Original Research Article

Evaluation of Thyroid Profile and Total Cholesterol in Type II Diabetes Mellitus - A Prospective Observational Study

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ABSTRACT

Introduction: The two most prevalent endocrine illnesses seen in clinical practice are thyroid problems and type 2 diabetes mellitus. It has been demonstrated that thyroid issues and diabetes mellitus are mutually influenced. Altered total cholesterol levels were also associated with type II Diabetes mellitus. Hence this study is done to evaluate the thyroid profile and total cholesterol in Type II Diabetes mellitus.

Objectives: The objective was to assess and compare the thyroid profile and total cholesterol levels between Type II diabetes mellitus patients and healthy volunteers.

Materials and methods: A prospective observational study was performed on 80 participants during a period of 1 year after obtaining ethical clearance and informed consent. 40 normal subjects in the age group of 30-60 years were taken as control group and 40 subjects with type II Diabetes Mellitus in the age group of 30-60 years were taken as study group. The inclusion criteria were patients with Type II Diabetes Mellitus of less than 5 years duration and without history of Thyroid and Lipid abnormalities. The exclusion criteria were those with history of cerebrovascular diseases, cardiovascular diseases, hypertension and those with history of chronic illness. FBS, PPBS, HbA1C, total T3, T4, TSH and total cholesterol were measured among all participants. Data was entered in MS Excel and analyzed using SPSS version 24. Descriptive statistics and inferential statistics such as independent t test and Pearsons's correlation coefficient were used.

Results: Among the type II Diabetes mellitus cases group, the mean T3 was 0.66 ± 0.31 and among the healthy control group the mean T3 was 1.04 ± 0.25 which was statistically significant by independent t test. ($p < 0.05$) Among the type II Diabetes mellitus cases group, the mean T4 was 5.72 ± 2.02 and among the healthy control group the mean T4 was 7.66 ± 1.86 which was statistically significant by independent t test. ($p < 0.05$) Among the type II Diabetes mellitus cases group, the mean TSH was 4.18 ± 2.95 and among the healthy control group the mean TSH was 2.61 ± 1.25 which was statistically significant by independent t test. ($p < 0.05$) Among the type II Diabetes mellitus cases group, the mean total cholesterol was 195.58 ± 33.79 and among the healthy control group the mean total cholesterol was 169.00 ± 11.56 which was statistically significant by independent t test. ($p < 0.05$)

Conclusion: This study shows the prevalence of hypothyroidism among type 2 diabetes mellitus patients which was statistically significant. here is also elevated total cholesterol

among type 2 diabetes mellitus patients which was statistically significant. Therefore, routine assessment of thyroid hormone level in addition to total cholesterol in the early stage of diabetes mellitus will help in the management of diabetes mellitus particularly in those patients, whose conditions are difficult to manage.

Keywords: Type II Diabetes Mellitus, TSH, FBS, PPBS, Total Cholesterol, HbA1C.

INTRODUCTION

The two most prevalent endocrine illnesses seen in clinical practice are thyroid problems and type 2 diabetes mellitus.[1] It has been demonstrated that thyroid issues and diabetes mellitus are mutually influenced. Thyroid function appears to be impacted by diabetes mellitus at two different levels: first, at the level of hypothalamic regulation of TSH release, and second, at the peripheral tissue's conversion of T4 to T3.[2] The prevalence of subclinical hypothyroidism is higher in those with type 2 diabetes. The frequency of thyroid diseases in the general population varies greatly; it can range from 6.6% to 13.4%.[3] The prevalence is still higher and ranges from 10 to 24% in patients with diabetes. These variations can be attributed to population diversity and varying levels of iodine intake in different geographic areas. Any source of persistent hyperglycemia might result in dyslipidemia, cardiovascular disorders, hypothyroidism, and increased thyroid stimulating hormone. [4,5]

The metabolic syndrome (MetS) is a group of endocrine/metabolic disorders that include obesity, hypertension, altered lipid profiles with low levels of HDL-C and elevated levels of triglycerides (TG), and type 2 diabetes mellitus (T2DM) brought on by insulin resistance and poor glucose regulation.[6] MetS frequently develops many years before type 2 diabetes (T2DM), and the risk factors that make up this syndrome also contribute to CVD.[7]

The fundamental pathophysiology of CVD, atherosclerosis, advances more quickly as a result of dyslipidemia.[8] A distinctive pattern of abnormalities in blood lipid levels, characterized by low levels of HDL-C and increased levels of TG, is seen in individuals with MetS or T2DM. An elevated concentration of tiny, dense low-density lipoprotein cholesterol (LDL-C) particles is another feature of this dyslipidemia.[9] The phrase "atherogenic dyslipidemia" refers to this lipid pattern. A significant risk factor for CVD appears to be the co-occurrence of elevated TG levels and low HDL-C levels, according to data from epidemiologic studies.[10]

Very few studies are available in India to evaluate the thyroid profile and total cholesterol in Type II diabetic patients. Hence, this study was carried out to evaluate the thyroid profile and total cholesterol in type II Diabetes mellitus patients.

Objectives:

The aim of the study was to evaluate the thyroid profile and total cholesterol in Type II Diabetes mellitus. The objective was to assess and compare the thyroid profile and total cholesterol levels between Type II diabetes mellitus patients and healthy volunteers.

MATERIALS & METHODS

A prospective observational study was conducted in a tertiary care hospital in South India. The study period was for a period of one year. 80 participants were chosen by simple random sampling. 40 normal subjects in the age group of 30-60 years were taken as control group and 40 subjects with type II Diabetes Mellitus in the age group of 30-60 years were taken as study group. The inclusion criteria were patients with Type II Diabetes Mellitus of less than 5 years duration and without history of Thyroid and Lipid abnormalities. The exclusion criteria were those with history of cerebrovascular diseases, cardiovascular diseases, hypertension and those with history of chronic illness. Those

who did not give consent were also excluded from the study.

Ethical clearance was obtained from the Institutional Ethical Committee. An informed written consent was obtained from all the participants. The details were collected in a pretested semi structured interviewer administered questionnaire.

The following parameters were measured - FBS and PPBS by GOD-POD Colorimetric method, HbA1C by High Performance Liquid Chromatography method and total T3, T4 & TSH by CLIA – ELIZA method, Total Cholesterol was measured by Trinder's end point method and compared with control group.

The data was entered in MS Excel and was analyzed using SPSS version 24.

Descriptive statistics such as frequencies and proportions were used and inferential statistics such as independent t test were used. Correlation was measured by Pearson's correlation coefficient. P value < 0.05 was considered significant. Data were expressed in tables and charts wherever necessary.

RESULT

The mean age of the study participants in control group was 47.00 ± 8.72 years and among type II Diabetic patients (cases) group was 50.03 ± 6.84. This difference was not statistically significant by independent t test and both groups were comparable with respect to age of the study participants. (Table 1)

Table 1. Age group of the study participants in both the groups

Mean ± SD	Normal participants (Controls)	Type II Diabetes mellitus (Cases)	Independent t test value	P value
Age	47.00 ± 8.72	50.03 ± 6.84	1.72	0.08

Among the cases, 20 were female and 20 were male. Among the control group, 20 were female and 20 were male.

Among the type II Diabetes mellitus cases group, the mean FBS was 135.0 ± 54.85 and among the healthy control group the mean FBS was 97.93 ± 15.10. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 1)

Among the type II Diabetes mellitus cases group, the mean PPBS was 227.95 ± 77.19 and among the healthy control group the mean PPBS was 128.05 ± 16.19. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 2)

Among the type II Diabetes mellitus cases group, the mean HbA1C was 6.61 ± 1.32 and among the healthy control group the mean HbA1C was 5.62 ± 0.47. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 3)

Among the type II Diabetes mellitus cases group, the mean T3 was 0.66 ± 0.31 and among the healthy control group the mean T3 was 1.04 ± 0.25. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 4)

Among the type II Diabetes mellitus cases group, the mean T4 was 5.72 ± 2.02 and among the healthy control group the mean T4 was 7.66 ± 1.86. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 5)

Among the type II Diabetes mellitus cases group, the mean TSH was 4.18 ± 2.95 and among the healthy control group the mean TSH was 2.61 ± 1.25. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 6)

Among the type II Diabetes mellitus cases group, the mean total cholesterol was 195.58 ± 33.79 and among the healthy control group the mean total cholesterol was 169.00 ± 11.56. This difference was statistically significant by independent t test. ($p < 0.05$) (Table 2) (Chart 7)
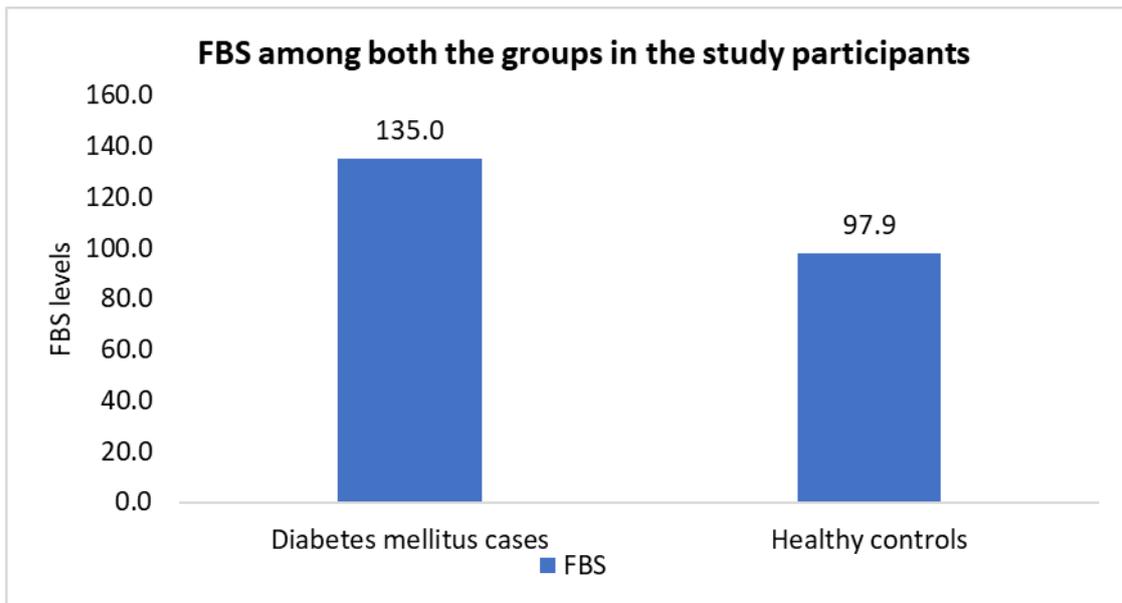
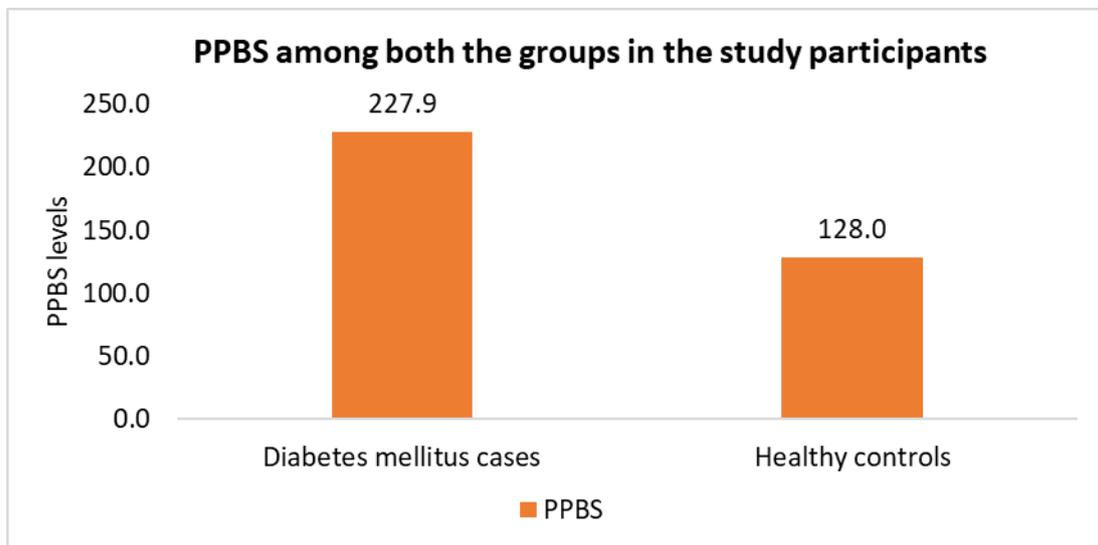**Chart 1. FBS among both the groups in the study participants**

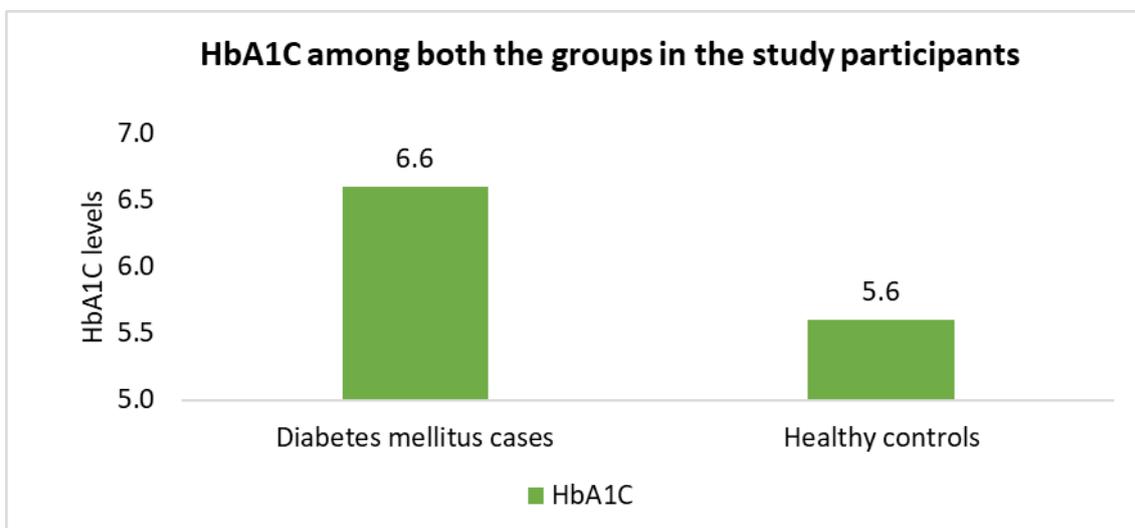**Chart 2. PPBS among both the groups in the study participants**

Chart 3. HbA1C among both the groups in the study participants
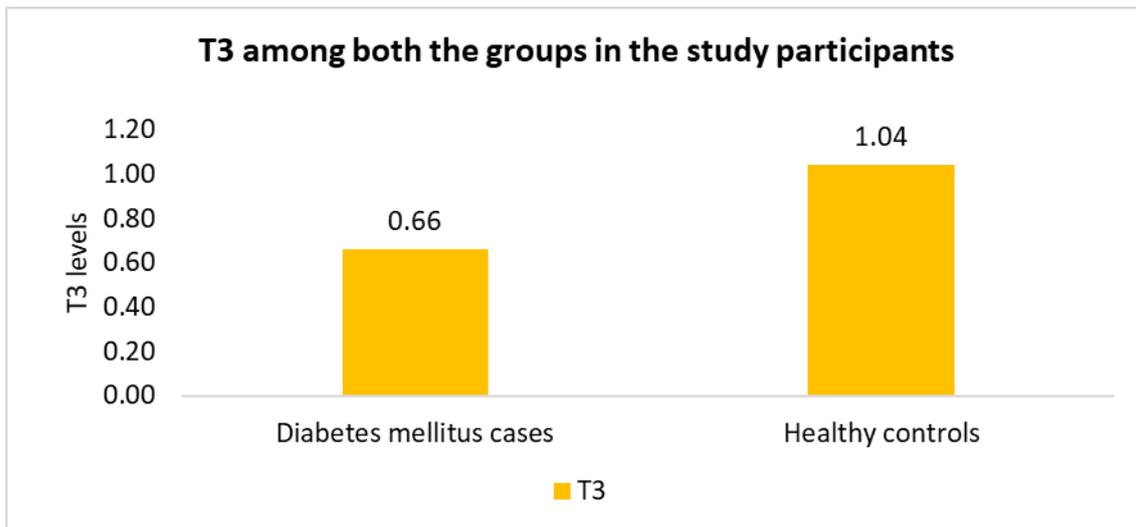
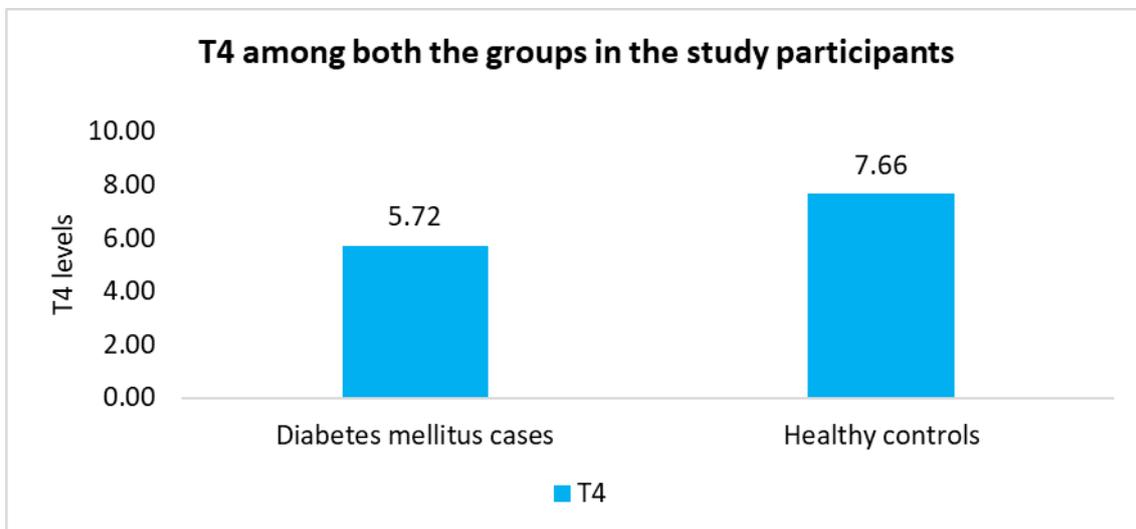**Chart 4. T3 among both the groups in the study participants**

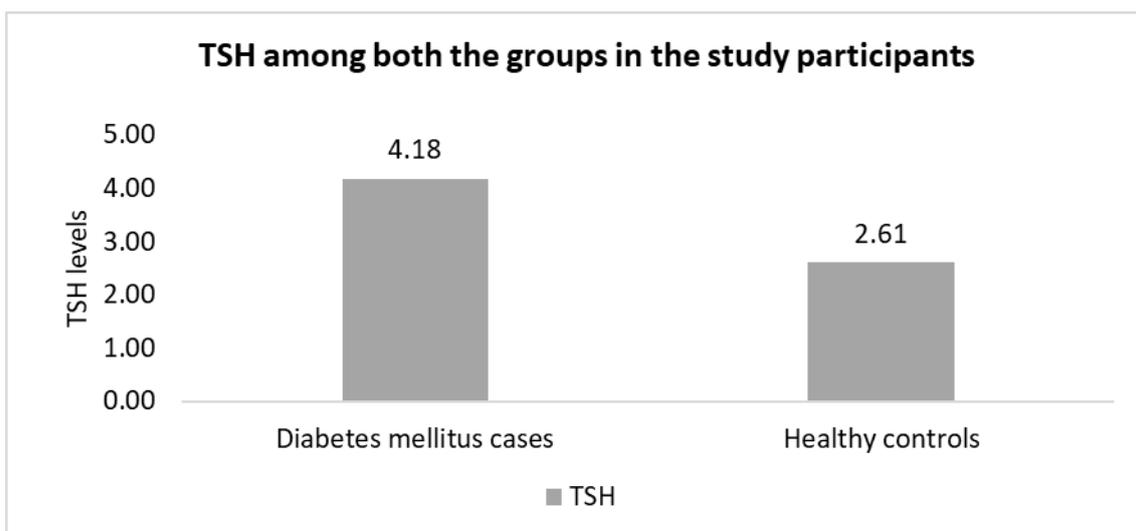**Chart 5. T4 among both the groups in the study participants**

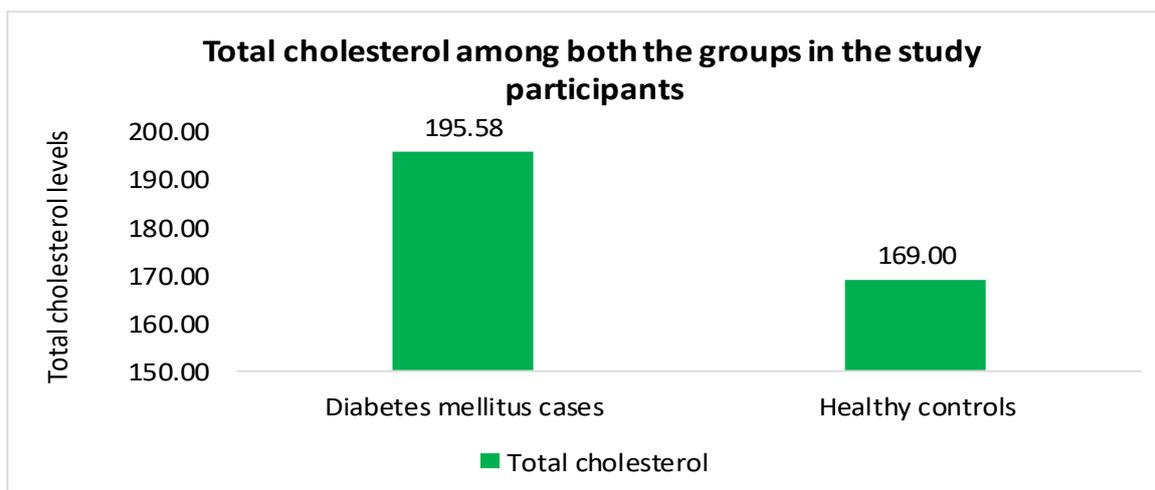**Chart 6. TSH among both the groups in the study participants**

Chart 7. Total cholesterol among both the groups in the study participants

Table 2. Parameters in both the groups among the study participants

Parameters	Normal participants (Controls)	Type II Diabetes mellitus (Cases)	Independent t test value	P value
FBS (mg/dl)	97.93 ± 15.10	135.0 ± 54.85	4.14	< 0.001*
PPBS (mg/dl)	128.05 ± 16.19	227.95 ± 77.19	8.01	< 0.001*
HbA1C (%)	5.62 ± 0.47	6.61 ± 1.32	4.41	< 0.001*
T3 (ng/ml)	1.04 ± 0.25	0.66 ± 0.31	6.02	< 0.001*
T4 (ug/ml)	7.66 ± 1.86	5.72 ± 2.02	4.46	< 0.001*
TSH (mlu/ml)	2.61 ± 1.25	4.18 ± 2.95	3.08	0.003*
Total Cholesterol	169.00 ± 11.56	195.58 ± 33.79	4.70	< 0.001*

*- statistically significant by independent t test

Total T3 had a mild positive correlation with FBS (Pearson correlation coefficient = 0.32) which was statistically significant. Total T3 had a moderate positive correlation with PPBS (Pearson correlation coefficient = 0.46) which was statistically significant. Total T3 had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.34) which was statistically significant. (Table 3)
Total T4 had a mild positive correlation with FBS (Pearson correlation coefficient = 0.19) which was statistically significant. Total T4 had a mild positive correlation with PPBS (Pearson correlation coefficient = 0.28) which was statistically significant. Total T4 had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.32) which was statistically significant. (Table 3)
TSH did not have a statistically significant correlation with FBS, PPBS and HbA1C. (Table 3)
Total cholesterol had a moderate positive correlation with FBS (Pearson correlation coefficient = 0.46) which was statistically significant. Total cholesterol had a moderate positive correlation with PPBS (Pearson correlation coefficient = 0.49) which was statistically significant. Total cholesterol had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.33) which was statistically significant. (Table 3)

Table 3. Correlation among parameters in the study participants

Parameters	FBS	P value	PPBS	P value	HbA1C	P value
Total T3	0.32	< 0.001*	0.46	< 0.001*	0.34	< 0.001*
Total T4	0.19	0.02*	0.28	0.01*	0.32	0.003*
TSH	0.06	0.54	0.14	0.19	0.19	0.08
Total cholesterol	0.46	< 0.001*	0.49	< 0.001*	0.33	< 0.001*

*- statistically significant by Pearsons's correlation coefficient

DISCUSSION

In our study, among the type II Diabetes mellitus cases group, the mean T3 was 0.66 ± 0.31 and among the healthy control group the mean T3 was 1.04 ± 0.25 which was statistically significant by independent t test. ($p < 0.05$) Among the type II Diabetes mellitus cases group, the mean T4 was 5.72 ± 2.02 and among the healthy control group the mean T4 was 7.66 ± 1.86 which was statistically significant by independent t test. ($p < 0.05$) Among the type II Diabetes mellitus cases group, the mean TSH was 4.18 ± 2.95 and among the healthy control group the mean TSH was 2.61 ± 1.25 which was statistically significant by independent t test. ($p < 0.05$)

This was similar to studies done by Galag et al,[1] Yadav et al,[2] Ravishankar et al,[3] Swamy et al[4] and Taksali et al.[5] Galag et al[1] reported mean T3 in Diabetes group was 0.91 ± 0.33 and in normal control group was 0.90 ± 0.21, mean T4 in Diabetes group was 5.96 ± 2.33 and in normal control group was 6.18 ± 2.75 and mean TSH in Diabetes group was 5.48 ± 2.32 and in normal control group was 2.91 ± 1.44. Yadav et al[2] reported mean T3 in Diabetes group was 0.60 ± 0.44 and in normal control group was 1.49 ± 0.26, mean T4 in Diabetes group was 3.79 ± 1.92 and in normal control group was 7.82 ± 2.49 and mean TSH in Diabetes group was 10.38 ± 7.73 and in normal control group was 2.89 ± 1.33. Ravishankar et al[3] reported among the diabetics, 1% had hypothyroidism, 15% had subclinical hypothyroidism and 13% had hyperthyroidism. Swamy et al[4] reported that mean T3 in Diabetes group was 1.91 ± 0.73 and in normal control group was 2.09 ± 0.68, mean T4 in Diabetes group was 78.69 ± 20.69 and in normal control group was 109.50 ± 31.37 and mean TSH in Diabetes group was 20.26 ± 10.60 and in normal control group was 2.64 ± 1.19. Taksali et al[5] reported that among the diabetic group, 10.34% were hyperthyroid, 31.03% were hypothyroid and 58.6% were euthyroid. Among the normal control group, 16.37% were hyperthyroid, 22.41% were hypothyroid and 61.21% were euthyroid.

In our study, total T3 had a mild positive correlation with FBS (Pearson correlation coefficient = 0.32) which was statistically significant. Total T3 had a moderate positive correlation with PPBS (Pearson correlation coefficient = 0.46) which was statistically significant. Total T3 had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.34) which was statistically significant. Total T4 had a mild positive correlation with FBS (Pearson correlation coefficient = 0.19) which was statistically significant. Total T4 had a mild positive correlation with PPBS (Pearson correlation coefficient = 0.28) which was statistically significant. Total T4 had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.32) which was statistically significant. TSH did not have a statistically significant correlation with FBS, PPBS and HbA1C. TSH did not have a statistically significant correlation with FBS, PPBS and HbA1C. In contrast to our results, Swamy et al[4] reported no significant correlation between FBS with T3,T4 or TSH levels.

In our study, among the type II Diabetes mellitus cases group, the mean total cholesterol was 195.58 ± 33.79 and among the healthy control group the mean total cholesterol was 169.00 ± 11.56 which was statistically significant by independent t test. ($p < 0.05$) Total cholesterol had a moderate positive correlation with FBS (Pearson correlation coefficient = 0.46) which was statistically significant. Total cholesterol had a moderate positive correlation with PPBS (Pearson correlation coefficient = 0.49) which was statistically significant. Total cholesterol had a mild positive correlation with HbA1C (Pearson correlation coefficient = 0.33) which was statistically significant.

This was similar to studies done by Singh et al,[6] Parikh et al,[7] Singh et al,[8] Shankar et al[9] and Kaur et al.[10] Singh et al[6] reported mean Total cholesterol in Type 2 diabetic patients was 191.83 ± 39.76, in impaired fasting glucose group was 201 ± 43.21 and in normal patients was 189.06 ± 27.61. Galag

et al[1] reported mean total cholesterol in Diabetes group was 197.78 ± 48.04 and in normal control group was 159.7 ± 29.84. Parikh et al[7] reported diabetic patients had increase in levels of total cholesterol which was significant. Singh et al[8] reported increase in total cholesterol levels are present in both obesity and type 2 Diabetes mellitus.

The limitations of our study include a single centric study and smaller sample size of participants. Conducting the study in many centers and a larger sample size is recommended in the future.

CONCLUSION

This study shows the prevalence of hypothyroidism among type 2 diabetes mellitus patients which was statistically significant. Failure to recognize the presence of subclinical hypothyroidism in diabetes mellitus patients may be a primary cause of poor management often encountered in treated diabetics. There is also elevated total cholesterol among type 2 diabetes mellitus patients which was statistically significant. Therefore, routine assessment of thyroid hormone level in addition to total cholesterol in the early stage of diabetes mellitus will help in the management of diabetes mellitus particularly in those patients, whose conditions are difficult to manage.

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