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Original Research Article

Comparison of Thyroid Hormones between Type 2 Diabetes Mellitus Patients & Matched healthy controls at SMS Medical College & Hospital, Jaipur

Arti Jain[1], Sangeeta Meena[2], Chitra Upadhyay[3], Mahesh Bairwa[4], Harjeet Singh[5], Balveer Singh[6]

[1]Senior Medical Officer, SMS Medical College and Hospital, Jaipur, Rajasthan
[2]Associate Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur, Rajasthan
[3]Sr. Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur
[4]Assistant Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur, Rajasthan
[5]Sr. Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur, Rajasthan
[6]Assistant Professor, Department of Biochemistry, SMS Medical College and Hospital, Jaipur, Rajasthan

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Corresponding author: Dr. Mahesh Bairwa
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Abstract

Background: Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice. Thyroid disease is a pathological state that can adversely affect glycaemic control in diabetics and has the potential to affect health.

Aims & Objectives: The aim of this study was to assess the levels of Thyroid hormones (FT3, FT4, TSH) in Type 2 Diabetes Mellitus patients and comparable control groups and to find out the correlation between thyroid function and Type 2 Diabetes Mellitus.

Methods: This study was a cross-sectional study in which clinically diagnosed cases of Type 2 diabetes mellitus in OPD of Department of Medicine SMS Medical College and Hospital, Jaipur were taken as cases.

Results: 55 cases of Type 2 diabetes mellitus and matched controls in age group of 40-65 years were analyzed in this study. In this study the mean age in control group was 54.07 ± 7.28 years while in cases group it was 52.95 ± 6.86 years. The mean FBS for controls was 83.47 ± 12.78 mg/dl and for cases was 165.25±21.51 mg/dl, mean HbAlc % for controls was 5.12 ± 0.59 and for cases was 8.27 ± 0.92, mean FT3 for controls was 2.71 ± 0.50 pg/ml and for cases was 2.27 ± 0.54 pg/ml, mean FT4 for controls was 1.15 ± 0.18 ng/ml and for cases was 0.96 ± 0.09 ng/ml, mean TSH for controls was 3.30 ± 2.05 µIU/ml and for cases was 4.95 ± 3.07 µIU/ml which was statistically significant (p-value<0.001).

Conclusion: Thyroid dysfunction exists in Type 2 DM and screening for the same is important because abnormal thyroid hormone levels in type 2 diabetics if unrecognized may be a primary cause of poor management of diabetes. This will also help in the early detection and treatment of thyroid dysfunction which in turn helps in better glycaemic control and associated cardiovascular risk measurement and its management.

Keywords: Type 2 Diabetes Mellitus, FT3, FT4, TSH, Glycated Hemoglobin (HbA1c).

Introduction

Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice. One of the primary health problems present globally and which is assuming epidemic proportions is Diabetes Mellitus.[1] It was 415 million in 2015 and estimated that it would increase by 2045 to 629 million. India is emerging as a leader in diabetes mellitus, with the maximum number of subjects with diabetes next only to China.[2,3] Defective insulin secretion leads to various metabolic aberrations in T2DM, spanning from hyperglycemia due to defective insulin-stimulated glucose uptake and up-regulated hepatic glucose production, along with dyslipidemia leads to increase atherosclerosis formation and increased cardiovascular risk.[4] The impact of this disease through the complications that affect the small and large vessels resulting in retinopathy, nephropathy, neuropathy, IHD, and large vessel obstruction has been emphasized by the findings of the national commission (USA) on diabetes. Diabetes being the most common endocrine metabolic disorder, there is a curiosity to understand and leam the association of this with another common endocrine gland that is thyroid gland functions.

Globally, thyroid diseases are highly prevalent. Around 42 million people were estimated to be suffering from thyroid diseases in India. Thyroid disease has higher widespread among the diabetic population as compared to the normal individuals.[5] Thyroid disease is a pathological state that can adversely affect glycaemic control in diabetics and has the potential to affect health. Thyroid disease is found commonly in diabetes particularly in type 2 diabetes and also in type 1 diabetes.[6]

Insulin and thyroid hormones are both intimately involved in cellular metabolism and thus excess or deficit of either of these hormones result in the functional derangement of the other. Some recorded data indicate that iodothyronines are insulin antagonists with high levels being diabetogenic while the absence of this hormone inhibits the development of diabetes.[7] The thyroid hormone replacement is associated with a decrease in glycated hemoglobin (HbA1c) level. Furthermore, it seems that unidentified thyroid dysfunction could negatively impact diabetes and its complications. In hypothyroidism, liver secretion of glycogen decreases, so does degradation, leading to increased levels of glycogen. Absorption of glucose from the gastrointestinal tract is slowed, and glucose utilization is slowed in the peripheral tissues. The availability of gluconeogenic substrate is decreased. Hyperthyroidism impairs glycaemic control in diabetic subjects, while hypothyroidism increases susceptibility to hypoglycemia thus complicating diabetes management. Recognition and treatment of thyroid dysfunction in diabetic patients will benefit glycaemic control, attenuate cardiovascular risk, and improve general well-being.[8]

There is a continuing interest in the association between thyroid disorders in diabetes mellitus type 2. Furthermore, on an extensive search of the literature, we found no major studies have been conducted to compare and correlate serum insulin levels and total tri-iodothyronine (T3), thyroxine (T4), thyroid-stimulating hormone (TSH) levels in type 2 diabetes mellitus patients. Data on comparison and correlation of the glycosylated hemoglobin (HbA1c) levels and total T3, T4, TSH levels in type 2 diabetes mellitus patients

is also scanty. The present study demonstrates the importance of recognition of this mutual relationship between thyroid and T2DM which will help guide clinicians on the optimal screening and management of these diseased states.

Materials and Methods

This Study was a Hospital-based comparative analysis in the Department of Biochemistry and Central Lab and Immunoassay lab SMS Medical College and Hospital, Jaipur. The Study Design was a Cross-sectional study done from the Study Period August 2019 to November 2020.

Based on ADA criteria clinically diagnosed cases of Type2 diabetes mellitus in OPD of the Department of Medicine were taken as cases. Known and established cases of Type2 diabetes mellitus between the age group of 40-65 years willing to participate were included in this study. Compilation of complete clinical records was done along with informed consent. Age and gender-matched healthy subjects were taken as the control group. Patients with a known history of thyroid dysfunction, Patients using drugs that affect thyroid hormone level or thyroid function like Amiodarone, Patients using lipid-lowering drugs, and Patients with diabetic ketoacidosis, chronic renal failure were excluded.

Statistical analysis

The sample size was calculated to be 47 of either sex for each of the two groups (cases and controls) at the study power of 80% and α error of 0.05 assessing mean TSH level of 5.21±3.1 and 3.4±1.4 among patients of Type2 DM and healthy controls respectively (as per seed article). At the precision of 10% (absolute allowable error) for the study purpose 55 Type2 DM patients and 55 matched healthy controls were taken. Quantitative data expressed in the form of Mean ± SD and inference was drawn with the use of the student's t-test. Samples were analyzed for the measurement of serum glucose, urea, creatinine, and total lipid profile by Colorimetric method and HbAlc by latex turbidimetric method on fully automated analyzer Beckman Coulter AU-680 and FT3, FT4 and TSH by Chemiluminescence immunoassay method on ADVIA CENTAUR XP analyzer.

Results

The characteristics of the studied population including age and values of fasting blood sugar, HbAlc, FT3, FT4, and TSH are shown in table1.

Table 1: The characteristics of the studied population including age and values of fasting blood sugar, HbAlc, FT3, FT4, and TSH

Test/Parameters	Controls n=55	Cases n=55	'p'-Value ∗
Age (Years)	54.07 ± 7.28	52.95 ± 6.86	0.203 (NS)
FBS (mg/dl)	83.47± 12.78	165.25±21.51	<0.001(S)
HbAlc %	5.12 ± 0.59	8.27 ± 0.92	<0.001(S)
FT3 (pg/ml)	2.71 ± 0.50	2.27 ± 0.54	<0.001(S)
FT4 (ng/ml)	1.15 ± 0.18	0.96 ± 0.09	<0.001(S)
TSH(µIU/ml)	3.30 ± 2.05	4.95 ± 3.07	<0.001(S)

∗ Unpaired t-test

The mean age in control group 54.07 ± 7.28 years was slightly more than cases group 52.95 ± 6.86 years. The mean FBS for controls was 83.47± 12.78 mg/dl and for cases was 165.25±21.51 mg/dl which was statistically significant (p-value<0.001) (Table1, Figure1). The mean HbAlc % for controls was 5.12 ± 0.59 and

for cases was 8.27 ± 0.92 which was statistically significant (p-value<0.001) (Table1, Figure2). The mean FT3 for controls was 2.71 ± 0.50 pg/ml and for cases was 2.27 ± 0.54 pg/ml (Table1, Figure3), mean FT4 for controls was 1.15 ± 0.18 ng/ml and for cases was 0.96 ± 0.09 ng/ml (Table1, Figure4), mean TSH for controls was 3.30 ± 2.05 µIU/ml and for cases was 4.95 ± 3.07 µIU/ml (Table1, Figure5) which was statistically significant (p-value<0.001). The mean FBS, HbAlc % and TSH level was significantly higher in cases group as compared to controls group. The mean FT3 and FT4 level was significantly lower in cases group as compared to controls group.

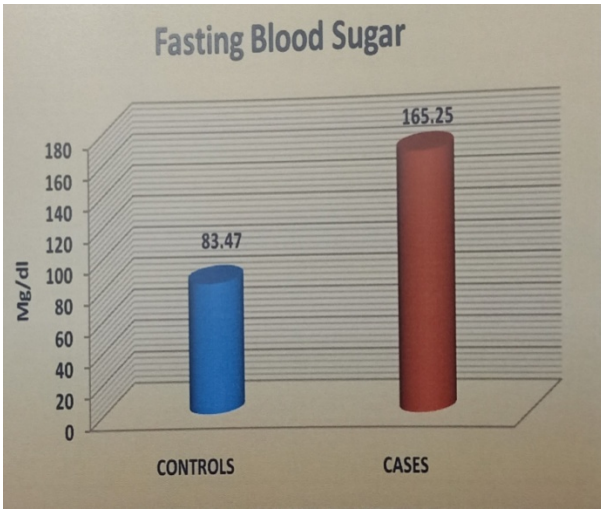

Figure 1: The mean FBS for controls was 83.47± 12.78 mg/dl and for cases was 165.25±21.51 mg/dl which was statistically significant (p-value<0.001)

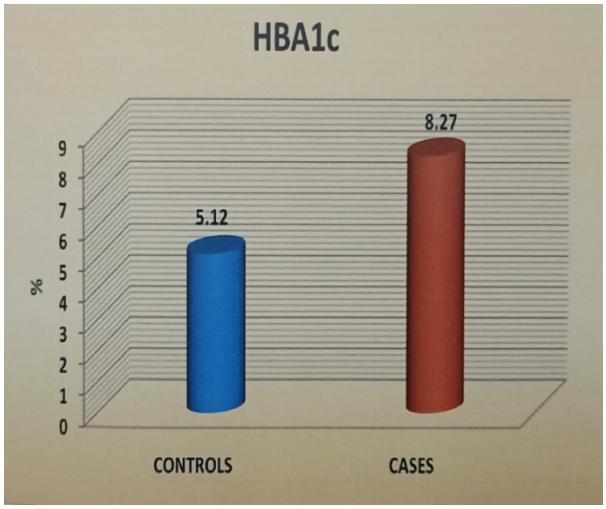

Figure 2: The mean HbAlc % for controls was 5.12 ± 0.59 and for cases was 8.27 ± 0.92 which was statistically significant (p-value<0.001)

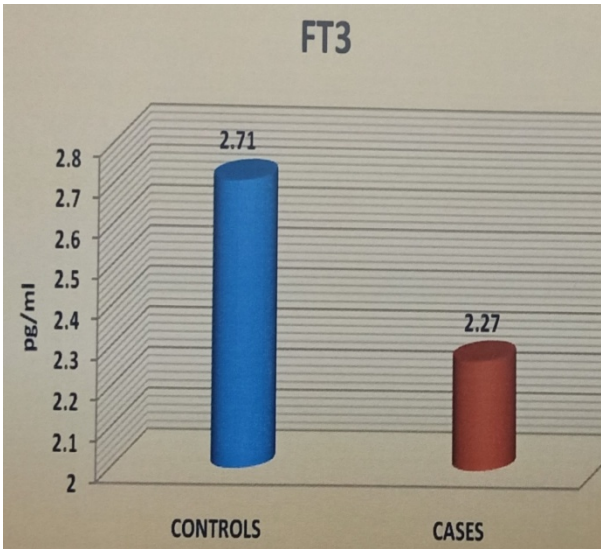

Figure 3: The mean FT3 for controls was 2.71 ± 0.50 pg/ml and for cases was 2.27 ± 0.54 pg/ml

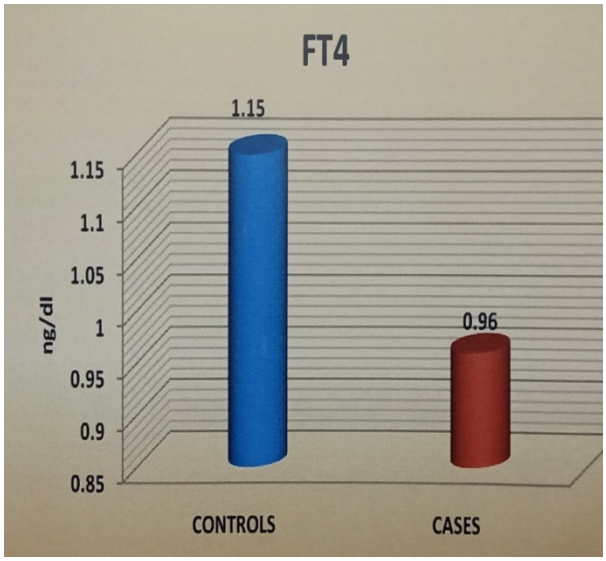

Figure 4: mean FT4 for controls was 1.15 ± 0.18 ng/ml and for cases was 0.96 ± 0.09 ng/ml

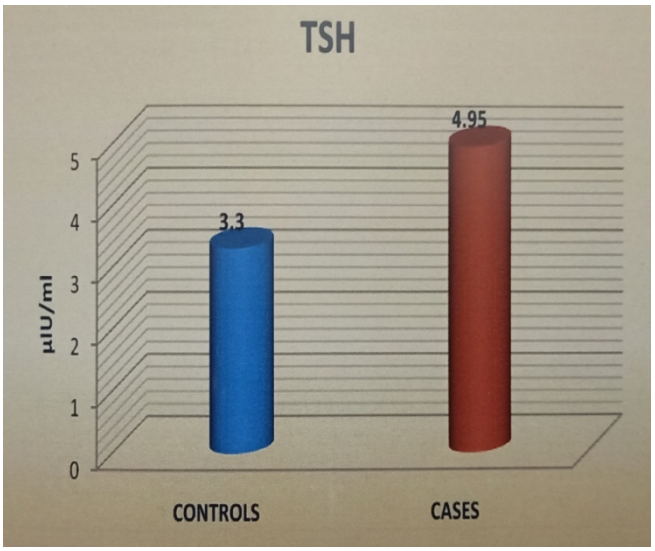

Figure 5: mean TSH for controls was 3.30 ± 2.05 µIU/ml and for cases was 4.95 ± 3.07 µIU/ml

Discussion

Diabetes Mellitus and Thyroid Disease are common endocrine disorders in the general population. There is a definite relationship between thyroid dysfunction and diabetes, a higher occurrence of thyroid dysfunction is seen among diabetics when compared with the general population. Subclinical thyroid dysfunctions are more frequent than overt diseases; they can be asymptomatic and, therefore, undiagnosed and untreated, leading to important adverse events.[9]

In this present study, we included 55 cases and 55 controls. The mean age of control was 54.07 ± 7.28 years while in cases 52.95 ± 6.86 years P-value was >0.203 which is statically Not Significant. This is in accordance with the fact that diabetes mellitus is common in the age above 40 years.

In our study Out of these 55 cases, we found 18 (32.72%) cases with thyroid dysfunction while only 6 (10.90%) in controls. It shows thyroid dysfunction was more among diabetics in comparison to controls. This difference was statistically significant (P-value <0.001). Similar results were also obtained in a study done by Pasupathi P. et al in the year 2008, in which the prevalence of thyroid disorders was 45% in type 2 diabetics.[10] Our results correlate with the study of Ajaz Ahmed Telwani et al in 2017 they also found that thyroid dysfunction was high in diabetic patients compared to controls (29% versus 9%).[11] In another study by M Sree Reddy et al in the year 2019 prevalence of thyroid dysfunction in the diabetic group was 20.16 % while it was only 9.27% in controls (P-value <0.001).[12]

In our study mean FBS in control group was 83.47 ± 12.78 mg/dl and in cases it was 165.25 ± 21.51mg/dl which was statistically significant (P-value <0.001). This finding is similar to the study done by Vikram B Vikhe et al in 2013 in Pune, in which the mean FBS was higher in cases as compared to controls.[13]

In our study HbAlc % value in control group was 5.12 ± 0.59 and in cases was 8.27± 0.92 which was statistically significant (P-value <0.001). This finding is similar to the study done by Abilash

Nair et al in the year 2018 in Thiruvananthapuram, India in which the HbAlc level in diabetics with hypothyroidism was 8.60 ± 2.0 as compared to diabetics with a euthyroid status.[14] This study shows the same trend as the study result of Jalal MJ, Riyas B et al in 2019 in Kerala, India in which the HbAlc levels with thyroid dysfunction were found to be 10.33 ± 2.37 while that of the control population is in the range of 4%-6%.[15]

Conclusion

The purpose of this study was to see the thyroid dysfunction in patients with Type 2 Diabetes mellitus. This study showed a high prevalence (32.72 %) of thyroid dysfunction in type 2 DM. Subclinical hypothyroidism is the most common in type 2 DM. Type 2 DM and thyroid dysfunction have a significant correlation. The presence of abnormal thyroid hormone levels in type 2 diabetics, if unrecognized, may be a primary cause of poor management of diabetes, hence there is a need for routine assay of thyroid hormones in diabetics which will help in the early detection and treatment of thyroid dysfunction, and this will also help in better glycaemic control and associated cardiovascular risk measurement and its management.

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