Original Research

ASSESSMENT OF SUBCLINICAL HYPOTHYROIDISM IN ADULTS WITH DIABETES MELLITUS: A TERTIARY CARE HOSPITAL STUDY

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ABSTRACT

Background: Subclinical hypothyroidism (SCH) is one of the most common thyroid dysfunctions observed in patients with Type 2 Diabetes Mellitus and may adversely affect glycemic control and cardiovascular risk. The coexistence of diabetes mellitus and thyroid dysfunction contributes significantly to metabolic disturbances and diabetic complications. This study aimed to determine the prevalence and association of SCH among adult patients with type 2 diabetes mellitus in a tertiary care hospital.

Methodology: This analytical cross-sectional study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences from March 2025 to November 2025. A total of 300 adult patients with type 2 diabetes mellitus were included using convenient sampling technique. Clinical evaluation and laboratory investigations including fasting blood sugar, HbA1c, lipid profile, serum TSH, free T3, and free T4 were performed. SCH was defined as elevated TSH levels with normal free T3 and free T4 levels. Statistical analysis was performed using SPSS version 25.0 with $p < 0.05$ considered statistically significant.

Results: The prevalence of SCH among diabetic patients was 16%. SCH was significantly more common among females compared to males ($p=0.02$). Patients with SCH had significantly higher HbA1c and total cholesterol levels compared to euthyroid patients. Multiple logistic regression analysis demonstrated increased odds of SCH among patients with poor glycemic control.

Conclusion: Subclinical hypothyroidism is prevalent among patients with type 2 diabetes mellitus and is associated with poor glycemic control and dyslipidemia. Routine thyroid screening may aid in early diagnosis and improved metabolic management.

Keywords: Type 2 Diabetes Mellitus, Subclinical Hypothyroidism, Thyroid Dysfunction, HbA1c, Dyslipidemia, TSH.

INTRODUCTION

Type 2 Diabetes Mellitus is one of the most common chronic metabolic disorders worldwide and has emerged as a major public health challenge due to its rapidly increasing prevalence and associated complications. According to the International Diabetes Federation, nearly 537 million adults were living with diabetes in 2021, and this number is projected to increase to 643 million by 2030 and 783 million by 2045 [1,2]. The rising prevalence of diabetes is attributed to factors such as urbanization, sedentary lifestyle, obesity, unhealthy dietary habits, and population aging.

www.ajmrhs.com
eISSN: 2583-7761

Date of Received: 22-05-2026
Date Acceptance: 30-05-2026
Date of Publication: 29-06-2026

Diabetes mellitus is associated with several microvascular and macrovascular complications that significantly contribute to morbidity and mortality worldwide [3].

Thyroid disorders are among the most common endocrine diseases encountered in clinical practice, and they frequently coexist with diabetes mellitus. Both diabetes and thyroid dysfunction are multifactorial disorders with complex metabolic interactions. They have been implicated in the development of dyslipidemia, endothelial dysfunction, atherosclerosis, cardiovascular disease, and impaired metabolic homeostasis [4,5]. Thyroid hormones play an essential role in regulating glucose metabolism, insulin secretion, hepatic glucose production, and lipid metabolism. Conversely, diabetes mellitus can alter thyroid hormone synthesis, secretion, and peripheral metabolism, thereby increasing the risk of thyroid dysfunction among diabetic patients [6].

Subclinical hypothyroidism (SCH) is characterized by elevated serum thyroid-stimulating hormone (TSH) levels with normal circulating free

triiodothyronine (FT3) and free thyroxine (FT4) concentrations [7]. SCH is considered the most common thyroid abnormality observed in patients with type 2 diabetes mellitus (T2DM). Several studies have demonstrated that the prevalence of SCH is significantly higher among patients with T2DM compared to the general population [8,9]. The prevalence of SCH among patients with T2DM has been reported to range between 2.2% and 17%, whereas the prevalence in the general population ranges from 4% to 10% [10,11]. The coexistence of SCH and diabetes mellitus may worsen insulin resistance, adversely affect glycemic control, and increase the risk of diabetic complications and cardiovascular disease [12].

Despite growing evidence regarding the association between T2DM and SCH, the relationship between these two endocrine disorders remains controversial. Some studies have reported a strong association between thyroid dysfunction and poor glycemic control, while others have demonstrated inconsistent findings [13,14]. SCH has also been linked to diabetic nephropathy, neuropathy, retinopathy, dyslipidemia, and peripheral vascular disease, suggesting that thyroid dysfunction may contribute to the progression of diabetic complications [15]. Early identification and management of SCH in diabetic patients may therefore play an important role in improving metabolic control and reducing long-term complications.

The present study aims to evaluate the prevalence and association of subclinical hypothyroidism among adult patients with type 2 diabetes mellitus in a tertiary care hospital setting. By assessing thyroid function parameters and their association with clinical and biochemical variables, the study seeks to improve understanding of the burden of SCH in diabetic patients. The findings of this study may contribute to better screening strategies, early diagnosis, and integrated management approaches for patients with diabetes mellitus and thyroid dysfunction [16].

Aim

To determine the prevalence and association of subclinical hypothyroidism among adult patients with type 2 diabetes mellitus attending a tertiary care hospital.

Objectives

1. To estimate the prevalence of subclinical hypothyroidism among adult patients with type 2 diabetes mellitus.
2. To assess the association between subclinical hypothyroidism and demographic variables such as age, gender, and body mass index (BMI).

METHODOLOGY

This analytical cross-sectional study was conducted in the Department of General Medicine at Sree Mookambika Institute of Medical Sciences during the study period from March 2025 to November 2025 after obtaining approval from the Institutional Ethics Committee. The study aimed to determine the prevalence and association of subclinical hypothyroidism among adult patients with type 2 diabetes mellitus attending the tertiary care hospital.

Adult patients aged 18 years and above diagnosed with Type 2 Diabetes Mellitus, either previously known cases on antidiabetic treatment or newly diagnosed cases fulfilling the diagnostic criteria of fasting plasma glucose ≥126 mg/dl or HbA1c ≥6.5%, were included in the study. Patients with known thyroid disorders, previous thyroid surgery, recent diagnosis of thyroid disease, radiation exposure to the thyroid gland, pregnancy, unstable cardiac disease, liver cirrhosis, renal impairment, malignancies, and patients receiving medications known to interfere with thyroid function such as glucocorticoids, lithium, or amiodarone were excluded from the study. Patients with type 1 diabetes mellitus, gestational diabetes mellitus, or secondary diabetes mellitus were also excluded. Written informed consent was obtained from all participants before enrollment.

Sample size was calculated based on the prevalence of subclinical hypothyroidism among patients with type 2 diabetes mellitus reported in previous studies. A total of 300 patients were included using convenient sampling technique. Detailed demographic information including age, gender, body mass index (BMI), duration of diabetes mellitus, medical history, personal history, and diabetic complications such as retinopathy, nephropathy, neuropathy, cardiovascular disease, and peripheral vascular disease were recorded using a semi-structured questionnaire.

Under aseptic precautions, fasting venous blood samples were collected from all study participants for laboratory investigations. Biochemical parameters including fasting blood sugar (FBS), postprandial blood sugar (PPBS), HbA1c, lipid profile, serum creatinine, hemoglobin, and C-reactive protein (CRP) were analyzed using a fully automated analyzer. Thyroid function tests including serum thyroid-stimulating hormone (TSH), free triiodothyronine (FT3), and free thyroxine (FT4) were measured using enhanced chemiluminescence assay. Subclinical hypothyroidism was defined as elevated serum TSH levels (>5.0 μIU/ml) with normal FT3 and FT4 levels.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 25.0. Continuous variables were expressed as mean ± standard deviation (SD), while

categorical variables were represented as frequencies and percentages. Student's t-test and Chi-square test were used to compare variables between euthyroid and subclinical hypothyroid patients. Spearman's correlation coefficient was used to assess the correlation between HbA1c and TSH levels. Multiple logistic regression analysis was performed to evaluate the association between subclinical hypothyroidism and glycemic control after adjusting for confounding variables. A p-value of less than 0.05 was considered statistically significant.

RESULT

Out of the 300 patients in the study, there were 175(58.3%) male and 125(41.7%) female patients.Age ranges from 22-75 years with mean ± Standard deviation (SD) of age being 55.14 ± 15.82, with majority belonging to 40-60(47%) years age group. With respect to duration of Type 2 DM, mean was 6.45±2.51. About 44% were suffering from Type 2 DM for ≥5 years. (shown in table 1)

Table 1: Patients by Age, Sex and Duration of Type2 Dm

Socio-demographic detail	Category	Frequency (n=300)	Percentage
Age in years	18-40	63	21%
	41-60	141	47%
	>60	96	32%
Sex	Male	175	58.3%
	Female	125	41.7%
Duration Of Type 2 DM	< 5 year	168	56%
	≥ 5 year	132	44%

The range forBMIwas18.3–31.6withmean21.73 ±1.98,range forFBSwas76 - 315mg/dl withmean of 161.58±62.75, range for PPBSwas97-328withmean294.6±96.75, range for HbA1c was5.7 –12.7 withmean 7.75 ± 1.91. Mean and SD of TSH, free T3 and T4 was 3.17±2.9 (range 0.25-6.5), 2.82±1.2 pg/dl (range1.12-4.9) and 2.69±0.61 µg/dl(range 1.7-5.4).Total cholesterol of study patients ranges from 87 to 431 with a mean of 156 ±49.31, LDL cholesterol ranges from 81 - 272with mean 102.9 ±45.6,HDLranges from 15 to 72 with mean33.3±10.7, Triglyceride ranges from 97-419 with mean 4 3.3±199.4, creatinine ranges from0.60 - 1.20 with mean 0.94 ± 0.14, CRP ranges from 0.6 – 12.2 with mean 2.94 ± 3.14. Haemoglobin ranges from 5.6gm/dl - 15.8 gm/dl, with mean 11.1±4.31.(Shown in the table 2)

Table 2: Minimum, Maximum Mean and Standard Deviation of Variables Studied

Parameters (n=300)	**Minimum**	**Maximum**	**Mean**	**SD**
Bodymass index	18.30	31.6	21.73	1.98
FBS mg/dl	76	315	161.58	62.75
PPBS mg/dl	97	328	294.6	96.75
HbA1c %	5.7	12.7	7.75	1.91
Total cholesterol mg/dl	87	431	156	49.31
Ldl-cholesterol mg/dl	81	272	102.9	45.6
Hdl-cholesterol mg/dl	15	72	33.3	10.7
Triglyceride mg/dl	97	419.00	43.3	19.40
Creatinine	0.60	12.2	2.94	3.14
Hemoglobin g/dl	5.6	15.8	11.1	4.31
TSH	0.25	6.5	3.17	2.9
Free T3 pg/dl	1.12	4.9	2.82	1.2
Free T4 µg/dl	1.7	5.4	2.69	0.61

The prevalence of subclinical hypothyroidism in this study was 16% (58/300 patients). Mean age of patients was high in patients with SCH (54.2) compared to euthyroid patients (52.7) but was not significant statistically. More proportion of females (21.6%) compared to males (12%) have SCH which was significant. Mean HbA1C, free T4 and total cholesterol was significantly more in patients with SCH compared to euthyroid patients. Distribution of mean of duration of diabetes mellitus, freeT3, HDL cholesterol, LDL cholesterol and proportion of patients with complications of DM was not significant statistically. (shown in table 3)

Table 3: Distribution of variables in euthyroid versus subclinical hypothyroid patients

Characteristics		Euthyroid (242)	Subclinical hypothyroid (58)	Chi-square or t test/ P value
Age in years (mean ± SD)		52.7±11.9	54.2±12.8	0.84/0.39
Gender	Male	154 (88%)	21(12%)	5/0.02
	Female	88 (70.4%)	37 (29.6%)	
Duration of diabetes in years (mean ± SD)		5.7±2.9 years	6.1±3.4 years	1.36/0.17
HbA1c (%)		7.5±1.2	8.1±3.5	2.19/0.03
Free T3 (pg/ml) (mean ± SD)		3.11±2.1	2.9±1.5	0.71/0.473
Free T4 (µg/dl) (mean ± SD)		5.6±2.7	6.7±1.1	3.03/0.002
Total cholesterol (mg/dl) (mean ± SD)		156±19.8	163±21.7	2.37/0.01
HDL cholesterol (mg/dl) (mean ± SD)		37±16.7	35±19.1	0.79/0.42
LDL cholesterol (mg/dl) (mean ± SD)		106.2±14.7	109.9±15.4	1.7/0.08
Complications of DM	Yes	60	19	1.53/0.216
	No	182	39	

Spearmans rho was used to assess correlation which shows weak association of HbA1C with TSH (r=0.14/p>0.05) which was not statistically significant. (shown in table 4)

Table 4: Correlation of HbA1C with TSH

		TSH
Hb1AC(%)	Spearmans rho	0.144
	Sig. (2-tailed)	0.318
	N	300

After adjusting for age, gender, BMI, duration of diabetes mellitus, dyslipidaemia and complications due to diabetes mellitus multiple logistic regression shows the odds of having SCH is 0.9 times and 1.2 times in patients with HbA1C 7-9%and >9%, when HbA1C <7% was considered as reference which was significant statistically. (shown in table 5)

Table 5: Multiple logistic regression of SCH versus HbA1C

SCH versus HbA1C	OR (95% CI)	P
HbA1C <7%	Reference	
HbA1C 7-9%	0.9 (0.7-1.5)	0.034
HbA1C >9%	1.2 (0.6-2.6)	0.027

DISCUSSION

The present study evaluated the prevalence and association of subclinical hypothyroidism (SCH) among adult patients with Type 2 Diabetes Mellitus attending a tertiary care hospital. The findings demonstrated that SCH was present in 16% of diabetic patients, indicating a relatively high prevalence of thyroid dysfunction among individuals with type 2 diabetes mellitus (T2DM). Similar prevalence rates have been reported in previous studies, which observed that thyroid dysfunction, particularly SCH, is more common among diabetic patients compared to the general population [17,18].

In the present study, the majority of patients belonged to the age group of 41–60 years, and males constituted 58.3% of the study population. However, SCH was significantly more common among females compared to males (29.6% vs. 12%, p = 0.02). This observation is consistent with earlier studies showing that thyroid disorders are more prevalent among women due to hormonal and autoimmune influences [19]. Although the mean age was slightly higher among SCH patients compared to euthyroid individuals, the difference was not statistically significant. These findings suggest that gender may be a stronger predictor of SCH than age in diabetic patients [20].

The study also demonstrated significantly higher HbA1c levels among patients with SCH compared to euthyroid patients (8.1% vs. 7.5%, p = 0.03). This finding indicates poorer glycemic control in diabetic patients with thyroid dysfunction. Thyroid hormones are known to influence glucose metabolism, insulin sensitivity, and hepatic glucose production; therefore, even mild thyroid

dysfunction may adversely affect glycemic status [21]. Previous studies by Díez et al. and Chen et al. also reported an association between SCH and poor glycemic control in T2DM patients [22,23].

A significant association was also observed between SCH and elevated total cholesterol levels. Patients with SCH had significantly higher mean total cholesterol compared to euthyroid patients (163 mg/dl vs. 156 mg/dl, p = 0.01). Thyroid hormones play a major role in lipid metabolism, and hypothyroidism is associated with decreased LDL receptor activity and impaired lipid clearance, leading to dyslipidemia [24]. Although LDL and HDL cholesterol levels were comparatively altered in SCH patients, the differences were not statistically significant in the present study. Nevertheless, these findings highlight the potential contribution of SCH to increased cardiovascular risk among diabetic patients [25].

The correlation analysis between HbA1c and thyroid-stimulating hormone (TSH) showed a weak positive association (r = 0.144), which was not statistically significant. This suggests that although SCH may influence glycemic control, the relationship between TSH levels and HbA1c is complex and may be affected by several confounding metabolic factors [26]. However, multiple logistic regression analysis demonstrated that patients with HbA1c levels between 7–9% and greater than 9% had higher odds of developing SCH compared to patients with HbA1c less than 7%. These findings support the concept that poor glycemic control may increase the risk of thyroid dysfunction in diabetic patients [27].

The prevalence of diabetic complications was higher among patients with SCH, although the association was not statistically significant. Previous studies have suggested that SCH may contribute to the progression of diabetic nephropathy, neuropathy, retinopathy, and cardiovascular disease through mechanisms involving endothelial dysfunction, oxidative stress, and dyslipidemia [28]. Early screening and identification of SCH in diabetic patients may therefore help improve metabolic control and reduce long-term complications.

Overall, the present study emphasizes the importance of routine thyroid function screening in patients with T2DM, especially among females and those with poor glycemic control. Early diagnosis and management of SCH may improve metabolic outcomes and reduce cardiovascular risk in diabetic patients [29].

Conclusion

The present study demonstrated a considerable prevalence of subclinical hypothyroidism among adult patients with Type 2 Diabetes Mellitus, highlighting the close association between thyroid dysfunction and diabetes mellitus. Subclinical hypothyroidism was found to be more common among female patients and was significantly associated with poor glycemic control and elevated total cholesterol levels. Although the correlation between HbA1c and TSH was weak, patients with higher HbA1c levels showed increased odds of developing subclinical hypothyroidism. These findings emphasize the importance of routine thyroid function screening in patients with type 2 diabetes mellitus for early identification and management of thyroid dysfunction. Early diagnosis and appropriate intervention may help improve metabolic control, reduce cardiovascular risk, and prevent long-term diabetic complications.

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How to cite this article: Dr. Praveen jeya singh. T, Dr. Mookambika. R.v., ASSESSMENT OF SUBCLINICAL HYPOTHYROIDISM IN ADULTS WITH DIABETES MELLITUS: A TERTIARY CARE HOSPITAL STUDY, Asian J. Med. Res. Health Sci., 2026; 4 (2):1337-1342.
Source of Support: Nil, Conflicts of Interest: None declared.