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Original Article

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To Study the Prevalence and Association of Thyroid Disorders in Patients with Type 2 Diabetes Mellitus

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Abstract

Background: Thyroid dysfunction is a significant comorbidity in type 2 diabetes mellitus, disrupting the metabolic balance and increasing the disease burden. The objective of the study was to assess the prevalence and association of thyroid disorders in patients with type 2 diabetes mellitus. ***Materials and Methods:*** A case control study was conducted among 100 patients with type 2 diabetes mellitus and 100 controls attending the outpatient department (OPD) and wards of Department of Endocrinology, Index Medical College, Hospital and Research Center, Indore, Madhya Pradesh. The study was done over a period of 21 months from July 2023 to March 2025. The study was done after obtaining ethical approval from the Institutional Ethics Committee. ***Results***: The mean age of the participants in the diabetic group was 52.14 ± 17.86 years and the control group was 52.07 ± 17.62 years. The gender distribution in the study population had 51% females. Subclinical hypothyroidism was the most common thyroid dysfunction found in type 2 diabetes mellitus patients. The prevalence of thyroid dysfunction in the study was 28% in patients with type 2 diabetes mellitus. Thyroid dysfunction is more prevalent in individuals with type 2 diabetes mellitus compared to non-diabetics. ***Conclusion*:** The study highlights the importance of thyroid screening and awareness among individuals with type 2 diabetes mellitus. It also underlines the need for holistic evaluation strategies that goes beyond glycaemic indices to ensure comprehensive metabolic care. The healthcare providers should foster strategies to ensure detection of thyroid dysfunction among diabetic individuals and optimize management so as to potentially improve outcomes for those individuals at risk.

Keywords: ***Diabetes mellitus, Thyroid dysfunction, Hormones, Subclinical hypothyroidism, Prevalence***

Introduction

Diabetes mellitus is a complex and chronic disease constituting a significant global health challenge[1]. With an estimated worldwide prevalence of 451 million people in 2017, projections indicate a rise to 693 million individuals by 2045[2]. The substantial burden imposed by diabetes mellitus underscores the need for effective management strategies to mitigate its impact[3].

Thyroid dysfunction is a significant comorbidity in type 2 diabetes mellitus, disrupting metabolic balance and increasing the disease burden[4]. Thyroid hormones has an insulin-antagonistic effect that can increase hepatic glucose production by enhancing gluconeogenesis and glycogenolysis[5]. Also, chronic inflammation and oxidative stress disrupt the hypothalamic-pituitary-thyroid axis contributing in thyroid dysfunction[6].

Type 2 diabetes mellitus causes thyroid function by disrupting thyroid hormone synthesis and secretion. In hypothyroidism, a reduced glucose induced insulin secretion by beta cells is seen, while the response of beta cells to glucose or catecholamines is increased in hyperthyroidism [7,8].

The study aims to determine the prevalence and association of thyroid disorders in patients with type 2 diabetes mellitus in the central Indian population. It highlights the relevance of thyroid screening in patients with type 2 diabetes mellitus and underlines the need for holistic evaluation strategies that goes beyond glycaemic indices to ensure comprehensive metabolic care.

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Materials and Methods

Study design: A case control study was conducted among 100 patients with type 2 diabetes mellitus and 100 controls in the outpatient department (OPD) and wards of Department of Endocrinology, Index Medical College, Hospital and Research Center, Indore, Madhya Pradesh. The objective of the study was to assess the prevalence and association of thyroid disorders in patients with Type 2 Diabetes Mellitus.

Study duration: The study was done over a period of 21 months from July 2023 to March 2025.

Ethical Clearance: The study was carried out after obtaining ethical approval from the Institutional Ethics Committee, Index Medical College, Hospital and Research Centre, Indore, Madhya Pradesh, vide letter No. IMCHRC/IEC/2023/27.

Inclusion Criteria

1. Age above 18 years
2. Patients of both gender with type 2 diabetes mellitus and on oral hypoglycemic agents, insulin or both.
3. An equal number of subjects with no history of diabetes mellitus were included as controls
4. Those who gave consent to undergo the study

Exclusion Criteria

1. Age less than 18 years
2. Patients with type 1 diabetes, gestational diabetes, chronic kidney disease, chronic liver disease, on immunosuppressive drugs, steroids, malignancy, serious illness, etc
3. Those not willing to take part in the study were excluded

Study tools

1. A pre-defined proforma for collecting the socio-demographic characteristics, clinical and disease characteristics
2. Patients underwent general physical examination and relevant systemic examination. Investigations like blood glucose estimation, HbA1c, Thyroid Function Test, Body Mass Index estimation were done.

Study procedure: The participants were informed about the nature of the study which was fully explained in the participant information sheet and only those who agreed to undergo the study signed in the informed consent form. In the study, 100 cases with type 2 diabetes mellitus and 100 controls with no history of diabetes mellitus were recruited. Their participation was completely voluntary and right to deny to participate in the study was reserved. Privacy and confidentiality was maintained at all cost for each participant.

Operational definitions

1. **Diabetes mellitus:** It is defined as fasting blood glucose level ≥126 mg/dl and/or 2 hours post prandial blood glucose level ≥200 mg/dl
2. **Thyroid disorder:**
   a. Subclinical hypothyroidism: TSH 4.2 to 10 mIU/L with normal T4 and T3
   b. Hypothyroidism: TSH > 10 with low T4 and T3
   c. Hyperthyroidism: TSH <0.27mIU/L

Statistical Analysis: The collected data was analysed using SPSS (Statistical Package for Social Sciences software) version 21.0. Microsoft word and Excel were used to generate graphs, tables etc. Descriptive statistics like frequency, percentage, mean, standard deviation and proportions were used. A probability value <0.05 was considered as statistically significant.

Results

Table 1: Baseline characteristics of the study population

Parameter	Diabetes group (n = 100)	Control group (n = 100)
Mean Age ± SD	52.14 ± 17.86	52.07 ± 17.62
Mean BMI (kg/m²)	24.29 ± 3.63	24.17 ± 3.85
Male	49%	49%
Female	51%	51%
HbA1c	7.9%	5.3%

In our study, 100 patients with type 2 diabetes mellitus and 100 controls with no history of diabetes mellitus were assessed for the prevalence and association of thyroid disorders in patients with type 2 diabetes mellitus. The baseline characteristics of the study population is listed in Table 1.

The mean age of the participants in the diabetic group was 52.14 ± 17.86 years, matched to 52.07 ± 17.62 years in the control group. The gender distribution in the study population had 51% females and 49% males in both the case and control groups. The mean body mass index in the diabetes group was 24.29 ± 3.63 kg/m^2 compared to 24.17 ± 3.85 kg/m^2 in the control group (Table 1). The demographic analysis shows that the two groups are similar in terms of age, sex, and body mass index and these factors are not likely to confound the association between thyroid dysfunction and type 2 diabetes mellitus (**Table 1**). The fasting plasma glucose, postprandial blood glucose and glycated hemoglobin (HbA1c) levels were higher in the diabetic group in comparison to the control group of the study population (**Figure 1**).

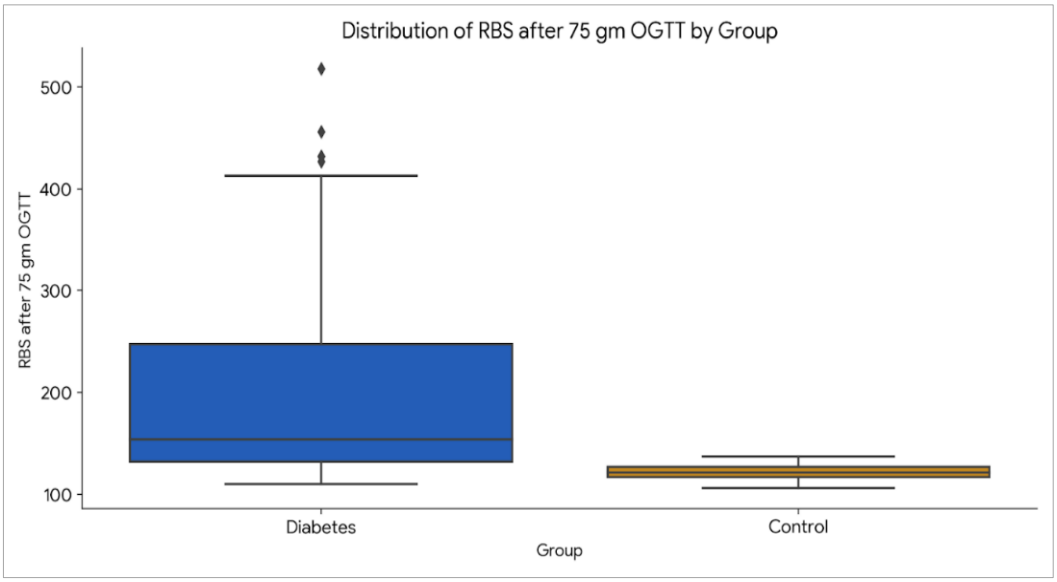

Figure 1: The distribution of RBS levels in the study population

The box plot (**Figure 1**) illustrates the distribution of Random Blood Sugar (RBS) levels between the two groups. The median RBS being higher in the diabetes group in comparison to the control group of the study population.

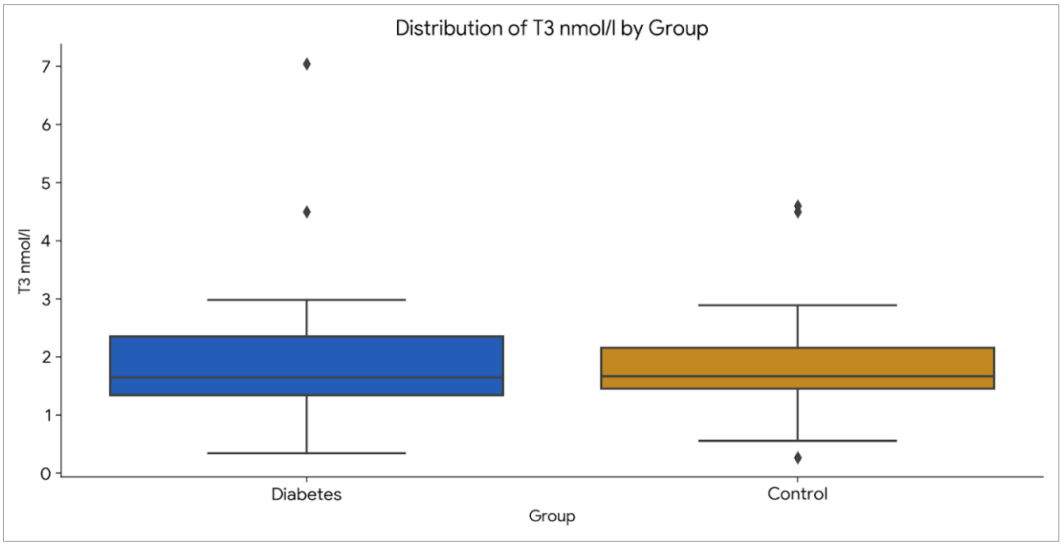

Figure 2: The distribution of T3 (triiodothyronine) levels in the study population

The box plot (**Figure 2**) illustrate the distribution of T3 (triiodothyronine) levels in the diabetes group and the control group. The differences in levels of TSH, T4 and T3 between the two groups can be attributed to the association between the thyroid disorders and diabetes.

Table 2. Thyroid Disorder in the study population

Thyroid Disorder	Diabetes group (n = 100)	Control group (n = 100)
Subclinical Hypothyroidism	14	8
Overt Hypothyroidism	12	6
Subclinical Hyperthyroidism	0	0
Overt Hyperthyroidism	2	1

In our study, the most common type of thyroid dysfunction in patients with type 2 diabetes mellitus was subclinical hypothyroidism in 14% patients, compared to 8% patients in the control group. Overt hypothyroidism was noted in 12% patients in the diabetes group, compared to 6% patients in the control group. The prevalence of thyroid dysfunction in the study population was 28% in the diabetes group, while that of the control group was 15% (**Table 2**).

Discussion

The early diagnosis of thyroid dysfunction in type 2 diabetes mellitus individuals is important for remedial care as thyroid disorders in diabetic population causes detrimental affect on metabolism, increasing the risk of diabetes complications[9]. The interrelation between diabetes and thyroid dysfunction is a recognized phenomenon[10].

Thyroid dysfunction encompasses a range of disorders altering thyroid hormone levels, presenting as hypothyroidism, hyperthyroidism, thyroid enlargement (diffuse or nodular), thyrotoxicosis or asymptomatic subclinical variants[11].

In the study, the mean age of the case group in the diabetic group was 52.14 ± 17.86 years, while that of the control group was 52.07 ± 17.62 years. The previous studies noted a significant association between thyroid dysfunction and age, as the occurrence of thyroid dysfunction rises with aging, independent of type 2 diabetes mellitus[12,13].

The gender distribution in our study population had females in majority in both the case and the control group. The mean body mass index in the diabetes group was 24.29 ± 3.63 kg/m^2 which was higher than the control group of the study population. Proces S et al.[14] in their study reported that the prevalence of thyroid disorder is not affected by body mass index.

In the study, the glycated hemoglobin (HbA1c) level 7.9% in the diabetes group was higher than those in the control group. Bhattacharjee R et al. [15] in their study reported that the baseline HbA1c levels are significantly higher in hypothyroid patients, as compared to those in control individuals despite similar glucose levels. Jain G et al. [16] in their study noted that most diabetic patients with thyroid disorder had higher glycated hemoglobin (HbA1c) levels. However, Díez JJ et al. [17] in their study reported that the prevalence of thyroid disorder was not affected by the level of glycated hemoglobin (HbA1c).

In our study of thyroid disorders, Subclinical hypothyroidism in 14% patients of the diabetes group was the commonest thyroid dysfunction noted. Overt hypothyroidism was noted in 12% patients and hyperthyroidism in 2% patients in the diabetes group. Vikhe VB etal.[18] in their study reported hypothyroidism in 22% and hyperthyroidism in 8% among diabetic population.

In our study, the prevalence of thyroid dysfunction in the study population was higher in the diabetes group at 28% than the control group at 15%[19]. In line with the findings of our study, Telwani AA et al.[20] in their study reported higher prevalence of thyroid dysfunctions in diabetic patients compared to controls group (29% versus 9%, P value <0.001)

Conclusion

Our study highlights the importance of thyroid screening and awareness among individuals with type 2 diabetes mellitus. It also underlines the need for holistic evaluation strategies that goes beyond glycaemic indices to ensure comprehensive metabolic care. The healthcare providers should foster strategies to ensure detection of thyroid dysfunction among diabetic individuals and optimize management so as to potentially improve outcomes for those individuals at risk.

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Declaration

Conflict of Interest

None declared

Funding

Nil

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