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Original Article

A STUDY ON THE PREVALENCE OF THYROID DYSFUNCTION IN PATIENTS WITH TYPE 2 DIABETES MELLITUS IN A TERTIARY CENTRE IN A TRIBAL POPULATION OF EASTERN INDIA

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ABSTRACT

Objective: Diabetes is the most common endocrine disorder and is the leading cause of death worldwide. Thyroid dysfunction is another common endocrine disorder frequently encountered in clinical practice worldwide, second only to diabetes. The present study was undertaken with the following aims and objectives: To know the prevalence of thyroid dysfunction in type 2 diabetes mellitus and the spectrum of thyroid dysfunction in type 2 diabetes mellitus.

Methods: Type 2 diabetes mellitus patients, as per World Health Organisation criteria, without pre-existing thyroid disease attending the Medicine Outpatient Department or admitted to the Department of Medicine from June 2019 to May 2020 were taken as cases. Patients with type 2 DM aged>15 y were included in our study. Patients below 15 y of age, pregnant or lactating women, patients suffering from malignancy and tuberculosis, hepatic dysfunction, renal dysfunction, and those on drugs known to affect thyroid function (steroid, oral contraceptive pills, beta-blockers, and amiodarone), and patients who had proven pre-existing thyroid dysfunction were excluded from the study.

Results: In our study, thyroid dysfunction was present in 14.69% of patients among 320 patients with diabetes. Thyroid dysfunction was present in 7.73% of males and 23.74% of females with diabetes. Out of 47 diabetic patients who had thyroid dysfunction, 76.60% had glycosylated haemoglobin (HbA1C)>7.

Conclusion: There was a higher prevalence of thyroid disorders in patients with type 2 diabetes. This finding was more common in female diabetics. Subclinical hypothyroidism was the most frequent thyroid disorder found among diabetics.

Keywords: Diabetes, Thyroid dysfunction, Subclinical hypothyroidism, HbA1C

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INTRODUCTION

Diabetes mellitus (T2DM) is a syndrome of impaired carbohydrate, fat, and protein metabolism caused by either a lack of insulin secretion or decreased sensitivity of the tissues to insulin [1]. Diabetes is the most common endocrine disorder and the leading cause of death worldwide [2, 3]. T2DM poses a major global health threat, both in developed and developing countries [4]. As per data from the International Diabetes Federation (IDF) in 2021, an estimated 53.7 crore adults (10.5% of all adults in the age group of 20-79 y) are living with diabetes, which is predicted to rise to 78.3 crore adults (12.2% of all adults in the age group of 20-79 y) by 2045. Thus, the number of people with diabetes is estimated to increase by 46% over this period [5]. Diabetes is one of the largest global health emergencies of this century, ranking among the 10 leading causes of mortality, together with cardiovascular disease (CVD), respiratory disease, and cancer [6]. Diabetes is responsible for 6.7 million deaths in 2021-one every 5 seconds in the world [5].

Thyroid dysfunction is another common endocrine disorder frequently encountered in clinical practice worldwide, second only to diabetes [7, 8]. The association between type 2 diabetes mellitus (T2DM) and thyroid dysfunction (TD) has been reported in the medical literature since 1979 [9]. The prevalence of thyroid dysfunction varies widely at the community level in different countries, ranging from 6.6% to 13.4% [7]. Many studies have reported varying prevalences (10%–24%) of thyroid dysfunction in type 2 diabetes [10]. The prevalence of thyroid dysfunction in type 2 diabetes varies in the literature from very low (5.5%) to very high (75%) [11, 12]. Thyroid disease is more widespread among the diabetic population as compared to the population of normal individuals [13-15].

Thyroid hormones directly control insulin secretion. In hypothyroidism, there is a reduction in glucose-induced insulin secretion by beta cells, and the response of beta cells to glucose or catecholamine is increased in hyperthyroidism due to increased beta cell mass. Moreover, insulin clearance is increased in thyrotoxicosis [16]. The half-life of insulin is reduced in a thyrotoxic environment; this is thought to be due to increased degradation of the active hormone and the release of inactive precursors [17]. The DM influences thyroid dysfunction at two sites: first at the level of the hypothalamus by controlling TSH release and second at the peripheral tissues by converting T4 to T3 [18]. Insulin and thyroid hormones are intimately involved in cellular metabolism and thus, excess or deficit of either of these hormones results in the functional derangement of the other. The physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins, and lipids are recorded. Such records indicate that iodothyronines are insulin antagonists, with high levels being diabetogenic, while the absence of the hormone inhibits the development of diabetes [19].

Thyroid hormone replacement is associated with a decrease in glycosylated haemoglobin (HbA1c) level, which is influenced more by increased erythropoiesis than by changes in glucose level [20]. Unrecognized thyroid dysfunction not only worsens metabolic control but also impedes the management of diabetes [21]. Studies have also suggested that type 2 diabetes mellitus patients with subclinical hypothyroidism are at risk of complications like nephropathy and cardiovascular events [22]. The ability to diagnose and treat subclinical hypothyroidism in these patients may greatly enhance their quality of life. Hence, there is a need to detect cases where hypothyroidism contributes to morbidity and is the cause of poor control of the associated conditions. The treatment of hypothyroidism helps better control other associated co-morbidities. It is seen that many diabetic patients may remain asymptomatic, especially with

subclinical hypothyroidism. Hence, screening diabetic patients for a thyroid disorder is justified for early detection. The American Diabetic Association (ADA) has proposed that people with diabetes be checked for thyroid disorders [23, 24].

The countries with the largest numbers of adults with diabetes aged 20-79 y in 2021 are China, India, and Pakistan [5]. An estimated 74.2 million adults (9.6% of all adults in the age group of 20-79 y) were living with diabetes in India in 2021, which is predicted to rise to 124.9 million adults (10.8% of all adults in the age group of 20-79 y) by 2045 [25]. Diabetes is responsible for 6.5 lakh deaths in 2021 in India [25]. Almost 90% of people with undiagnosed diabetes live in low-and middle-income countries like India [5].

Many studies were conducted in different countries, but very little data is available in our country, especially in the tribal area of South Odisha. Against this backdrop, the present study was undertaken with the following aims and objectives: to know the prevalence of thyroid dysfunction in type 2 diabetes mellitus and the spectrum of thyroid dysfunction in type 2 diabetes mellitus.

MATERIALS AND METHODS

Type 2 diabetes mellitus patients, as per World Health Organisation (WHO) criteria without pre-existing thyroid disease attending the Medicine Outpatient Department or admitted to the Department of Medicine from June 2019 to May 2020 were taken as cases. Patients with type 2 DM aged>15 y were included in our study. Patients below 15 y of age, pregnant or lactating women, patients suffering from malignancy, tuberculosis, hepatic dysfunction, renal dysfunction, and those on drugs known to affect thyroid function (steroid, oral contraceptive pills, beta-blockers, and amiodarone), patients who had proven pre-existing thyroid dysfunction were excluded from the study.

After obtaining approval and clearance from the ethical committee [EC-4 (4)/2020], all adult patients with diabetes mellitus who attended Saheed Laxman Nayak Hospital and gave informed written consent were enrolled in this study. Socio-demographic, anthropometric, and clinical profiles such as age, gender, marital status, literacy status, weight (in kg), body mass index (BMI), family history (parents or siblings), and duration of illness were collected from patients using standardised questionnaires. All these patients were investigated for fasting blood sugar (FBS), postprandial 2 h blood sugar (PP2BS), HbA1C, thyroid profile (S. TSH, S. T3 and S. T4), serum urea and creatinine.

Statistical analysis

All data collected from the target population were fed into an Excel spreadsheet, and statistical analyses were made using SPSS version 25.0 software. Since our study was a cross-sectional study, the data was expressed in categorical variables, and the derivation of our study was calculated in the form of average±standard deviation (SD), frequencies, and percentages. Continuous data were compared using chi-square with Yates correction. The mean and SD were used to compare quantitative variables such as age, weight, height, BMI, HbA1C, serum TSH, serum T3, and serum T4. A statistically significant value was defined as $p<0.05$, and $p<0.001$ was considered statistically extremely significant for all tests conducted.

RESULTS

Age-sex distribution among diabetes patients

In our study, we included 320 cases of diabetes mellitus. Out of which 181 (56.56%) were male and 139 (43.44%) were female, with an M: F ratio of 1.3:1. The average age of the diabetes patients in our study was 51.89+12.16 y. The average age of male and female diabetes patients in our study was 51.97+12.69 and 51.80+11.47 y, respectively.

In our present study, the highest number of patients belonged to the age group of 46-60 y (143-44.69%) followed by 31-45 y (95-29.69%) in both males and females. 21.56% (69) of patients with diabetes belong to the age group of more than 60 y. Only 4.06% of patients (13) were younger than 30 y (fig. 1).

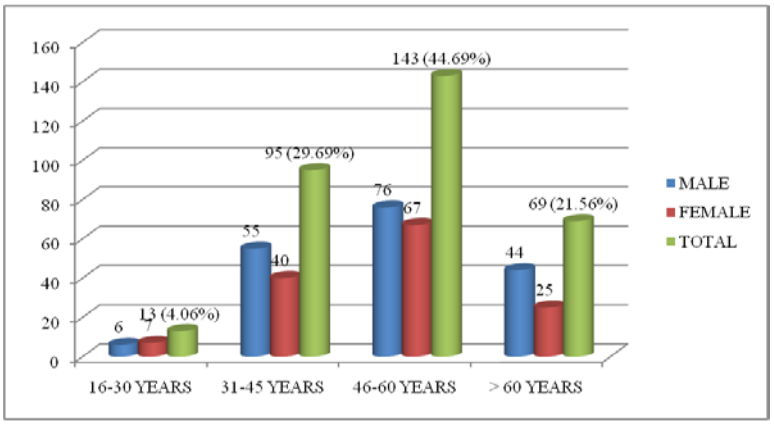

Fig. 1: Age-sex distribution among diabetes patients

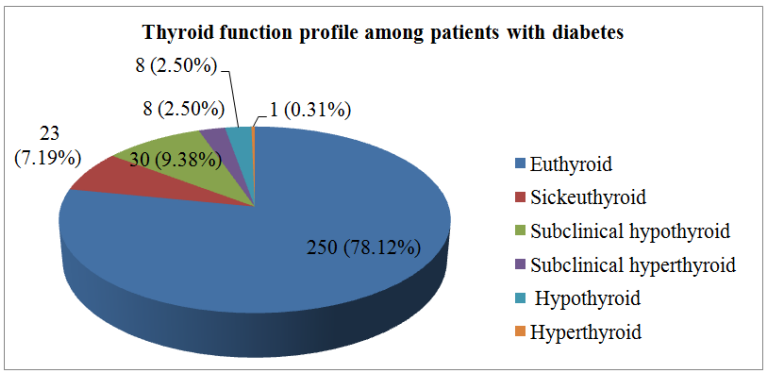

Fig. 2: Thyroid function profile among patients with diabetes

Thyroid function profile among patients with diabetes

Fig. 2 shows thyroid dysfunction was present in 47 (14.69%) patients among 320 patients with diabetes. Subclinical hypothyroidism was the most prevalent thyroid dysfunction in diabetic patients in our study, occurring in 9.38%, followed by hypothyroidism in 2.5%, subclinical hyperthyroidism in 2.5%, and hyperthyroidism in 0.30% of the total 320 diabetic patients (fig. 2). We found sick euthyroid in 23 (7.19%) patients.

Age distribution and thyroid dysfunction

Out of 47 diabetic patients with thyroid dysfunction, 17 (36.17%) patients belonged to the age group of<46 y of age among 108 patients with diabetes, and 30 (63.83%) belonged to the age group of>46 y of age among 212 patients with diabetes (chi-square with Yates correction statistic was 0.045, p-value = 0.8314). Out of 47 diabetic patients with thyroid dysfunction, 8 (17.02%) patients belonged to the age group of >60 y of age among 69 patients with diabetes, and 39 (82.98%) belonged to the age group of<60 y of age among 251 patients with diabetes (chi-square with Yates correction statistic was 0.394, p-value = 0.5303). 22 (46.81%) patients belonged to the age group of 46-60 y, followed by 15 (31.91%) patients belonged to the age group of 31-45 y, and 8 (17.02%) patients belonged to the age group>60 y (table 1).

Thus, the age-specific trend in the prevalence of thyroid disorder was found to be highest in the age group of 46-60 y. 63.83% (30) of the patients with diabetes with thyroid dysfunction had subclinical hypothyroid in both males and females, followed by 17.02% (8) of subclinical hyperthyroidism and hypothyroidism each. Only 2.13% (1 patient) had hyperthyroidism among the patients with diabetes with thyroid dysfunction (table 1).

Table 1: Age distribution and thyroid dysfunction

Thyroid dysfunction	Subclinical hypothyroid	Subclinical hyperthyroid	Hypothyroid	Hyperthyroid	Total
Age	Total	Total	Total	Total	Total
16-30	2 (6.67%)	0 (0%)	0 (0%)	0 (0%)	2 (4.26%)
31-45	10 (33.33%)	2 (25.00%)	2 (25.00%)	1 (100.00%)	15 (31.91%)
46-60	13 (43.33%)	3 (37.50%)	6 (75.00%)	0 (0%)	22 (46.81%)
>60	5 (16.67%)	3 (37.50%)	0 (0%)	0 (0%)	8 (17.02%)
Total	30 (63.83%)	8 (17.02%)	8 (17.02%)	1 (2.13%)	47 (100.00%)

Thyroid dysfunction was present in a total of 47 patients, with 14 (29.79%) males and 33 (70.21%) females. Thus, the age-sex-specific trend in the prevalence of thyroid disorder was found to be highest in the age group of 31-45 y among females and highest in the age group of 46-60 y among males. Subclinical hypothyroid was the earliest and most common thyroid dysfunction in all age groups, in both males and females. Hypothyroid patients were more common in females (75% of hypothyroid patients with diabetes are female) than males, with the highest prevalence in the age group of 46-60 y of age (66.67% of female hypothyroid patients with diabetes) (table 2).

Table 2: Age-sex distribution and thyroid dysfunction

Thyroid dysfunction	Subclinical hypothyroid		Subclinical hyperthyroid		Hypothyroid		Hyperthyroid		Total		
Age	M	F	M	F	M	F	M	F	M	F	Total
16-30	0/6	2/7 28.57%	0/6	0/7	0/6	0/7	0/6	0/7	0/6	2/7 28.57%	2/13 15.34%
31-45	1/55 1.82%	9/40 22.5%	1/55 1.82%	1/40 2.5%	0/55	2/40 5.0%	1/55 1.82%	0/40	3/55 5.45%	12/40 30.0%	15/95 15.79%
46-60	5/76 6.58%	8/67 11.94%	1/76 1.32%	2/67 2.98%	2/76 2.63%	4/67 5.97%	0/76	0/67	8/76 10.53%	14/67 20.90%	22/143 15.38%
>60	2/44 4.54%	3/25 12.0%	1/44 2.27%	2/25 8.0%	0/44	0/25	0/44	0/25	3/44 6.82%	5/25 20.0%	8/69 11.59%
Total	8/181 4.42%	22/139 15.83%	3/181 1.66%	5/139 3.60%	2/181 1.10%	6/139 4.32%	1/181 0.05%	0/139	14/181 7.73%	33/139 23.74%	47/320 14.69%

Table 3: Sociodemographic profiles of patients with diabetes

Sex distribution and thyroid dysfunction							
	Male		**Female**		**Total**		**p value**
	n	%	n	%	n	%	p = 0.0001**, chi
Euthyroid	167	92.27%	106	76.26%	273	85.31%	square 14.823 with 1
Thyroid dysfunction	14	7.73%	33	23.74%	47	14.69%	df
Total	181	56.56%	139	43.44%	320	100.00%	
Marital status and thyroid dysfunction							
	Married		Unmarried		Total		p value
	n	%	n	%	n	%	p = 0.7390,
Euthyroid	264	85.44%	9	81.82%	273	85.31%	chi square 0.111 with
Thyroid dysfunction	45	14.56%	2	18.18%	47	14.69%	1 df
Total	309	96.56%	11	3.44%	320	100.00%	
Literacy status and thyroid dysfunction							
Education	Patients with diabetes without thyroid dysfunction		Patients with diabetes with thyroid dysfunction		Total		p value
	n	%	n	%	n	%	p = 0.2155, chi square
<10th	84	30.77%	11	23.40%	95	26.69%	4.4632 with d. f. = 3*1
10th	28	10.26%	9	19.15%	37	11.56%	= 3
Plus 2 and equivalent	23	8.42%	2	4.26%	25	7.81%	
Graduate and postgraduate	23	8.42%	4	8.51%	27	8.44%	
Not available	115	42.13%	21	44.68%	136	42.50%	
Total	273	100.00%	47	100.00%	320	100.00%	

Table 4 shows the prevalence of thyroid dysfunction among cases with diabetes was higher than the control (14.69% vs. 5.00%), which was statistically significant (p = 0.0327*).

Table 4: Thyroid dysfunction among patients with diabetes and control

Thyroid dysfunction	Patients with diabetes			Control			P value
	n	Total	%	n	Total	%	
Euthyroid	273	273	85.31%	76	76	95.00%	p = 0.0327*, chi-square
Subclinical hypothyroid	30	47	14.69%	2	4	5.00%	4.563 with 1 df
Subclinical hyperthyroid	8			1			
Hypothyroid	8			1			
Hyperthyroid	1			0			
Total	320	320	100.00%	80	80	100.00%	

Table 5 shows the association of HbA1c level among cases and controls was statistically significant. The thyroid profile parameters among cases and control were not associated statistically significantly, but the thyroid profile parameters among the cases of diabetes with thyroid dysfunction were associated statistically significantly (p = 0.0001**) with controls.

Table 5: Thyroid profile among patients with diabetes and control

	Total cases (320) group A	Control (80) group B	P value (group A vs. group B)	Diabetes with thyroid dysfunction (47) group C	P value (group B vs. group C)
HbA1c	8.02+2.28	5.47+0.73	0.0001**	8.53+2.41	0.0001**
e-AG	182.75+66.06	110.90+23.46	0.0001**	197.18+74.77	0.0001**
T3	1.36+6.58	1.12+0.31	0.7447	3.42+17.08	0.2295
T4	10.01+2.75	10.24+2.26	0.4895	9.32+4.39	0.1217
TSH	3.38+5.76	2.54+2.39	0.2026	10.44+12.76	0.0001**

Table 6 shows the comparison between male and female patients with diabetes. BMI was higher among males than females with diabetes. BMI and TSH were statistically associated, which was highly significant (p = 0.0004** and P = 0.0007**).

Table 6: Parameters comparing between male and female diabetic cases

	Total cases (320) group A	Male (181) group B	P value (group A vs group B)	Female (139) group C	P value (group A vs group C)	P value (group B vs group C)
BMI	24.35+3.95	25.03+3.91	0.0638	23.47+3.84	0.0275*	0.0004**
HbA1c	8.02+2.28	7.95+2.17	0.7371	8.09+2.42	0.7669	0.5868
e-AG	182.75+66.06	181.48+62.64	0.8333	184.41+70.61	0.8087	0.6951
T3	1.36+6.58	1.03+0.93	0.5027	1.78+9.93	0.5938	0.3129
T4	10.01+2.75	10+2.91	0.9695	10.02+2.54	0.9708	0.9487
TSH	3.38+5.76	2.43+1.86	0.0316*	4.61+8.33	0.0689	0.0007**

Table 7 shows 31.43% of patients with diabetes with thyroid dysfunction had hypertension. The chi-square statistic was 0.563. The p-value was 0.4531. The result was not significant at p<0.05. Only 12.77% of patients had a family history of diabetes that had thyroid dysfunction. Though we found thyroid dysfunction among 12.5% of patients with diabetes with the duration of less than one year, there was no statistically significant relationship between patients with diabetes with thyroid dysfunction and patients with diabetes without thyroid dysfunction. In our study, out of 47 diabetic patients and thyroid dysfunction, 20 had a BMI<25, 23 had a BMI between 25-30, and 4 had a BMI>30. 57.45% of patients with diabetes with thyroid dysfunction had a BMI>25. Thus, the prevalence of thyroid disorders was found to be higher in patients with a BMI>25 though not statistically significant.

Table 7: Anthropometric profiles of patients with diabetes

	Patients with diabetes without thyroid dysfunction		Patients with diabetes with thyroid dysfunction		Total		P value
	n (273)	%	n (47)	%	n (320)	%	
Hypertension							p = 0.4531
HTN	86	32.80%	18	31.43%	104	32.50%	Chi square 0.563
No HTN	187	67.20%	29	68.57%	216	67.50%	with df = 1
Family history							p = 0.9182, Chi
Family history	49	17.95%	6	12.77%	55	17.19%	square 0.011 with
No family history	85	31.14%	11	23.40%	96	30.00%	d. f. = 1
Not available	139	50.91%	30	63.83%	169	52.81%	
Duration							p = 0.2328, Chi
Newly detected	15	5.50%	3	6.38%	18	5.63%	square 5.5796
<1yr	27	9.89%	3	6.38%	30	9.37%	with
>1 y<10 y	99	36.26%	14	29.79%	113	35.31%	d. f. = 4
>10 y<20 y	13	4.76%	6	12.77%	19	5.94%	
>20 y	8	2.93%	1	2.13%	9	2.81%	
Not available	111	40.66%	20	42.55%	131	40.94%	
WHO Asian-BMI classification							p = 0.361262,
<18.5	20	7.33%	1	2.13%	21	6.56%	Chi square 4.3455
18.5-22.9	83	30.40%	12	25.53%	95	29.69%	with
>23-24.9	53	19.41%	7	14.89%	60	18.75%	d. f. = 4
>25-29.9	98	35.90%	23	48.94%	121	37.81%	
>30	19	6.96%	4	8.51%	23	7.19%	

HbA1C and thyroid dysfunction

In this study, out of 47 diabetic patients who had thyroid dysfunction, 11 (23.40%) had HbA1C<7 and 36 (76.60%) had HbA1C>7. The prevalence of thyroid disorders was found to be increasing in patients with HbA1C>7 (table 8). The chi-square statistic was 7.2834. The p-value was 0.0262. The result was significant at p<0.05 (table 8).

Table 8: HbA1c and thyroid dysfunction

HbA1c	Patients with diabetes without thyroid dysfunction		Patients with diabetes with thyroid dysfunction		Total		p value
	n (273)	%	n (47)	%	n (320)	%	p = 0.0262*, Chi square 13.5899 with d. f. = 2
<7	111	40.66%	11	23.40%	122	38.12%	
7-9	101	37.00%	18	38.30%	119	37.19%	
>9	61	22.34%	18	38.30%	79	24.69%	

DISCUSSION

In our study, we included 320 cases of diabetes mellitus. Out of which 56.56% were male and 43.44% were female. A similar study was done by Vadivelan Mehalingam, *et al.*, in which a total of 331 patients with T2DM were taken, out of which 52.57% were male and 42.43% were female [26].

The average age of the diabetes patient in our study was 51.89+12.16 y, similar to Jinaga Satyanarayan Rao, *et al.*, in which the mean age was 53.89±11.61 y [8]. In our study, the highest number of patients belonged to the age group of 46-60 y. 21.56% of cases were older than 60 y of age, with only 4.06% of patients younger than 30 y. Vadivelan Mehalingam, *et al.* also found similar results, with 25.98% of cases above 60 y of age and only 2.42% of patients younger than 30 y [26]. In our study, the mean BMI was 24.35±3.95 kg/m2 and the mean HBA1c was 8.01±2.28%; similar to the Pramanik S., *et al.* study [9]. The prevalence of thyroid disorder among type 2 diabetes mellitus patients was 14.69% in our study population, lower (17.5%) than Vadivelan Mehalingam, *et al.* study [26], but quite similar (14.7%) to that found by Shekhar *et al.* [27]. Subclinical hypothyroidism was the most prevalent thyroid dysfunction in diabetic patients in our study. Similar observations were found in Shekhar *et al.* and Sreelatha M. Study [28]. Hyperthyroidism was rare in all studies.

29.79% of thyroid dysfunction patients were male (7.73% of total male patients) and 70.21% of thyroid dysfunction patients were female (23.74% of total female patients), suggesting thyroid dysfunction was more prevalent among females. The Telwani *et al.* study found females with type 2 diabetes suffered more than three times as much as males from thyroid dysfunction [29]. An Indian study also found similar findings: ladies were more likely than men to suffer from thyroid diseases (69% vs. 31%) [30].

Subclinical hypothyroidism was the most prevalent thyroid dysfunction in diabetic patients in our study, similar to the line of the Reddy *et al.* study [16]. Subclinical hypothyroid was the earliest and most common thyroid dysfunction in all age groups, in both males and females. Hypothyroid patients were more common in females. The prevalence of thyroid disorders was found to be higher in patients who had a BMI>25, though other anthropometric parameters were not statistically significantly associated with thyroid dysfunction in our study. 40.66% of subjects with normal thyroid profiles in the study group had glycosylated haemoglobin of less than 7%. This was in contrast to the fact that 76.60% of subjects diagnosed with abnormal thyroid profiles had glycosylated haemoglobin of more than or equal to 7%. This finding was similar to the line of the Vibha Uppal *et al.* study [19]. Thus, the prevalence of thyroid disorders was found to be higher in patients with uncontrolled diabetes with higher HbA1C levels.

LIMITATIONS OF THE STUDY

Anti-thyroid peroxidase (anti-TPO) antibody estimation was not done in our study. Thus, the role of thyroid autoimmune antibodies in patients developing thyroid dysfunction among type 2 diabetic patients could not be assessed. Further studies are needed to determine whether diabetes mellitus has a causative association in the pathogenesis of thyroid dysfunction.

CONCLUSION

There was a higher prevalence of thyroid disorders in patients with type 2 diabetes. This finding was more common in female diabetics than male diabetics. The prevalence of thyroid disorder was found to be the highest in the age group of 46-60 y. Subclinical hypothyroidism was the most frequent thyroid disorder found among diabetics, with hyperthyroidism found the least. The prevalence of thyroid disorders was found to be higher in diabetic patients who had higher body mass indexes and poor metabolic control. The prevalence of thyroid disorders was found to be higher in patients with uncontrolled diabetes with higher HbA1C levels. Hence, screening for thyroid dysfunction in diabetic patients should be performed routinely to recognise these dysfunctions early, thus improving their quality of life and reducing their morbidity rate. But for hyperthyroidism, the data we evaluated was not significant, and for a further conclusion, a bigger study is needed.

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AUTHORS CONTRIBUTIONS

Both Dr. Bibhu Prasad Behera and Dr. Ranjan Kumar Sen contributed equally to the design of the study, data collection, statistical study, analysis of the data, data interpretation, and manuscript writing. Dr. Bibhu Prasad Behera is also the corresponding author.

CONFLICTS OF INTERESTS

Declared none

REFERENCES

1. Hall JE. Insulin, glucagon, and diabetes mellitus. In: Hall JE. editor. Guyton and Hall textbook of medical physiology. 12th ed. Philadelphia: Saunders Publications; 2011. p. 950-2.
2. Ramachandran A, Snehalatha C. Current scenario of diabetes in India. J Diabetes. 2009;1(1):18-28. doi: 10.1111/j.1753-0407.2008.00004.x, PMID 20923516.
3. Sonali Chaturvedi. Thyroid dysfunction and its relation with type 2 diabetes mellitus in Meerut. Int J Sci Res. 2016;5(7):305-7.
4. Vinu V, Chitnis P, Gupta VK. Evaluation of thyroid dysfunction among type II diabetes mellitus. Int J Pharm Biol Sci. 2012;2:150-5.
5. IDF diabetes atlas. 10th ed. Brussels, Belgium: International Diabetes Federation; 2021.
6. World Health Organization. The top 10 causes of death.
7. Deuri DA, Thakuria DJ, Kalita DD. A prospective study of thyroid dysfunction in patients with type 2 diabetes mellitus in a tertiary Care Hospital (FAAMCH, Barpeta, Assam, India). IOSR JDMS. 2016;15(7):21-5. doi: 10.9790/0853-150722125.
8. Rao JS. Study of clinical profile of thyroid functions in patients of type 2 diabetes mellitus. MIJO Med. 2021;20(3):150-3. doi: 10.26611/102120318.
9. Pramanik S, Ghosh S, Mukhopadhyay P, Bhattacharjee R, Mukherjee B, Mondal SA. Thyroid status in patients with type 2 diabetes attending a Tertiary Care Hospital in Eastern India.

Indian J Endocrinol Metab. 2018;22(1):112-5. doi: 10.4103/ijem.IJEM_572_17, PMID 29535948.
10. Gharib H, Tuttle RM, Baskin HJ, Fish LH, Singer PA, McDermott MT. Subclinical thyroid dysfunction: a joint statement on management from the American Association of Clinical Endocrinologists, the American Thyroid Association, and the Endocrine Society. J Clin Endocrinol Metab. 2005;90(1):581-6. doi: 10.1210/jc.2004-1231, PMID 15643019.
11. Smithson MJ. Screening for thyroid dysfunction in a community population of diabetic patients. Diabet Med. 1998;15(2):148-50. doi: 10.1002/(SICI)1096-9136(199802)15:2<148::AID-DIA540>3.0.CO;2-H, PMID 9507916.
12. Mukherjee S, Datta S, Datta P, Mukherjee AK, Maisnam I. A study of the prevalence of primary hypothyroidism in recently diagnosed type 2 diabetes mellitus in a tertiary care hospital. Int J Sci Rep. 2015;1(2):105-12. doi: 10.18203/issn.2454-2156.IntJSciRep20150216.
13. Unnikrishnan AG, Menon UV. Thyroid disorders in India: an epidemiological perspective. Indian J Endocrinol Metab. 2011;15Suppl 2:S78-81. doi: 10.4103/2230-8210.83329, PMID 21966658.
14. Palma CC, Pavesi M, Nogueira VG, Clemente EL, Vasconcellos F, Pereira LCJ. Prevalence of thyroid dysfunction in patients with diabetes mellitus. Diabetol Metab Syndr. 2013;5(1):58. doi: 10.1186/1758-5996-5-58, PMID 24499529.
15. Raghuwanshi PK, Rajput DPS, Ratre BK, Jain R, Patel N, Jain S. Evaluation of thyroid dysfunction among type 2 diabetic patients. Asian J Med Sci. 2015;6(3):33-7. doi: 10.3126/ajms.v6i3.10814.
16. Reddy. A study of thyroid dysfunction in type 2 diabetes mellitus in tertiary Care Center. Int J Contemp Med Res. 2020;7(1):A22-6.
17. Hage M, Zantout MS, Azar ST. Thyroid disorders and diabetes mellitus. J Thyroid Res. 2011;2011:439463. doi: 10.4061/2011/439463, PMID 21785689.
18. Kumar KD, Solu MG, Kakadiya AP, Patel AV, Ramawat SS, Vishwakiran. A study of thyroid dysfunction in patients with type 2 diabetes mellitus at new civil hospital, Surat, Gujarat, India. Int J Adv Med. 2020;7(4):678-82. doi: 10.18203/2349-3933.ijam20201122.
19. Uppal V, Vij C, Bedi GK, Vij A, Banerjee BD. Thyroid disorders in patients of type 2 diabetes mellitus. Ind J Clin Biochem. 2013;28(4):336-41. doi: 10.1007/s12291-012-0293-9.
20. Kim MK, Kwon HS, Baek KH, Lee JH, Park WC, Sohn HS. Effects of thyroid hormone on A1C and glycated albumin levels in nondiabetic subjects with overt hypothyroidism. Diabetes Care. 2010;33(12):2546-8. doi: 10.2337/dc10-0988, PMID 20823345.
21. Duntas LH, Orgiazzi J, Brabant G. The Interface between thyroid and diabetes mellitus. Clin Endocrinol (Oxf). 2011;75(1):1-9. doi: 10.1111/j.1365-2265.2011.04029.x, PMID 21521298.
22. Chen HS, Wu TE, Jap TS, Lu RA, Wang ML, Chen RL. Subclinical hypothyroidism is a risk factor for nephropathy and cardiovascular diseases in type 2 diabetic patients. Diabet Med. 2007;24(12):1336-44. doi: 10.1111/j.1464-5491.2007.02270.x, PMID 17941864.
23. Nima V, Thakkar JSM. The impact of diabetes on thyroid dysfunction and outcomes in a native Indian female population. J Thy Sci. 2011;6(4):1-9.
24. American Diabetes Association. Comprehensive medical evaluation and assessment of comorbidities. Diabetes Care. 2017;40Suppl 1:S25-32. doi: 10.2337/dc17-S006, PMID 27979890.
25. India diabetes report; 2000-2045.
26. Mehalingam V, Sahoo J, Bobby Z, Vinod KV. Thyroid dysfunction in patients with type 2 diabetes mellitus and its association with diabetic complications. J Family Med Prim Care. 2020;9(8):4277-81. doi: 10.4103/jfmpc.jfmpc_838_20, PMID 33110845.
27. Shekhar R. A cross-sectional study of thyroid disorder in patients with type 2 diabetes mellitus in a Tertiary Care Hospital. Asian J Pharm Clin Res. 2022;15(8):46-50. doi: 10.22159/ajpcr.2022.v15i8.45000.
28. Sreelatha M. Study of thyroid profile in patients with type 2 diabetes mellitus. Int J Sci Stud. 2017;5(2):211-20.
29. Telwani AA, Wani ZH, Ashraf Y, Shah AA. Prevalence of thyroid dysfunction in type 2 diabetes mellitus: a case-control study. Int J Res Med Sci. 2017;5(10):ijrms20174590. doi: 10.18203/2320-6012.ijrms20174590. doi: 10.18203/2320-6012.ijrms20174590.
30. Babu K, Kakar A, Byotra SP. Prevalence of thyroid disorder in type II diabetes mellitus patients. J Assoc Phys Ind. 2001;49:43.