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ORIGINAL RESEARCH

Thyroid Profile Alterations in Patients Diagnosed with Type 2 Diabetes Mellitus

Akanksha Dubey[1], Jaimin Parmar[2], Akash Dubey[3], Sanjay Deshwali[4], Deepak Kori[5], Manishi Singh[6]

[1]Associate Professor, Department of Biochemistry, GMERS Medical College, Vadnagar Gujarat, India
[2,3]Tutor, Department of Biochemistry, GMERS Medical College, Vadnagar Gujarat, India
[4]Assistant Professor, Department of Biochemistry, PCMS & RC Bhopal, Madhya Pradesh, India
[5]MLT Student, CMCH Bhopal, Madhya Pradesh, India
[6]Professor and Head, Department of Biochemistry, CMCH Bhopal, Madhya Pradesh, India

Corresponding Author
Akash Dubey
Tutor, Department of Biochemistry, GMERS Medical College, Vadnagar Gujarat, India
Email: aakash.dby@gmail.com

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ABSTRACT

Background: Diabetes mellitus (DM), particularly type 2 diabetes mellitus (T2DM), is a global health concern due to its high prevalence and complications. Thyroid dysfunction, especially hypothyroidism, is common in T2DM patients, yet the relationship between the two is complex and not fully understood. This study investigates the prevalence, patterns, and clinical implications of thyroid dysfunction in T2DM patients, emphasizing the need for routine thyroid screening. **Aim:** To investigate the prevalence and pattern of thyroid dysfunction in T2DM patients and highlight the importance of routine thyroid screening. **Materials and Methods:** This study involved 100 subjects, divided into two groups: 50 healthy controls and 50 diabetic patients, aged 30-60. Detailed medical histories were recorded, and blood samples were analysed for thyroid hormones (T3, T4, TSH), fasting plasma glucose (FPG) and 2-hour plasma glucose. Data analysis was performed using statistical software with significance set at $p<0.05$. **Results:** The study showed a high prevalence of thyroid dysfunction in T2DM patients, with subclinical hypothyroidism being most common. Diabetic patients had significantly higher TSH levels and lower T3 and T4 levels than controls. A higher prevalence of thyroid dysfunction was observed in females, with many T2DM patients testing positive for anti-TPO antibodies, suggesting an autoimmune cause for the thyroid dysfunction.
Conclusion: Thyroid dysfunction, particularly subclinical hypothyroidism, is common in T2DM patients. Routine thyroid screening is crucial for early detection and management. Regular assessments of TSH levels and comprehensive metabolic evaluations should be integrated into diabetic care protocols to optimize outcomes and reduce complications. This study emphasizes the importance of thyroid screening in T2DM to improve patient care and quality of life.

Keywords: Thyroid dysfunction, Diabetes Mellitus, TSH, Immunoassay

INTRODUCTION

Diabetes mellitus (DM) is a chronic condition characterized by elevated levels of blood glucose due to insulin resistance or inadequate insulin secretion. Type 2 diabetes mellitus (T2DM) is the most prevalent form of diabetes and is associated with numerous complications that significantly impact patient morbidity and mortality[1]. One such complication is thyroid dysfunction, which is particularly common in patients with T2DM. The interplay between thyroid function and diabetes is intricate, involving various metabolic and hormonal pathways. Understanding this relationship is crucial for improving the management of T2DM and enhancing patient outcomes. The relationship between diabetes and thyroid dysfunction has not been extensively studied in Madhya Pradesh, although the prevalence of diabetes is very high and increasing. There may be diabetics who may have thyroid dysfunction, which can greatly affect their blood sugar control[2-3]. Due to the lack of complete information on both conditions, preventive management planning is difficult. In this context, this study aimed to determine the prevalence of thyroid dysfunction in the type 2 diabetic population. An attempt was made to compare and correlate these two metabolic disorders taking into account different biochemical parameters

AIM AND OBJECTIVES

The main aim of the present study is to Study of Thyroid hormone level in patients of Type 2 Diabetes Mellitusand to understand the clinical implications of thyroid disorders in this population. The study seeks

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to highlight the importance of routine thyroid screening and its role in improving the management and outcomes of T2DM patients.**Objectives Prevalence Determination**: To determine the prevalence of thyroid dysfunction among T2DM patients compared to healthy controls.

MATERIAL AND METHODS

The main aim of the present research is to Study of Thyroid hormone level in patients of Type 2 Diabetes Mellitus.The current study was conducted in the biochemistry department of Chirayu Medical College and Hospital Bhopal under MPMSU Jabalpur Madhya Pradesh. All institutional committees approved the research protocol. The data was collected from subject's fulfilling inclusion and exclusion criteria at Chirayu Medical College and Hospital Bhopal under MPMSU Jabalpur Madhya Pradesh. Subjects were recruited for the study from the community through their general practitioner by self-visit to the OPD. The study's sample size was calculated to be approximately 100, which were divided into two groups i.e. Control and Cases with 50 subjects in each group. All the subjects were of 30-60 years age group.

Inclusion criteria

Age 30-60 years

Patient of type 2 diabetes mellitus will be included in the study

Exclusion criteria

Patients with secondary complication of diabetes mellitus and suffering from any type of thyroid diseases and any other complications will be excluded from the study

Participants were required to fast at least twelve hours before the blood sample was taken. 6 ml of whole blood was collected from each subject and samples were further divided into two aliquot, one of 2 ml in EDTA 2ml in fluoride vial and other of 2 ml in plain dry vacutainer. Serum was separated from the cells within 30 minutes and was further used for estimation of thyroid test. The fluoride vial is used for estimation of plasma glucose. Similarly, after two hours of meal post prandial blood sample was collected for 2-hour plasma glucose estimation. Standard procedures would be followed for the preservation and storage of sample before analysis.

T3, T4 and TSH were estimated by using Competitive Chemiluminescence Immunoassay (CLIA) methodand fasting and 2H-plasma glucose by Enzymatic reference method with Hexokinase (HK)method. Criteria used in the study for diagnosis of type 2 DM (According to American Diabetic Association) are 1) FBS (Fasting Blood Sugar) ≥ 126 mg/dl (7.0 mmol/L) or 2) Symptoms of diabetes plus RBS (Random Blood Sugar) ≥ 200 mg/dl (11.1 mmol/L).

Statistical analysis

The results obtained and expressed in mean ± SD. The comparison was done by student t test and statistical analysis of each parameter was done by online available statistical tool. p value < 0.05 was considered statistically significant.

RESULT

The present study was conducted on 100 subjects aged between 30-60 years old. The total subjects enrolled for the study were divided into two groups of 50 subjects in healthy controls and diabetic subjects.

Table No 1: Demographic details of subjects.

	Controls	Cases
Age (Mean±SD)	42.80 ± 7.55	43.30 ± 8.13
Male/Female	26/24	26/24

This table demonstrates age distribution of subjects in control and cases of the study population. The age group, 30-60 years, includes in the study, control group include 42.80 ± 7.55 (Mean±SD), while case group includes 43.30 ± 8.13 (Mean±SD). Distribution of males and females were equal in both the groups.

Table No 2. The comparison of thyroid hormones and TSH in healthy control and diabetic subjects

Study Group	Healthy Control	Diabetic Subjects	t Value	p-Value
T3 (ng/ml)	1.28±0.37	0.50±0.10	14.05	<0.0001*
T4 (ng/ml)	87.31±17.84	63.46±3.45	9.27	<0.0001*
TSH(µIU/ml)	2.12±0.90	9.466±2.17	22.06	<0.0001*
*p<0.001, which is considered to be highly significant **p<0.05, which is considered to be significant ** Non-Significant				

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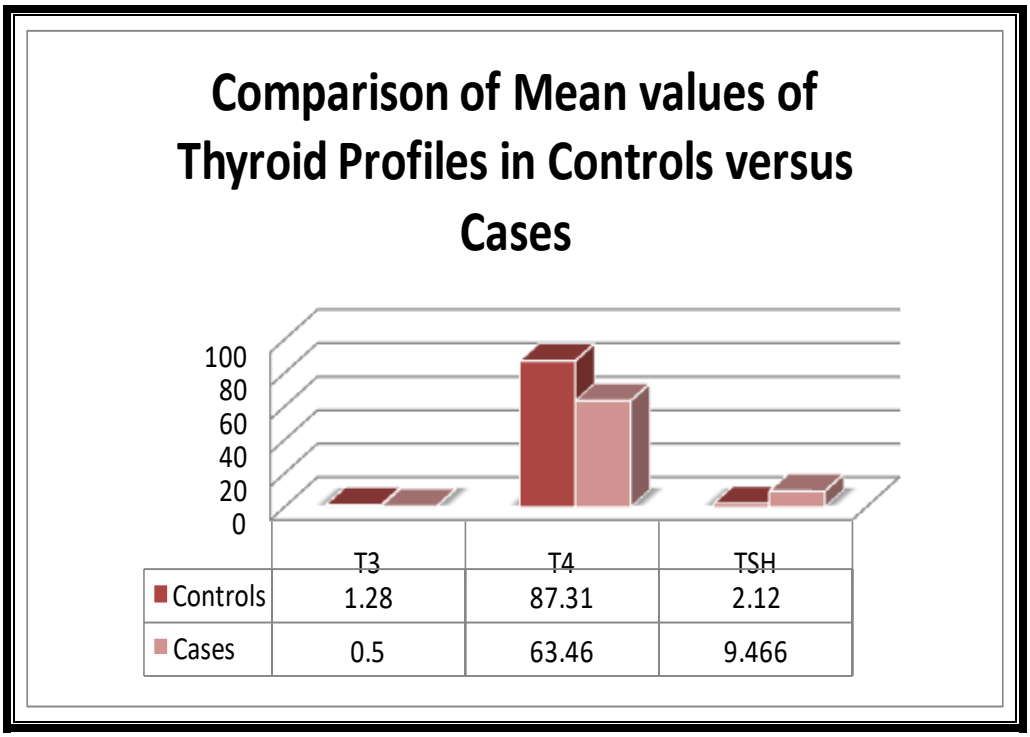
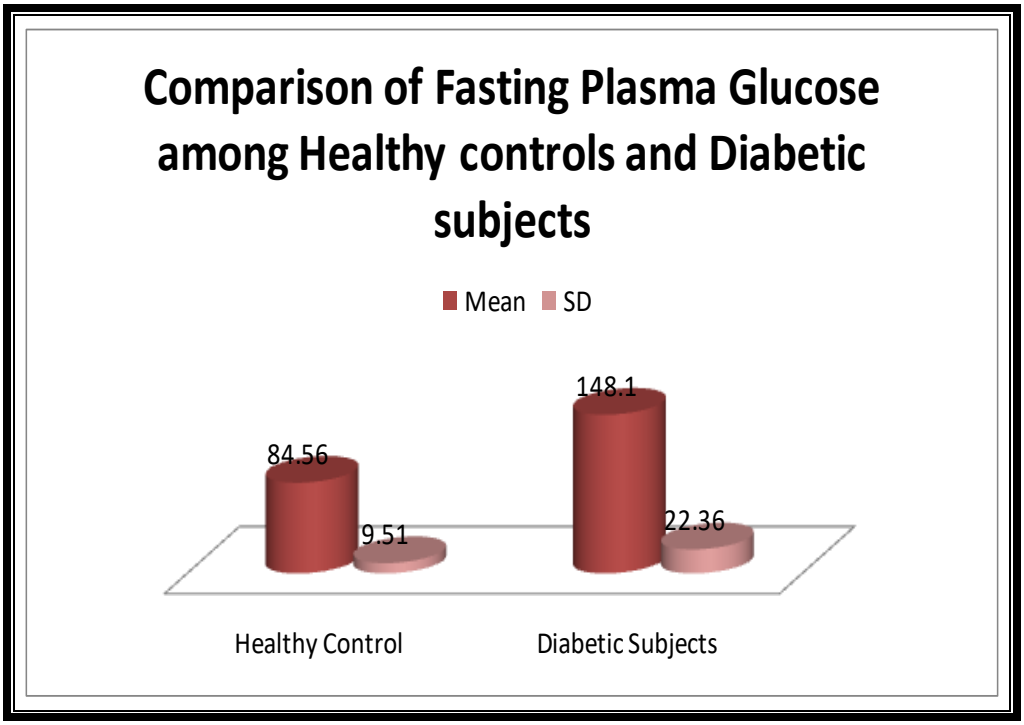


Graph 01: Graph showing comparison of mean values of thyroid profiles in controls versus diabetic cases

Table No 3. The comparison of Fasting and 2-Hour Plasma Glucose in patients of type 2 diabetes mellitus and healthy subjects

Study Group	Healthy Control	Diabetic Subjects	t Value	p-Value
FPG(mg/dl)	84.56±9.51	148.1±22.36	18.50	<0.0001*
2-hour PG(mg/dl)	117.06±18.45	181.95±16.59	18.48	<0.0001*
*p<0.001, which is considered to be highly significant **p<0.05, which is considered to be significant *** Non-Significant				



Graph 02: Graph showing comparison of Fasting plasma glucose among healthy controls and diabetic subjects

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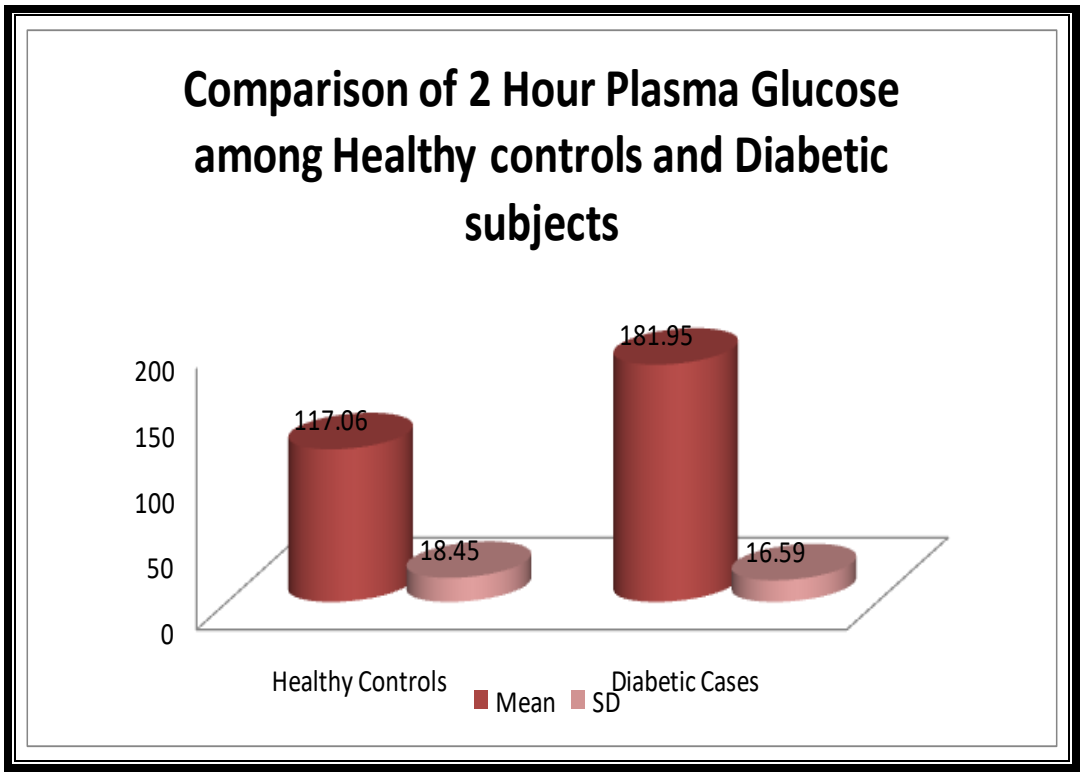

Graph 03: Graph showing comparison of 2 Hour plasma glucose among healthy controls and diabetic subjects

DISCUSSION

Diabetes mellitus (DM) is a major global health issue, with a significant number of patients presenting with complications due to poor glycemic control, despite advances in treatment. One important factor contributing to inadequate glycemic control is thyroid dysfunction, which is commonly associated with DM[3]. Type 2 diabetes mellitus (T2DM) is a multifactorial disorder, and there is a complex interaction between T2DM and thyroid disorders[4]. Both insulin and thyroid hormones are closely involved in cellular metabolism, and any abnormal levels of one can result in the functional derangement of the other. In India, the prevalence of diabetes was 9.1% in 2013, compared to 8.3% globally, with an estimated 65.1 million people affected in 2013, and projections indicating 109 million by 2035[5]. DM is characterized by persistent hyperglycemia, and both type 1 (T1DM) and type 2 diabetes (T2DM) are caused by a combination of genetic and environmental factors.[6-7]

This study aimed to determine the prevalence of thyroid dysfunction in patients with T2DM in our region. The findings suggest that hypothyroidism is more prevalent in diabetic individuals compared to healthy controls. This could be explained by the fact that thyroid hormones such as triiodothyronine (T3) and thyroxine (T4) act as insulin antagonists, but also potentiate insulin's effects indirectly[8]. In diabetic patients, the nocturnal peak of thyroid-stimulating hormone (TSH) is often blunted, and TSH responses to thyrotropin-releasing hormone (TRH) are impaired, which contributes to lower thyroid hormone levels[9]. Furthermore, an inhibitor of extrathyroidal conversion enzymes, known as thyroid hormone-binding inhibitor (THBI), has been implicated in abnormal thyroid hormone levels in diabetes, leading to dysfunction of the hypothalamus-pituitary-thyroid axis, a situation that may worsen in poorly controlled diabetics[10]. Stress, commonly associated with diabetes, can also alter the hypothalamus-pituitary axis[11-12].

Our study compared fasting plasma glucose (FPG) levels between diabetic patients and healthy controls, revealing significantly higher levels in the diabetic group ($p<0.001$). Similarly, the two-hour postprandial glucose (2h-PG) levels were also significantly elevated in diabetic patients compared to controls ($p<0.001$).

The correlation analysis revealed a weak positive correlation between glucose and T3 levels, but no significant correlation was found with T4 or TSH. This supports previous research indicating a high prevalence of hypothyroidism, particularly subclinical hypothyroidism, in diabetic patients. The abnormalities in thyroid hormone levels in diabetic individuals may result from various medications, such as insulin, which is known to enhance T4 levels while suppressing T3 by inhibiting the hepatic conversion of T4 to T3[13-14]. Some oral hypoglycemic agents can also affect thyroid function, further complicating the relationship between thyroid hormones and diabetes[15-16]. Overall, this study aligns with other research that highlights the prevalence of thyroid dysfunction, particularly hypothyroidism, in patients with diabetes.

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CONCLUSION

Based on the findings of the present study, it can be concluded that among diabetic subject's thyroid dysfunctions are very common although most of the cases were of subclinical type. Therefore, regular screening for thyroid abnormalities is very essential for proper management of diabetes. Diabetic subjects having abnormal thyroid profile have significant effect on lipid and thyroid stimulating hormones as compared to non- diabetics' subjects having abnormal thyroid profile. Hence evaluation of thyroid dysfunction in diabetics can help in the prevention of hyperlipidaemia, renal, FPG parameters.

Our study has proved that increased prevalence of hypothyroidism especially subclinical hypothyroidism in T2DM patients which is consistent with many previous studies, hence it may be advisable to check thyroid status in every T2DM patients for the better management of T2DM and to reduce its complications.

Limitation

Due to financial constraints: Unable to do thyroid autoantibody assays in this population. Further research needs to be done with regards to thyroid antibodies bearing in mind strong family history and high prevalence of thyroid dysfunction in this population. Our sample size was small and the limited observation period do not allow definite conclusion from our data. So, we need more comprehensive study with large sample population and long period. That would be more informative.

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Conflict of interest: NONE

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