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STUDY OF THYROID DYSFUNCTION IN TYPE 2 DIABETIC PATIENTS.

Suvarna Shilpa[1], Waseem Raja[1]* and Rohey Jan[2]

[1]Department of Internal Medicine, MTH Kochi – Kerala, India.
[2]Department of Anesthesia & Critical Care Medicine, MTH Kochi – Kerala, India.

***Corresponding Author: Dr. Waseem Raja**
Department of Internal Medicine, Medical Trust Hospital Kochi – Kerala, India.

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ABSTRACT
Introduction: Thyroid diseases and diabetes mellitus are the two most common endocrine disorders encountered in clinical practice. This paper demonstrates the importance of recognition of this interdependent relationship between thyroid disease and diabetes which in turn will help guide clinicians on the optimal screening and management of these conditions. **Aims and Objectives:** (1). To study the prevalence, pattern, relation of thyroid dysfunction in patients with T2DM. (2). To study the relationship between thyroid dysfunction and glycemic control. (3). To study the relationship of hypertension, dyslipidaemia and obesity with thyroid dysfunction. **Material and Methods:** This cross-sectional, observational study was conducted at Medical Trust Hospital, Ernakulam, Kochi, from October 2015 to December 2017. A total of 150 Type 2 DM patients who satisfied inclusion and exclusion criteria were included in the study. **Results:** We studied 150 patients of which 55.3% were males and 44.7% were females. The mean age of study group was 59.94(+/-11.72) years. Most (32%) of the patients in our study were in the age group of 56-65 years followed by 46-55 years age (25.3%). 42% diabetics were hypertensive, 70% had dyslipidimia. The mean BMI was 23.74(+/-2.15) kg/m2.m The mean HbA1c in the study group was 8.16 (+/- 1.61) %. Out of 150 patients, 41 patients were detected to have thyroid dysfunction**.** Thyroid dysfunction was more common in females (31.3%) compared to males (24.1%), and the difference was not statistically significant. The prevalence of thyroid dysfunction in our study was 27.33%. Of this 19.33% had hypothyroidism (11.33% SCH + 8% overt hypothyroid) and 8% had hyperthyroidism (4.7% subclinical hyperthyroidism + 3.3% overt hyperthyroidism). **Conclusion:** There was higher prevalence of thyroid dysfunction among females compared to males. Diabetics with thyroid dysfunction had poor glycemic control compared to euthyroid Diabetics. There was no correlation between age, duration of diabetes between euthyroid and patients with thyroid dysfunction. The mean BMI of patients with thyroid dysfunction was higher compared to euthyroid patients. Lastly, our study emphasizes the need to check TSH levels in all type 2 diabetic patients.

KEYWORDS: T2DM, Hypothyroidism, Dyslipidemia, Obesity.

INTRODUCTION
Diabetic patients have a higher prevalence of thyroid disorders compared with the normal population and the most common amongst them is Subclinical hypothyroidism (SCH).[1,2] The prevalence of thyroid dysfunction in type 2 DM patients is as high as 31.4%.[2]

Thyroid dysfunction is very well known in Type 1 Diabetes Mellitus where it is due to autoimmune process.[3,4] Recently few studies have shown that Thyroid dysfunction especially hypothyroidism is found in patients with Type 2 Diabetes Mellitus but the mechanism for this is largely unknown. Hyperthyroidism is typically associated with worsening glycemic control and increased insulin requirements.[3,1] In hypothyroid patients there will be reduced rate of insulin degradation which may lower the exogenous insulin requirement. But more importantly hypothyroidism is accompanied by a variety of abnormalities in plasma lipid metabolism, including elevated triglyceride and LDL cholesterol concentrations.[3,4] Even subclinical hypothyroidism can exacerbate the coexisting dyslipidemia commonly found in type 2 diabetes and further increase the risk of cardiovascular diseases.[1,5] Subclinical hyperthyroidism may increase the risk of cardiac arrhythmias and exacerbate angina.[1]

Identification of associated thyroid dysfunction and early intervention may significantly reduce the risk of adverse cardiovascular and cerebrovascular events.[1,5] Hence this study aims to know the prevalence of thyroid dysfunction among Type 2 diabetic patients.

AIMS AND OBJECTIVES
1. To study the prevalence of thyroid dysfunction in patients with T2DM.

2. To study the pattern of thyroid dysfunction in patients with T2DM.
3. To study the relation of thyroid dysfunction with duration of type 2 DM.
4. To study the relationship between thyroid dysfunction and glycemic control.
5. To study the relationship of hypertension, dyslipidaemia and obesity with thyroid dysfunction.

MATERIAL AND METHODS

This cross-sectional study was done at Medical Trust Hospital, Ernakulam, Kochi, during October 2015 to December 2017. A total of 150 Type 2 DM patients who satisfied inclusion and exclusion criteria were included in the study.

Method of collection of data: Data collection was done by taking detailed history, clinical examination and laboratory investigations through proforma specially designed for this study, after taking the informed consent.

Inclusion Criteria

- Patients with type 2 DM either newly diagnosed or on treatment.
- All patients age > 35 years.

Exclusion criteria

- Patients with Infections, trauma
- Pregnant women
- Patients with pre-existing liver disease
- Patients on medication that alter thyroid functioning
- Diabetic Patients with previously known Thyroid dysfunction

Sample size

Sample size was determined using the formula

$n = z^2pq / d^2$

Where n> sample size

z>confidence coefficient

p>rate of prevalence in the population

q> (1-p)

d>difference between estimated value & true value in the population

Taking p as 30%, q>70% & z>1.96, with d of 10%, the minimum sample size worked out for the study is 127.

STATISTICAL ANALYSIS

Test proposed to be used in the analysis &interpretation:-

- Student 't' test for comparison of demographic variables
- Chi-square test for testing the independence of attributes.
- ANOVA test for comparison of different parameters.

Statistical analysis was done by using SPSS 20.0 software. The data collected was summarized by computing the descriptive statistics like mean, standard deviation, standard error of mean, median for all the quantitative variables such as Age, Duration of DM, TSH levels, free T_4, HbA1c, BMI etc. and percentages for all the qualitative variables like Hypertension, dyslipidemia etc. The difference between different parameters based on quantitative variables was compared using Student's t test, ANOVA for independent samples and the chi-square for comparison of difference in proportions. The difference was considered statistically significant when the p value < 0.05.

Ethical clearance: This study was approved by the ethical committee of Medical Trust Hospital, Ernakulam. Kochi, India.

Definition used in the study[6,7]

We classified patients as SCH, overt hypothyroidism, hyperthyroidism, subclinical hyperthyroid based on the definitions as per ATA guidelines.

SCH- was defined as TSH-4.5 to 10 with normal FT_4

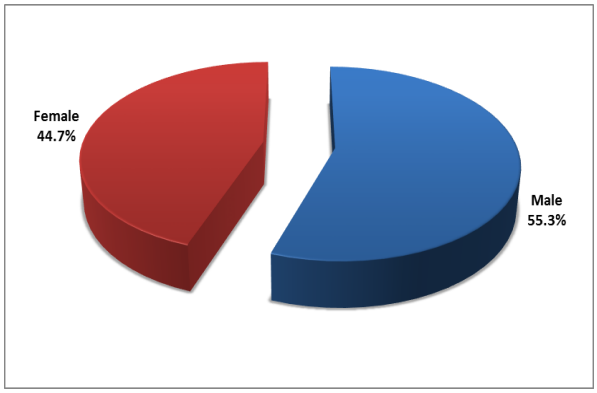
Overt Hypothyroidism - TSH>10 with low FT_4

Hyperthyroidism - <0.45 TSH with raised FT_4

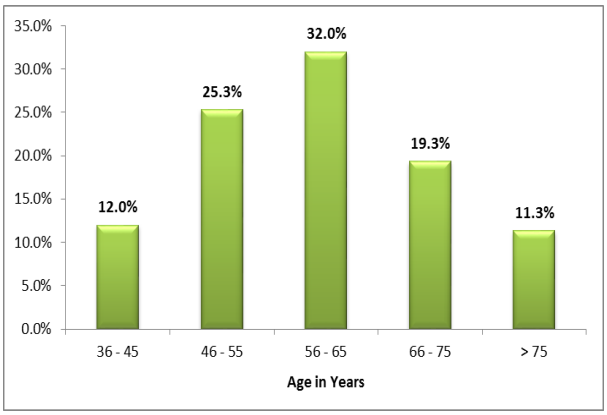
Subclinical Hyperthyroidism - <0.45 TSH with normal FT_4

Dyslipidemia- LDL>100 mg/dl or on statin therapy

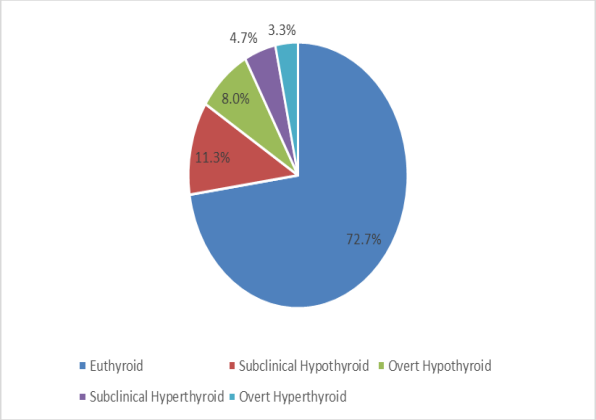
OBSERVATION AND RESULTS



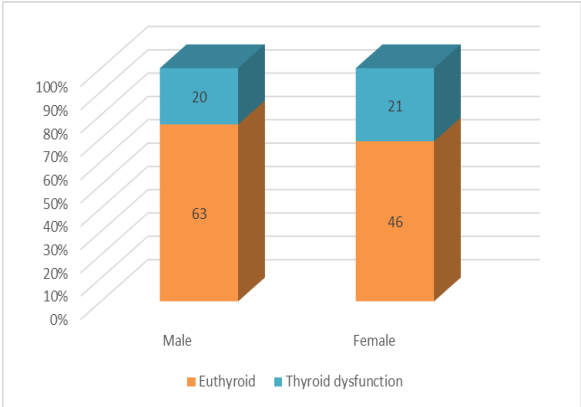
Graph. 1: Gender distribution of study population.



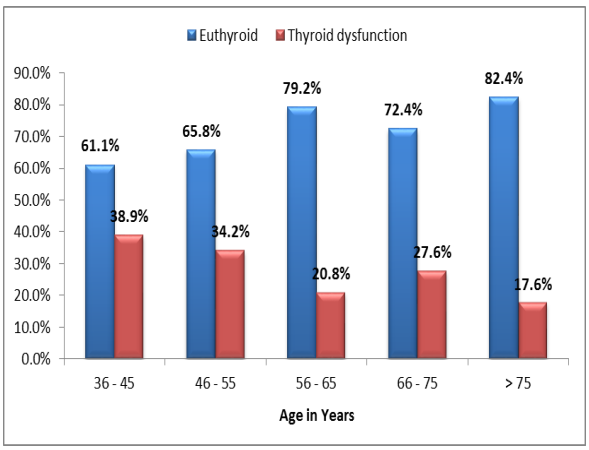
Graph. 2: Age distribution of study population.



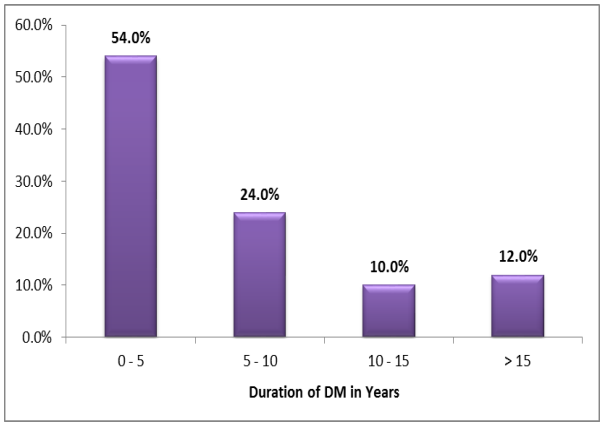
Graph. 3: Distribution of thyroid function in the study population.



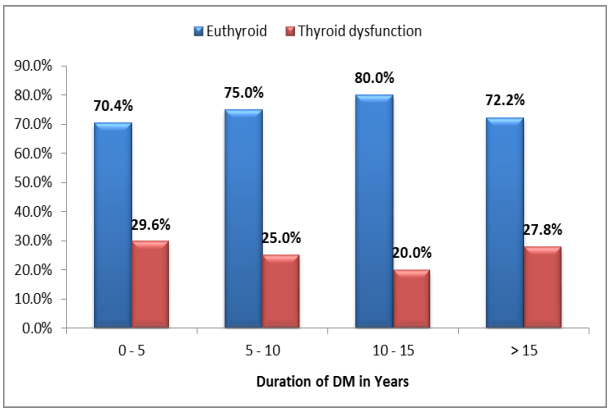
Graph. 4: Gender distribution of thyroid dysfunction.



Graph. 5: Correlation between age group and thyroid dysfunction.



Graph. 6: Distribution of patients based on duration of Diabetes.



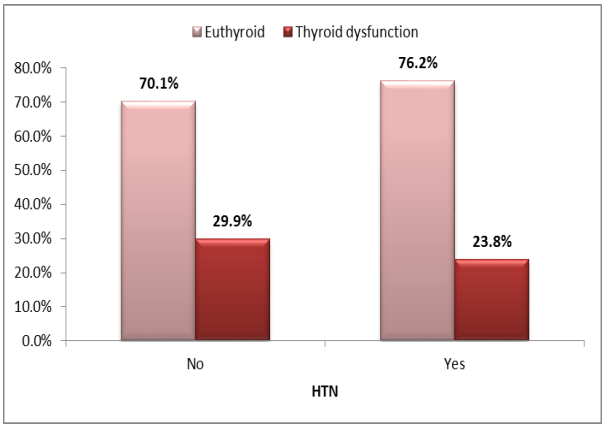
Graph. 7: Correlation between duration of diabetes and occurrence of thyroid dysfunction.

Table 8: Distribution of hypertension in the study population.

Hypertension	Number of cases	Percent
No	87	58.0%
Yes	63	42.0%
Total	150	100.0%

Table. 9: Relationship between Thyroid Function and HTN.

HTN	Thyroid Function				
	Euthyroid	Subclinical Hypothyroid	Overt Hypothyroid	Subclinical Hyperthyroid	Overt Hyperthyroid
No	61 (70.1%)	9 (10.4%)	8 (9.2%)	5(5.7%)	4 (4.6%)
Yes	48 (76.2%)	8 (12.7%)	4 (6.3%)	2(3.2%)	1 (1.6%)
Total	109 (72.7%)	17 (11.3%)	12 (8.0%)	7(4.7%)	5 (3.3%)



Graph 10: Correlation between hypertension and thyroid dysfunction.

Table. 11: Distribution of dyslipidemia in the study population.

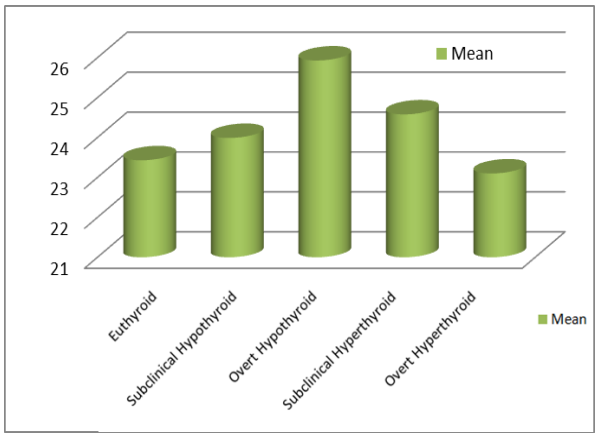
Dyslipidemia	Frequency	Percent
No	45	30.0%
Yes	105	70.0%
Total	150	100.0%

Table. 12: Correlation between dyslipidemia and thyroid dysfunction.

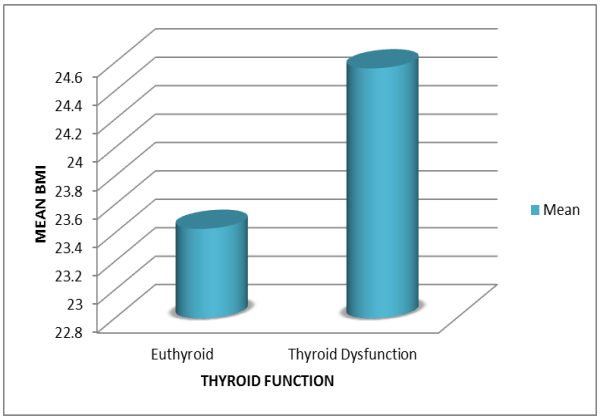
Dyslipidemia	Thyroid Function		p - value
	Euthyroid	Thyroid dysfunction	
No	38 (84.4%)	7 (15.6%)	0.0449
Yes	71 (67.6%)	34 (32.4%)	
Total	109 (72.7%)	41 (27.3%)	

Table. 13: Correlation between HbA_1c and thyroid dysfunction.

Thyroid Function	Mean	SD	p – value
Euthyroid	8.085	1.613	0.345
Thyroid Dysfunction	8.366	1.626	



Graph. 14: Relationship between thyroid function and BMI.



Graph. 15: Correlation between thyroid dysfunction and BMI.

DISCUSSION

We studied 150 patients of which 55.3% were males and 44.7% were females. The mean age of study group was 59.94(+/-11.72) years. Most (32%) of the patients in our study were in the age group of 56-65 years followed by 46-55 years age group (25.3%). 42% diabetics were hypertensive, 70% had dyslipidemia. The mean BMI was 23.74(+/-2.15) kg/m^2.m The mean HbA1c in the study group was 8.16 (+/- 1.61) %. The mean creatinine was 0.98 (+/-0.19) mg/dl.

The prevalence of thyroid dysfunction in our study was 27.33%. Of this 19.33% had hypothyroidism (11.33% SCH +8% overt hypothyroid) and 8% had hyperthyroidism (4.7% subclinical hyperthyroidism +3.3% overt hyperthyroidism).

Table No. 26: Comparison of prevalence of thyroid dysfunction with other studies.

	Study	Prevalence
1	Present study	27.33%
2	Celani MF et al.,[2]	31.4%
3	Radaideh AR et al.,[8]	12.5%
4	Kiran Babu et al.,[9]	28%

Our study findings are similar to study done by Singh et al., in which he found hypothyroidism in 23.75% (15% subclinical hypothyroidism and 8.75% Primary hypothyroidism) and hyperthyroidism in 6.25% (all primary hyperthyroidism) of diabetic subjects.[10]

The mean age of euthyroid diabetic's was 60.94 (+/-11.56) years and the mean age of diabetic's with thyroid dysfunction was 57.26(+/-12) years. Though the mean age was slightly lower in patients with thyroid dysfunction it was not significant statistically (p value 0.087). In the study by Kim et al[11], the mean age of euthyroid patients of type 2 DM was 57.8 (SD ±11.8) years and the mean age of type 2 diabetics with SCH was 61.7 (SD ±9.8) years (p value 0.014) indicating that SCH in type 2 DM was associated with increasing age.

31.3% of females had thyroid dysfunction and 24.1% of males had thyroid dysfunction and the difference was not statistically significant. Yang GR etal., studied 371 diabetics, in which 83 subjects (22.4%) were diagnosed as SCH of whom 12.1% were males and 29.9% were females.[12] Most of the studies have shown that thyroid disorders are more common in females with Type 2 Diabetes –Celani MF et al.[4], Singh et al., Babu K et al.,[9] etc.

The mean duration of diabetes in patients with thyroid dysfunction was 8.027 (+/-7.37)yrs, in euthyroid patients was 8.605 (+/-7.22) yrs, the difference was statistically insignificant. Study done by Diez jj et al., showed the duration of diabetes mellitus in patients with thyroid dysfunction is higher compared to euthyroid patients though it was not statistically significant.[13]

In the present study 23.8% of hypertensives had thyroid dysfunction as compared 29.9% of normotensives who had thyroid dysfunction. There was no statistically significant difference (p=0.410). 12 out of 29 hypothyroid patients were hypertensive, 3 out of 12 hyperthyroid patients were hypertensives, but the difference was not statistically significant (p value=0.47). Kim et al., showed that though the mean SBP and DBP was higher in patients with thyroid dysfunction although it was not significant.[11,14]

Out of 105 of patients with dyslipidemia 34 had thyroid dysfunction compared to 7 out of 45 patients without dyslipidemia, the difference was statistically significant (p value =0.0449). In a study by Kim et al[11], SCH patients had relatively higher mean values of serum TC, LDL, HDL, compared to euthyroid subjects and relatively lower mean TG compared to euthyroid counterparts; but none of the above parameters showed any statistically significant difference between the two groups.

In our study 6 of 26 patients who were on insulin therapy had thyroid dysfunction as compared to 35 of 124 patients who were only on OHA's or no treatment. There was no statistical significance for the same (p =0.80). The study done by Celani MF et al., on 290 type 2 diabetics with mean age of 60.6 years, hospitalised because of poor diabetic control or recent-onset diabetes (mean HbA1c value = 9.6%), concluded that patients treated with insulin therapy had higher prevalence of thyroid dysfunction as compared to those who were not.[2,15]

In our study patients with thyroid dysfunction has significantly higher BMI than those who are euthyroid. Overt hypothyroid group has the highest average BMI, followed by those with subclinical hyperthyroidism.

Studies	Mean BMI of SCH patients (kg/m2)	Mean BMI of euthyroid patients (kg/m2)	P value
Present study	23.8	23.43	0.458
Kim et al[11]	24.1	24.8	0.208
Yang et al[12]	24.8	24.6	0.816

CONCLUSION

- The prevalence of thyroid dysfunction in our study was 27.3%. Of this 17% were SCH, 12 % were overt hypothyroid, 7% had subclinical hyperthyroidism and 5% had overt hyperthyroidism.
- There was higher prevalence of thyroid dysfunction among females compared to males.
- 42% of diabetics had hypertension and 70% had dyslipidemia.
- Diabetics with thyroid dysfunction had poor glycemic control compared to euthyroid diabetics.
- There was no correlation between age, duration of diabetes between euthyroid patients and patients with thyroid dysfunction.
- The mean BMI of patients with thyroid dysfunction higher was compared to euthyroid patients.
- Lastly, our study emphasizes the need to check TSH levels in all type 2 diabetic patients.

RECOMMENDATIONS

✓Thyroid functions should be checked in all type 2 diabetes mellitus patients at the time of initial diagnosis.
✓Patients with Type 2 diabetes mellitus require more frequent monitoring of thyroid functions compared to general population.
✓Type 2 diabetes mellitus patients with uncontrolled glycemic status should be tested for any thyroid dysfunction.
✓Thyroid functional status should be optimised in all type 2 diabetes mellitus patients.
✓Treatment of subclinical thyroid dysfunction should be considered in appropriate situations.

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