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Study of thyroid profile and its association with glycemic control in type ii diabetes mellitus

Dr. Shilpa Sontakke[1*], Dr. Prashant Dharme[2]

[1*]MBBS, MD, *JR-2 at Dept. of Bio-chemistry, Shri Vasantrao Naik Government Medical College, Yavatmal*
Email id- shilpasontakke49@gmail.com
[2]MBBS, MD, *Associate Professor at Dept. of Bio-chemistry, Shri Vasantrao Naik Government Medical College, Yavatmal* Email id- pvdprashant@gmail.com

***Corresponding Author:** Dr. Shilpa Sontakke
**Dept. of Bio-chemistry, Shri Vasantrao Naik Government Medical College, Yavatmal*
Email: shilpasontakke49@gmail.com

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KEYWORDS
Thyroid dysfunction, type 2 diabetes mellitus, Hypothyroid, Glycemic control.

ABSTRACT:

Background:
Individuals with type 2 diabetes mellitus face an elevated susceptibility to thyroid disorders. The presence of hypothyroidism in these patients exacerbates microvascular complications, further increasing the risk of cardiovascular disease. Early screening for thyroid dysfunction in diabetic individuals is crucial, as it facilitates prompt intervention and treatment for hypothyroidism. Thus, the aim of the study was to evaluate the thyroid dysfunction and its association with glycemic control in type II diabetes mellitus.

Methods:
This cross-sectional study was conducted at the SVNGMC, Yavatmal. In this study, we included the patients with age of 30-59 years old and all type II diabetes patients, irrespective of glucose control or treatment. Various clinical and laboratory tests were conducted, including assessments such as fasting blood glucose, fasting insulin, HbA1c, complete blood count, and thyroid function. Subsequently, statistical analysis was performed on the collected data.

Results:
Elevated glucose levels (172.2 mg/dL) and HbA1C levels (7.98%) compared to Controls ($p < 0.0001$), indicating impaired blood sugar control. Serum TSH show higher level in type 2 diabetic group and Control group shows, higher T4 levels, suggesting potential thyroid function abnormalities. Hypothyroidism was the most commonly found in the patients with diabetes.

Conclusion:
Type 2 diabetes cases show higher rates of thyroid issues, worsening with elevated HbA1c levels. Inadequate glycemic control may contribute to this. Regular thyroid function tests in diabetics are essential for early diagnosis and improved diabetes management, reducing complications and enhancing quality of life.

INTRODUCTION:

Diabetes is a collection of metabolic disorders defined by consistently elevated blood sugar levels, which are caused by problems with insulin production, efficacy, or a combination of the two. The causes of diabetes encompass diverse pathogenic mechanisms, ranging from the autoimmune damage of pancreatic cells results in inadequate insulin synthesis and abnormalities that cause insulin resistance. [1] Diabetes is divided into two types: Type 1 diabetes and Type 2 diabetes mellitus (T2DM). Type 1 diabetes is characterized by a complete lack of insulin secretion, whereas Type 2 diabetes is caused by abnormalities in insulin production and secretion.[2,3]

T2DM and thyroid dysfunction (TD) are prevalent endocrine disorders frequently experienced in clinical setting. There is a well-established mutual influence between diabetes and thyroid disorders, and their association has been long-standing in medical literature.[4] In the 19th century, Smithson MJ[5] , and colleagues were the first to introduce the

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link between diabetes and thyroid dysfunction. Subsequent research has indicated that, 2.2 to 17 % of diabetic patients experience thyroid issues. Hypothyroidism is significantly more prevalent in India, affecting 11% of the population as compared to UK 2% and 4.6% in the USA. [6]

Both diabetes and thyroid disorders are autoimmune conditions.[7] When stimulated by thyroid-stimulating hormone (TSH), the 2 thyroid hormones are synthesized and emitted by the thyroid gland: Triiodothyronine (T3) and Thyroxine (T4).[8] The two most common pathological conditions affecting the thyroid gland are hyperthyroidism and hypothyroidism.[9] Hypothyroidism, the most prevalent thyroid disorder in adults, arises when the thyroid gland fails to produce an adequate amount of thyroid hormones. Hyperthyroidism, on the other hand, is a condition in which the thyroid gland is overactive, resulting in an overproduction of thyroid hormones.[1]

TD can impact management diabetes. Hyperthyroidism is linked to deteriorating glycemic control and increase insulin requirment. This is attributed to its promotion of elevated glucose production in the liver, accelerated absorption of glucose in the digestive system, and raised the resistance to insulin. [4]

Because of symptom overlap with hyperglycemia, identifying thyroid disorders in diabetics is difficult. Although, there have been research on type 2 diabetes and TD, many of them have been restricted or lack controls, finding a significant frequency of diabetes complications in persons with thyroid abnormalities. It is important to evaluate the incidence of TD in people with type 2 diabetes in order to improve control and prevent complications. Thus, study aims to investigate the thyroid profile and its relationship to glycemic control in T2DM

METHODOLOGY:

Inclusion criteria:

- Patients with age of 30-59 years old
- All type II diabetes patients, irrespective of glucose control or treatment.

Exclusion criteria:

- Patients with Age below 30 or above 59 years.
- Type I or gestational diabetes.
- Pancreatitis or proven thyroid disorder on treatment.
- Pregnant/lactating women, renal failure, acute myocardial infarction, chronic diarrhea
- Patients on diuretics, aminoglycosides, vitamins, minerals

METHOD:

The current cross-sectional study was carried out at SVNGMC, Yavatmal tertiary care hospital. The entire patients with T2DM matches the inclusion criteria were studied. Prior to start this study, approval was acquired from the Institutional Ethical Committee.

Further laboratory investigations was carried out on the patients, fasting blood glucose, fasting insulin, HbA1c, complete blood count, thyroid function (TSH, FT3, FT4), total cholesterol, triglycerides, ALT, AST, blood urea, serum creatinine, and thyroid antibodies (anti-TPO, anti-Tg for hypothyroidism). Normal thyroid function ranges were TSH: 0.27–4.2 mIU/L, FT3: 2–4.4 Pg/ml, FT4: 0.93–1.7 ng/dl.

STATISTICAL ANALYSIS:

Microsoft Office Excel was utilized for data entry, and SPSS version 22 software was employed for statistical analyses. The data in question were of a qualitative nature. T test was used to compare between the two groups. Correlation was also be used. Factors showing statistical significance were selected for inclusion in multivariate analysis, with a significance level established at $p < 0.05$

RESULTS:

Table1. Age wise distribution of Study participants.

Age in years	Cases		Controls		p Value
	n	%	n	%	
30 to 40	5	16.67%	4	13.33%	
41 to 50	14	46.67%	17	56.67%	
51 to 59	11	36.67%	9	30.00%	
Total	30	100.00%	30	100.00%	
Mean Age	47.15 ± 7.9		46.11 ± 8.1		0.72

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Table 1 depicts the age distribution within the participants and controls. The average age of individuals in the cases and controls groups were found to be similar, and this similarity was not statistically significant (p value = 0.72).

Table 2 displays the fasting plasma glucose and HbA1C levels in the study participants.

Parameter	Cases (n=30) Mean ±SD	Controls (n=30) Mean± SD	p Value
Fasting blood glucose (mg/dL)	172.2 ± 53.34	91.21 ± 10.11	p= 0.0001
HbA1C (%)	7.98 ± 1.8	4.7 ± 0.56	p= 0.0001

The type 2 diabetic group shows significantly higher fasting blood glucose (172.2 mg/dL) than Controls (91.21 mg/dL), supported by a p value of 0.0001. Similarly, HbA1C was notably elevated in Cases (7.98%) compared to "Controls" (4.7%), with a p value of 0.0001. These differences suggest potential blood sugar control issues in the "Cases" group, highlighting disparities in regulation and control.

Table 3. Comparison of Thyroid profile in the study participants

Parameter	Cases (n=30) Mean ±SD	Controls (n=30) Mean± SD	p Value
Serum T3 (ng/ml)	0.92± 0.21	0.98 ± 0.59	**0.6018**
Serum T4 (µg/dL)	5.88 ±2.87	7.68 ±2.14	**0.007**
Serum TSH (mIU/ml)	4.26±1.53	3.78± 1.42	**0.0001**

The above table -3 indicates that, while serum T3 levels show no significant differences between cases and controls, there was distinct variations in serum T4 with controls displaying higher values. Serum TSH level was seen higher in cases group. These observations offer valuable insights into potential differences in thyroid function between the two groups.

Table 4. Distribution of T2DM patients according to their Thyroid

Thyroid Status	Number (n)	Percentage (%)
Hypothyroidism	11	36.67
Hyperthyroidism	2	6.67
Euthyroidism	17	56.67

The above Table 4 illustrates the distribution of type II diabetes mellitus patients within the case group based on their thyroid status. Among 30 patients, 56.67% exhibited a euthyroid status, 36.67% had hypothyroidism, and 6.67% were identified with hyperthyroidism. Consequently, the most prevalent thyroid abnormality observed in our study was hypothyroidism.

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Figure-1: Distribution of type II diabetes mellitus

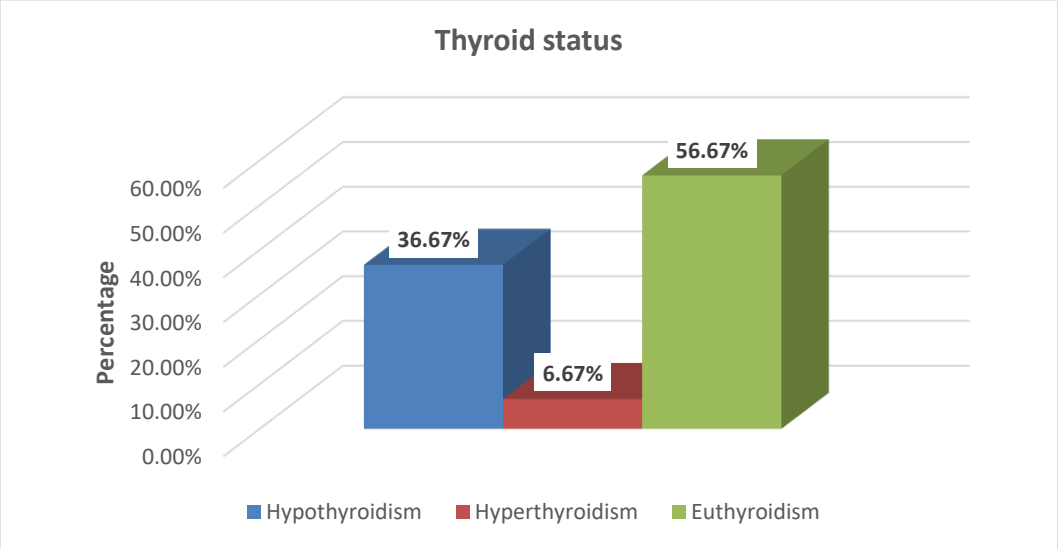

Table 5. Correlation between Thyroid profile and HbA1C in T2DM cases

Parameter	HbA1C
Serum T3	**r= -0.41 p= 0.0001**
Serum T4	**r= 0.0125 p= 0.8912**
Serum TSH	**r= 0.2911 p= 0.12**

r = Spearman correlation coefficient; p =P-value; P-value <0.05.

Table 5 outlines the relationship between the average serum T3, T4, and TSH levels and HbA1C in type II diabetes patients. The analysis revealed significant findings: a statistically significant inverse association between average serum T3 and HbA1C, a direct association exists between average serum TSH and HbA1C, and no observed correlation between serum T4 and HbA1C.

DISCUSSION:

Diabetes is a major cause of health problems around the world, with more people getting affected every day. This poses a big threat to public health. Thyroid issues are also common in the general population. Therefore, it's very common to have both thyroid and diabetes.

In this present study, we examined 60 cases, of which 30 were categorized in control group. The average age of the patients enrolled in this study was 47.15±7.9.

Among these 30 patients 36.67% of patients had hypothyroidism and only 6.67% patients had hyperthyroidism. Similarly, the study conducted by **Mehalingam et al.** [10] showed that, Thyroid dysfunction was present in 17.5% of diabetic patients, with a higher prevalence of hypothyroidism compared to hyperthyroidism among the study participants. Another study conducted in South India by **Jali MV et al.**[11] revealed that, 16.2% of diabetic patients exhibited thyroid dysfunction, highlighting the significant prevalence of this comorbidity.

In this present study , the "Cases" group exhibits a significantly higher fasting blood glucose level (172.2 mg/dL) compared to the "Controls" group (91.21 mg/dL), as shown by a p-value of 0.0001. Similarly, the HbA1C levels were markedly elevated in the "Cases" group (7.98%) in contrast to the "Controls" group (4.7%), with a p-value of 0.0001. These distinctions indicate potential challenges in blood sugar control within the "Cases" group, emphasizing disparities in regulation and management.

Elgazar EH et al. [12] evaluated, the relationship between TD and glycemic control in diabetic patients, it was observed that TD commonly, exhibited an association with elevated HbA1c levels. Notably, when HbA1c levels reached or surpassed 8%, there was a marked increase in the prevalence of thyroid dysfunction. Equally, effective glycemic control, defined by HbA1c levels below 7%, was linked to a significant rise in the number of patients displaying normal thyroid functions. These findings suggest a potential contributory role of inadequate glycemic control in the progression of TD among the cases with T2DM.

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Another study conducted by **Sreelatha et al.**[13] reported the incidence of TD was higher when HbA1c was 7% (78.57%) when compared to HbA1c <7% (21.4%).

Also, in this present study, serum T3 levels show no significant differences between cases and controls, there are distinct variations in serum T4 with controls displaying higher values. These observations offer valuable insights into potential differences in thyroid function between the two groups.

HbA1c exhibited a positive linear connection with the occurrence of hypothyroidism or hyperthyroidism in this investigation. This implies that in T2DM, poor glycemic control (higher HbA1c) is directly related to the development of thyroid dysfunction. Thyroid diseases and diabetes may have a common autoimmune origin, and elevated TSH levels in diabetic individuals may indicate immunological problems. TSH levels in diabetics are higher than in healthy persons, indicating probable subclinical hypothyroidism. More study is needed to prove the autoimmune relationship and to investigate screening and therapy options for diabetics with subclinical hypothyroidism.

CONCLUSION:

Thyroid dysfunction is prevalent in type II diabetes individuals; leading to notable metabolic disruptions affect overlooking thyroid issues could adversely type II diabetes management. Regular thyroid hormone assessment, especially in those with inadequate glycemic control, is vital for timely detection and treatment, potentially enhancing glycemic control and overall diabetes management.

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