euthyroid and Hypothyroid patients

HbA1c after thyroxine	Euthyroid		Hypothyroid		Total	
	No.	%	No.	%	No	%
≤ 6%	7	14.6	0	0.0	7	12.7
6.1—8.0 %	40	83.3	5	71.4	45	81.8
> 8%	1	2.1	2	28.6	3	5.5
Total	48	100.0	7	100.0	55	100.0
Mean ± SD	6.85 ± 0.63		7.68 ± 0.35		6.95 ± 0.66	
X^2-test, P-value	X^2 = 8.984 P = 0.011, S					

NS= not significant, S=significant, HS=highly significant

Table 6 illustrates that the average HbA1c level after thyroxine treatment in euthyroid patients was 6.85, while in hypothyroid patients it was 7.68. A statistically significant association was found between HbA1c levels after thyroxine treatment in euthyroid and hypothyroid patients ($P<0.05$). This suggests that hypothyroid patients have a lower frequency of elevated HbA1c levels after thyroxine treatment compared to euthyroid patients.

In conclusion, this study indicates that correcting hypothyroidism results in HbA1c levels after thyroxine treatment approaching normal values.

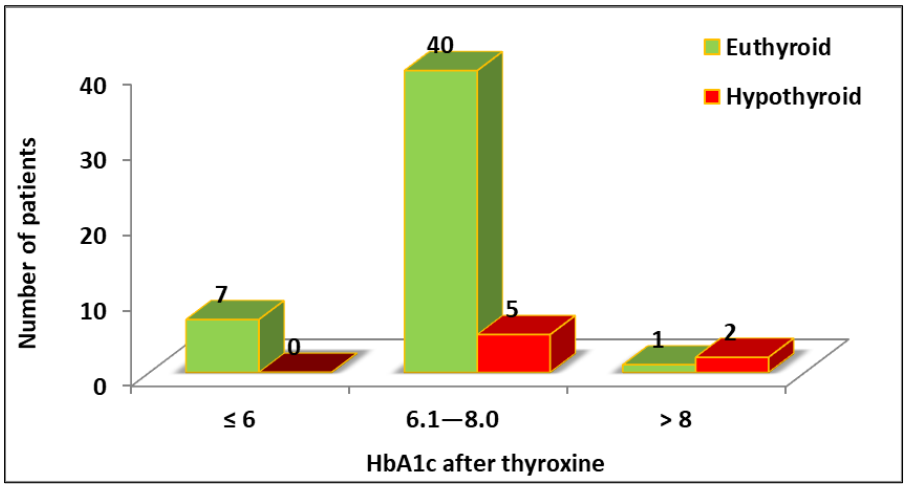

Figure 6 Association of HbA1c fasting with Euthyroid and Hypothyroid patients

Table 7 Comparison of HbA1c-fasting and HbA1c-after thyroxine

HbA1c Levels	**Euthyroid**	**Hypothyroid**
	Mean ± SD	**Mean ± SD**
HbA1c-fasting values	7.08 ± 0.63	8.12 ± 0.29
HbA1c-after thyroxine values	6.85 ± 0.63	7.68 ± 0.35
Paired t-test and P-value	t = 6.473, P = 0.000, HS	t = 6.819, P = 0.000, HS
Correlation coefficient and P-value	r = +0.931, P = 0.015, S	r = +0.871, P =0.010, HS

NS= not significant, S=significant, HS=highly significant

Table 7 displays the statistically significant association between HbA1c-Fasting and After Thyroxine values in Euthyroid patients (P<0.001) and Hypothyroid patients (P<0.05). In the study, a strong positive correlation (Pearson's correlation coefficient of 0.871) was found between HbA1c-Fasting and After Thyroxine values among Hypothyroid patients with diabetes mellitus. This correlation highlights the importance of monitoring these values in patients with hypothyroidism and diabetes.

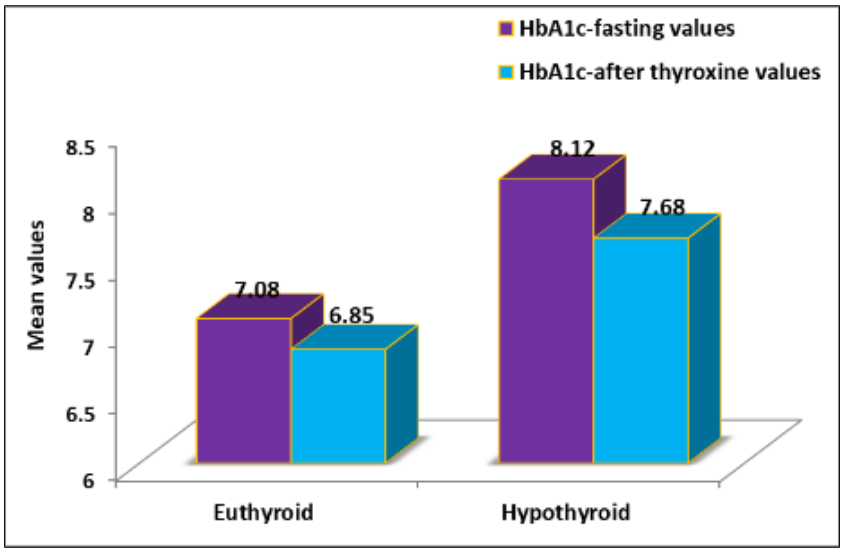

Figure 7 Comparison of HbA1c-fasting and HbA1c-after thyroxine

4. Discussion

The observed prevalence of hypothyroidism in our cohort of type 2 diabetes mellitus (T2DM) patients was 12.7%, with 87.3% remaining euthyroid. This finding aligns with several studies that have reported varying prevalence rates of thyroid dysfunction among T2DM populations.

A systematic review and meta-analysis by Han et al.[5] reported prevalence rates of subclinical hypothyroidism (SCH) in T2DM patients ranging from 4.69% to 18.86%, with a pooled prevalence of 12% (95% CI: 10%, 14%) . This is consistent with our finding of a 12.7% prevalence, suggesting that our cohort reflects the broader population studied in the meta-analysis.

In contrast, a study by Demitrost and Ranabir reported a lower prevalence of thyroid dysfunction in T2DM patients, at 11.4% . This slight discrepancy may be attributed to differences in study populations, diagnostic criteria, and geographic variations.[6]

Furthermore, a study by Akbar et al.[7] reported a prevalence of thyroid dysfunction in T2DM patients of 16% in Saudi Arabia . This higher prevalence compared to our study could be due to regional differences in iodine intake, genetic factors, or variations in healthcare access.

Regarding the correlation between HbA1c and thyroid-stimulating hormone (TSH) levels, our study did not find a significant association. This is in line with the findings of Díez and Iglesias, who reported no significant correlation between HbA1c and TSH levels in diabetic patients .[8]

However, other studies have reported contrasting results. For instance, a study by Bazrafshan et al.[9] found a positive relationship between HbA1c and TSH in T2DM patients, suggesting that poor glycemic control may be associated with thyroid dysfunction.

Similarly, a study by Díez and Iglesias reported a significant correlation between HbA1c concentration and TSH levels, indicating that higher HbA1c levels may be associated with higher TSH levels .[8]

These discrepancies highlight the complex interplay between glycemic control and thyroid function in T2DM patients. Factors such as study design, sample size, population characteristics, and the presence of comorbidities may contribute to the varying findings. Further large-scale, prospective studies are warranted to elucidate the relationship between HbA1c and TSH levels in this population.

Our study's prevalence of hypothyroidism among T2DM patients is consistent with existing literature, though reported rates vary across studies. The correlation between HbA1c and TSH levels remains inconclusive, underscoring the need for further research to clarify this relationship.

Limitations

- The study was conducted on a relatively small sample size, limiting the generalizability of the findings.
- It was a cross-sectional study, which does not establish a causal relationship between hypothyroidism and glycemic control.
- Other confounding factors, such as lifestyle, dietary habits, and medication adherence, were not assessed.
- The study did not differentiate between subclinical and overt hypothyroidism, which could have provided further insights.
- Long-term effects of thyroxine treatment on glycemic control were not evaluated.

5. Conclusion

In our study, the prevalence of hypothyroidism in diabetes patients was 12.7%

The study demonstrates a significant association between hypothyroidism and poor glycemic control in patients with T2DM.

Hypothyroid patients had higher FBS, PPBS, and HbA1c levels, indicating a potential impact of thyroid dysfunction on diabetes management.

The findings underscore the importance of early detection and management of hypothyroidism in diabetic patients to optimize glycemic control.

The study also confirms that thyroxine treatment improves metabolic parameters in hypothyroid patients, emphasizing the need for integrated thyroid and diabetes care.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

The study was approved by the Institutional Ethical Committee.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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