

ASSOCIATION OF THYROID DYSFUNCTION WITH TYPE 2 DIABETES: A PROSPECTIVE STUDYO. Padmini¹, V. Sumanth², V. Sri Divya³, M. Rama Devi⁴**HOW TO CITE THIS ARTICLE:**

O. Padmini, V. Sumanth, V. Sri Divya, M. Rama Devi. "Association of Thyroid Dysfunction with Type 2 Diabetes: A Prospective Study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 31, April 16; Page: 5292-5307, DOI: 10.14260/jemds/2015/775

ABSTRACT: BACKGROUND: Diabetes mellitus (DM) and Thyroid Diseases are the two most common endocrine disorders seen in general population. Type 2 Diabetes Mellitus is commonly associated with altered thyroid function. **AIM:** The present study was done to study the Prevalence of Thyroid Disease in patients of Type II diabetes mellitus. **MATERIALS AND METHODS:** In the present study 250 type-2 diabetic patients were investigated for fasting blood sugar (FBS), Post lunch blood sugar, Glycosylated Haemoglobin (HbA1c), Total tri-iodo-thyronine (T3), Total thyroxine (T4), Thyroid Stimulating Hormone (TSH). **RESULTS:** Out of the 250 type 2 diabetic subjects studied, 49 (19.60%) cases showed abnormal thyroid function, 23cases had Subclinical Hypothyroidism, 17 cases were Overt Hypothyroidism, 9 cases were Overt Hyperthyroidism, 2 cases of Subclinical Hyperthyroidism and 201 (80.40%) cases showed normal thyroid hormone level. Dyslipidaemia was found in most diabetic patients. P value (<0.05) was significant for age, body mass index, pulse rate, fasting blood sugar, post lunch blood sugar, total cholesterol, low density lipoproteins. **CONCLUSION:** The ability to diagnose and treat unsuspected thyroid diseases in type II diabetic patients may result in better control of the diabetic state, thereby greatly enhancing the quality of life. This study justifies the view that all type II diabetic patients should be screened for thyroid diseases due to the close association of these two disorders.

KEYWORDS: DIABETES TYPE-2, T3, T4, TSH.

INTRODUCTION: Diabetes mellitus and thyroid diseases are the two common endocrinal disorders seen in the adult population. With insulin and thyroid hormones being intimately involved in cellular metabolism and thus excess or deficit of either of these hormones could result in the functional derangement of the other.

The effect on carbohydrate metabolism can potentially lead to disruptions in diabetes control.

Type-2 DM owes its pathological origin to inappropriate secretion of insulin and insulin resistance. Continuous consumption of calories-rich meals, junk food and sedentary lifestyle have culminated into an epidemic of diabetes projected to afflict around 300 million people across the globe by 2020. Defective insulin secretion leads to various metabolic disturbances in T2DM, spanning from hyperglycaemia due to defective insulin-stimulated glucose uptake and upregulated hepatic glucose production.

In hyperthyroidism there is elevated pulse rate, decreased body mass index due increased catabolism of proteins in muscle tissue along with increased appetite, increases circulation of fatty acids. There is increased intestinal glucose absorption, increased upregulation of GLUT 2 in the liver, increased production of insulin associated with increased insulin degradation or decrease in half-life of insulin leading to hyperglycaemia. All these mechanisms of hyperthyroidism lead to altered glucose levels in blood and it has been reported in 2-3 % patients can develop frank diabetes.

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In hypothyroidism, there decreased metabolism. There increase in weight even with decreased appetite. There is decreased clearance of lipids in the blood, decreased pulse rate, blood pressure is also elevated in these individuals. On glucose metabolism, there decreased absorption of glucose from gut, decreased synthesis of insulin, decreased hepatic output of glucose all of which lead to episodes of hypoglycaemia.

Hyperthyroidism impairs glycaemic control in diabetic subjects, while hypothyroidism may increase susceptibility to hypoglycaemia thus complicating diabetes management.

In euthyroid individuals with type 2 diabetes it has been reported more prevalence of subclinical hypothyroidism where there is abnormal rise in TSH along with normal levels of T3 and T4 who can develop hypothyroidism later in life which remains undiagnosed. Cases of subclinical hyperthyroidism were also reported where there is low TSH levels along with normal levels of T3 and T4 who can develop hyperthyroidism later.

In this study we tried to show how diabetes affects thyroid function in euthyroid individuals, how it affects pre-existing thyroid disorders, conversely how thyroid diseases could affect the glycemic status and finally discuss clinical situations where both the diseases could coexist.

AIM OF STUDY:

1. To estimate the Prevalence of Thyroid Disease in type 2 Diabetes, patients coming to Gandhi Hospital, Secunderabad, A. P. -To measure BMI, Pulse rate, Blood Pressure, Thyroid profile, and diabetic profile in diabetic and record any alteration in parameters.
2. To evaluate the association of family history in these patients.
3. To calculate no of new cases and old cases of Thyroid Diseases in Type 2 Diabetes.

MATERIAL AND METHODS: This study was a prospective, cross-sectional study of 250 patients of Type 2 Diabetes attending the out-patient departments of Gandhi General Hospital, Secunderabad, during a period of 6 months i. e from January 2013 to July 2013.

A proforma incorporating information regarding the demographic and clinical data was used in the study.

Inclusion Criteria: Known cases of patients suffering with type 2 diabetes of age groups between 40-70 years without complications were included.

Exclusion Criteria: Patients suffering with type 1 diabetes, Diabetes mellitus with complications, acutely ill patients were excluded to rule out Euthyroid Sick Syndrome.

The patients were divided into 2 groups for the study.

GROUP A: In this group patients with both type 2 diabetes and thyroid diseases without complications between 40-70 years age group were included.

GROUP B: Patients with Type 2 Diabetes without Thyroid Diseases between 40-70 years age group were this study group.

STATISTICAL ANALYSIS: The data obtained was compiled, tabulated, analysed and statistical analysis of the data was done by using appropriate computer package. Wherever possible the data was arranged in tables. Prevalence is expressed in percentages and test of significance was done.

METHODS:

- 1. Clinical Examination:** To calculate the body mass index. Height is measured bare foot to the nearest 0.5 cm wall mounted or Harpenden Stationometer. Weight is measured to the nearest 0.5 kg. Body mass index a measure of relative obesity was calculated as a mathematical function of weight and height (kg/m²).

$$\text{BMI (kg/m}^2\text{)} = \text{weight (kg)} / \text{height (mts}^2\text{)}$$

The BMI value ranging between 18.5-25.0 is considered normal, below 18.5 indicates the status as under nourished, while value above 25.0 as over- weight and above 30.0 as obese.

During clinical examination patients' blood pressure was measured by sphygmomanometer and values were expressed as systolic blood pressure and diastolic pressure.

Body temperature was recorded with a clinical mercury thermometer.

Pulse rate- palpating radial artery with three digits and time was recorded with a watch for 60 sec.

- 2. Biochemical Assay: Blood Sample collection:** Fasting blood samples were taken (overnight fast of a minimum of 8 hours). 5ml of venous blood sample was collected in two separate sterile, clean and dry sample collecting bottles and centrifuged at 3000 rpm for 10 minutes for the preparation of plasma and serum for estimation of biochemical parameters. Plasma glucose levels were determined by GOD-POD method, glycosylated Haemoglobin (HbA1C) by Cation-exchange chromatography and thyroid profile by electrochemiluminescence method.

RESULTS: In our study,

- The Prevalence of Thyroid Disease in Type 2 Diabetes is 19.6% with the no of old cases being 24 and the new cases being 25 out of total of 250 patients suffering with type 2 diabetes (Table 1 & Graph 1). The chi square P value is 0.0378 (<0.05), considered significant. Relative risk = 0.5896.
- The association of age with type 2 diabetes and thyroid disease (table 2 & graph 2), The P value is 0.7785 (>0.05), the row and column variables are not significantly associated.
- Association of body mass index with type 2 diabetes and thyroid disease (table & graph 3) The P value is 0.0166 (<0.05), considered significant. Chi-square statistic (with Yates correction) = 4.539. Relative risk = 0.5019.
- Association of systolic blood pressure with type 2 diabetes and thyroid disease (table&graph4), The P value is 0.3631 (>0.05), considered not significant.
- Association of diastolic blood pressure with type 2 diabetes and thyroid disease (table & graph 5), The P value is 0.4931 (>0.05), considered not significant. Relative risk = 0.8406 Chi-square statistic (with Yates correction) = 0.0002978.
- Association of fasting blood sugar with type 2 diabetes and thyroid disease (table& graph6) The P value is < 0.0001 (<0.05), considered extremely significant. Relative risk = 3.516 Chi-square statistic (with Yates correction) = 24.332.

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7. Association of post lunch blood sugar with type 2 diabetes and thyroid disease (Table & graph 7), The P value is 0.0051, considered very significant.
8. Relative risk = 2.007, Chi-square statistic (with Yates correction) = 6.594.
9. Association of duration of diabetes treatment in type 2 diabetes and thyroid disease (table & graph 8), The P value is 0.1021. NOT SIGNIFICANT (>0.05).

DISCUSSION: In our study out of 250 diabetic cases 49 cases were diagnosed to have thyroid dysfunction, 201 cases did not show any thyroid abnormalities (graph A). The no of old cases who were already diagnosed were 24 cases and 25 newly diagnosed cases. Prevalence rate of thyroid diseases in type 2 diabetes is 19.60 %.

23 cases of Subclinical Hypothyroidism, 17 cases of Overt Hypothyroidism, and 7 cases of Overt Hyperthyroidism and 2 Subclinical Hyperthyroidism were diagnosed (table & graph 9).

Some other studies were also done on the association of Type 2 DM and Thyroid disorders.

In whichham et al¹ in 1979 found a prevalence rate of 6% in United Kingdom population.

Perros et al reported. The prevalence of thyroid disorder in diabetic population to be 13.4% with higher prevalence (31.4%) in female T2DM patients as compared to (6.9%) in male T2DM patients.²

Prevalence in thyroid dysfunction in type 2 diabetic were found to be 16 % in Saudi population.³

In Vinu Vij et al⁴ a study revealed a 28.75% prevalence in thyroid dysfunction in type 2 diabetes in indian population.

Thyroid dysfunction in type 2 diabetes mellitus: A retrospective study Laloo Demitrost, Salam Ranabir et al reported a prevalence rate of 32.22%.⁵

Jain et al reported a Prevalence of Thyroid disorders in Patients of type 2 Diabetes to be 16% in 200 type 2 diabetes patients.⁶

All of these studies suggest an increased prevalence of thyroid diseases in type 2 diabetes when compared to prevalence of thyroid disorders in non-diabetic population. Our findings corroborated the results of the various studies enumerated above.

Table 1: Association of sex in thyroid diseases in type2 diabetes

Sex	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
Male	15(6%)	92(37%)	107(43%)
Female	34(14%)	109(57%)	143(57%)
Total	49(20%)	201(80%)	250(100%)

TABLE 1: ASSOCIATION OF SEX WITH TYPE2 DIABETES AND THYROID DISEASE

The chi square P value is 0.0378(<0.05), considered significant.

Relative risk = 0.5896.

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In our study, there was a higher prevalence of thyroid disease among diabetic females and was found to be significant ($p = <0.05$). It is well established that hypothyroidism is more common in diabetic females.

In Perros et al reported the prevalence of thyroid disorder in diabetic population to be 13.4% with higher prevalence (31.4%) in female T2DM patients as compared to (6.9%) in male T2DM patients

The NHANES III study reported that the prevalence of subclinical hypothyroidism was 3.4% in males and 5.8% in females.

Table 2: Association of age with type2 diabetes and thyroid diseases.

Age	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
40-50	16	91	107
51-60	23	84	107
61-70	10	26	36
Total	49	201	250

TABLE 2: ASSOCIATION OF AGE WITH TYPE 2 DIABETES AND THYROID DISEASE

The P value is 0.7785 (>0.05), the row and column variables are not significantly associated.

There was increase in number of cases between 51-60 age group about 23 in Group A and 84 in Group B. between 40-50 years of age there were 16 cases in group A and 91 cases in group B. in age group between 61 – 70 years there were 10 in group A and 26 in group B.

Table 3: Association of body mass index in type 2 diabetes and thyroid diseases. In this table the association with BMI were found to be significant (p value= <0.05) indicating higher BMI in thyroid diseases.

BMI	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
Male	37(15%)	178(71%)	215(86%)
Female	12(5%)	23(9%)	35(14%)
Total	49(20%)	201(80%)	250(100%)

TABLE 3: ASSOCIATION OF BODY MASS INDEX WITH TYPE 2 DIABETS AND THYROID DISEASE

The P value is 0.0166(<0.05), considered significant.

Chi-square statistic (with Yates correction) = 4.539.

Relative risk = 0.5019.

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Table 4: In this table the association with systolic blood pressure p value=>0.05, considered not significant indicating no association of systolic blood pressure with thyroid diseases and type 2 diabetes.

SBP	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
less than 120 mm of hg	12(5%)	57(23%)	69(28%)
more than 120 mm of hg	37(15%)	144(58%)	181(72%)
Total	49(20%)	201(80%)	250(100%)

TABLE 4: ASSOCIATION OF SYSTOLIC BLOOD PRESSURE WITH TYPE 2 DIABETES AND THYROID DISEASE

The P value is 0.3631(>0.05), Considered not significant.

Relative risk = 0.8508, Chi-square statistic (with Yates correction) = 0.1332.

Table 5: In this table the association with diastolic blood pressure p value=>0.05, considered not significant. Relative risk = 0.8406, indicating no association of Diastolic blood pressure with Thyroid Diseases and Type 2 Diabetes.

DBP	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
less than 80 mm of hg	3(1%)	15(6%)	18(18%)
more than 80 mm of hg	46(18%)	186(74%)	232(93%)
Total	49(20%)	201(80%)	250(100%)

TABLE 5: ASSOCIATION OF DIASTOLIC BLOOD PRESSURE WITH TYPE 2 DIABETES AND THYROID DISEASE

The P value is 0.4931(>0.05), considered not significant Relative risk = 0.8406 Chi-square statistic (with Yates correction) = 0.0002978.

Table 6: In this table the association with fasting blood sugar P value is < 0.0001 considered significant. Relative risk = 3.516, Relative risk = 0.8406, indicating association of Diastolic blood pressure with thyroid diseases and type 2 diabetes.

FBS	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
less than 110 mg/dl	20(8%)	21(8%)	41(16%)
more than 110 mg/dl	29(12%)	180(72%)	209(84%)
Total	49(20%)	201(80%)	250(100%)

TABLE 6: ASSOCIATION OF FASING BLOOD SUGAR WITH TYPE 2 DIABETES AND THYROID DISEASE

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The P value is $< 0.0001 (<0.05)$, Considered extremely significant.

Relative risk = 3.516.

Chi-square statistic (with Yates correction) = 24.332.

Table 7: In this table the association with post lunch blood sugar with the P value is <0.05 , considered very significant. Relative risk = 2.007. Indicating association of post lunch blood sugar with thyroid diseases and type 2 diabetes.

PLBS	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
less than 180 mg/dl	21(8%)	47(19%)	68(27%)
more than 180 mg/dl	28(11%)	154(62%)	182(73%)
Total	49(20%)	201(80%)	250(100%)

TABLE 7: ASSOCIATION OF POST LUNCH BLOOD SUGAR WITH TYPE 2 DIABETES AND THYROID DISEASE

The P value is 0.0051, considered very significant.

Relative risk = 2.007, Chi-square statistic (with Yates correction) = 6.594.

Table 8: Association of duration of Diabetes Treatment in Type 2 diabetes and Thyroid Disease. In this table p value was not significant ($p \geq 0.05$). There were 30 cases in group A and 108 cases in group B in the group with duration of diabetes treatment between 5-10 years age group indicating increases chances of thyroid diseases after 5 years of diabetes.

Duration of Diabetes treatment	Type 2 Diabetes with Thyroid Disease	Type 2 Diabetes without Thyroid Disease	Total
less than 5 years	0	36	36
5 - 10 years	30	108	138
more than 10 years	19	57	76
Total	49	201	250

TABLE 8: ASSOCIATION OF DURATION OF DIABETES TREATMENT IN TYPE 2 DIABETES AND THYROID DISEASE

The P value is 0.1021. NOT SIGNIFICANT (>0.05).

Pulse Rate showed a significant p value (<0.05). It was elevated in overt hyperthyroid patient and it was near normal in hypothyroid patients.

T-test was done to find out the association between two groups i. e., Type2 Diabetics and Thyroid Disease with Type 2 Diabetes. Significant p value was found out for BMI, Body Temperature, and Fasting Blood sugar, Post Lunch Blood Sugar, TSH, T4 and Thyroid Treatment.

In some studies use of Metformin reported to show an improvement in thyroid patients.

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American Association of Clinical Endocrinologists, Thyroid disease clinical Practice guidelines, 2002⁷ recommends to do screening for thyroid diseases in patients above 35 years. American thyroid Association guidelines for detection of thyroid dysfunction recommend palpation and TSH assay in diabetic patients

Our study showed an increased prevalence in thyroid diseases in type 2 diabetes, though further investigation should be done to get a better understanding the link between Thyroid Diseases and Type 2 Diabetes.

OVERT HYPOTHYROIDISM	SUBCLINICAL HYPOTHYROIDISM	OVERT HYPERTHYROIDISM	SUBCLINICAL HYPERTHYROIDISM
17	23	7	2

TABLE 9: THYROID DSYFUNCTION

Variable	Normal	±	Std. Err.	Thyroid	±	Std. Err.	T Test	Probability	
AGE	52.950	±	0.526	54.510	±	0.979	1.334	0.184	
SEX	1.542	±	0.035	1.694	±	0.067	1.930	0.055	
BMI	22.929	±	0.137	23.672	±	0.366	2.250	0.025	*
Pulse Rate	85.990	±	0.620	87.449	±	1.882	0.935	0.350	
Systolic BP	130.100	±	1.035	133.837	±	2.221	1.579	0.116	
Diastolic BP	82.677	±	0.381	83.265	±	0.786	0.682	0.496	
Body temp.	98.538	±	0.011	98.751	±	0.103	3.870	0.000	***
Fasting BS	123.040	±	1.097	108.592	±	2.094	5.893	0.000	***
Post Lunch BS	193.891	±	1.947	183.449	±	3.694	2.403	0.017	*
HBA1C	7.729	±	0.028	7.739	±	0.065	0.152	0.879	
Diabetes Treat Duraiton	8.706	±	0.207	9.265	±	0.428	1.189	0.235	
Type 2 Diabetes	0.194	±	0.028	0.286	±	0.065	1.408	0.160	
Total Cholesterol	173.050	±	2.943	220.816	±	6.370	7.089	0.000	***
HDL	40.413	±	0.317	40.633	±	0.746	0.297	0.767	
Tri Glycerides	215.592	±	6.320	194.837	±	9.709	1.518	0.130	
VLDL	43.353	±	1.286	39.286	±	2.204	1.441	0.151	
LDL	96.493	±	3.327	136.265	±	6.789	5.285	0.000	***
TSH	2.412	±	0.060	8.391	±	0.651	17.494	0.000	***
T3	1.249	±	0.024	1.231	±	0.157	0.196	0.845	
T4	8.467	±	0.084	7.685	±	0.654	2.151	0.032	*
Thyroid Treatment	0.040	±	0.014	0.429	±	0.071	8.662	0.000	***
Insulin	0.159	±	0.026	0.122	±	0.047	0.641	0.522	
Outcome	0.000	±	0.000	2.429	±	0.196	25.304	0.000	***

Table 10: MEAN AND STANDARD ERROR OF DEVIATION AND T TEST

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Sl. No.	NAME	THYROID DYSFUNCTION	THYROID DISEASE
1	MRS.R	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
2	MRS.N	SUBCLINICAL HYPOTHYROIDISM	-
3	MR.R	OVERT. HYPOTHYROIDISM	DIFFUSE GOITRE
4	MRS.F	SUBCLINICAL HYPOTHYROIDISM	-
5	MR.V	OVERT HYPERTHYROIDISM	GRAVE'S DISEASE
6	MR.B	SUBCLINICAL HYPOTHYROIDISM	-
7	MR.P	OVERT HYPERTHYROIDISM	TOXIC SOLITARY NODULE
8	MRS.J	SUBCLINICAL HYPOTHYROIDISM	-
9	MR.B	OVERT. HYPOTHYROIDISM	MULTINODULAR GOITRE
10	MRS.G	SUBCLINICAL HYPOTHYROIDISM	-
11	MR.N	SUBCLINICAL HYPOTHYROIDISM	-
12	MRS.M	SUBCLINICAL HYPOTHYROIDISM	-
13	MR.Y	OVERT. HYPOTHYROIDISM	DIFFUSE GOITRE
14	MR. B	SUBCLINICAL HYPOTHYROIDISM	-
15	MRS. R	SUBCLINICAL HYPOTHYROIDISM	-
16	MRS.V	SUBCLINICAL HYPOTHYROIDISM	-
17	MR. P	OVERT .HYPERTHYROIDISM	GRAVE'S DISEASE
18	MRS. L	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
19	MRS.S	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
20	MR .R	OVERT .HYPERTHYROIDISM	GRAVE'S DISEASE
21	MR. P	SUBCLINICAL HYPOTHYROIDISM	-
22	MRS R	SUBCLINICAL HYPERTHYROIDISM	-
23	MR.V	OVERT. HYPOTHYROIDISM	MULTI NODULAR GOITRE
24	MRS J	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
25	MRS M	SUBCLINICAL HYPOTHYROIDISM	-
26	MR. B	SUBCLINICAL HYPOTHYROIDISM	-
27	MRS. R	SUBCLINICAL HYPOTHYROIDISM	-
28	MRS. S	SUBCLINICAL HYPOTHYROIDISM	-
29	MR.P	SUBCLINICAL HYPERTHYROIDISM	-
30	MRS. L	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS

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31	MRS. B	SUBCLINICAL HYPOTHYROIDISM	-
32	MRS. M	SUBCLINICAL HYPOTHYROIDISM	-
33	MRS. R	SUBCLINICAL HYPOTHYROIDISM	-
34	MR. S	OVERT HYPERTHYROIDISM	TOXIC NODULAR GOITRE
35	MRS. L	OVERT. HYPOTHYROIDISM	DIFFUSE GOITRE
36	MRS S	SUBCLINICAL HYPOTHYROIDISM	-
37	MRS S	SUBCLINICAL HYPOTHYROIDISM	-
38	MRS Y	SUBCLINICAL HYPOTHYROIDISM	-
39	MR. I	OVERT HYPERTHYROIDISM	TOXIC GOITRE
40	MRS K	OVERT HYPERTHYROIDISM	SOLITARY NODULE
41	MRS L	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
42	MRS. R	OVERT. HYPOTHYROIDISM	MULTI NODULAR GOITRE
43	MR V	OVERT. HYPOTHYROIDISM	DIFFUSE GOITRE
44	MRS N	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
45	MRS J	SUBCLINICAL HYPOTHYROIDISM	-
46	MRS V	OVERT. HYPOTHYROIDISM	DIFFUSE GOITRE
47	MRS. R	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS
48	MRS N	SUBCLINICAL HYPOTHYROIDISM	-
49	MRS A	OVERT. HYPOTHYROIDISM	HASHIMOTO'S THYROIDITIS

TABLE 11

The names of the patients were changed to protect their identity.

CONCLUSION: It is evident that there is an association of thyroid diseases and type 2 diabetes and there has been increased prevalence in diabetic patients.

It is also evident that insulin resistance and decreased activity of 5 mono deiodinases-2 which causes peripheral conversion of T₄ to T₃ could be the causes of thyroid diseases in type 2 diabetes.

Measures to decrease glucose levels, including life style improvement, control of blood pressure and supplementation with agents known to decrease insulin resistance like metformin should be advised.

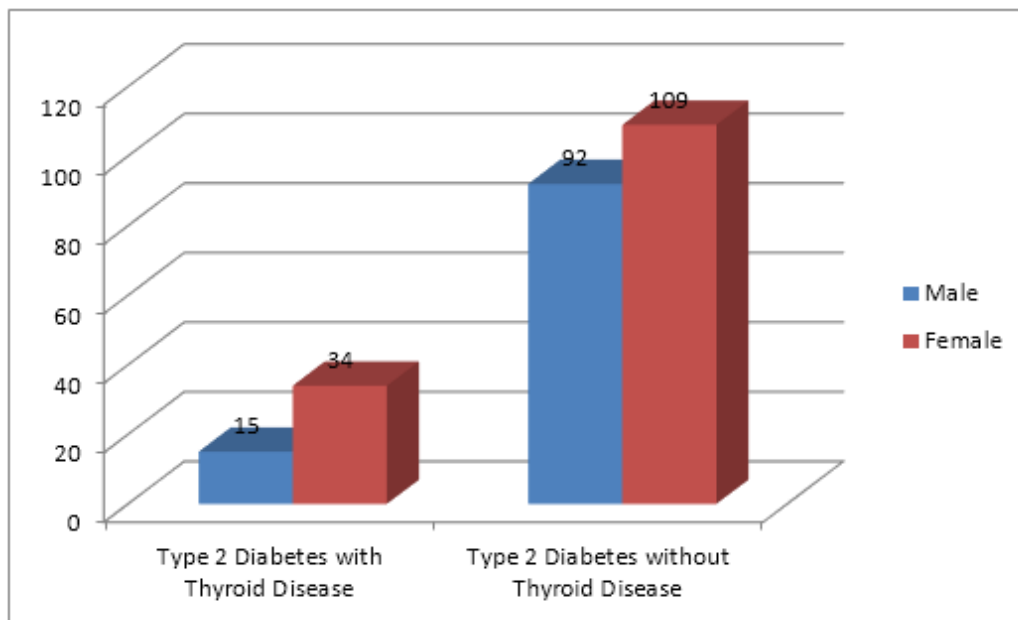
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We conclude that it is important to do screening of thyroid profile in every patient of Type-2 Diabetes and this practice should be inculcated to nourish further understanding of the association of Thyroid Diseases and Type2 Diabetic Mellitus.

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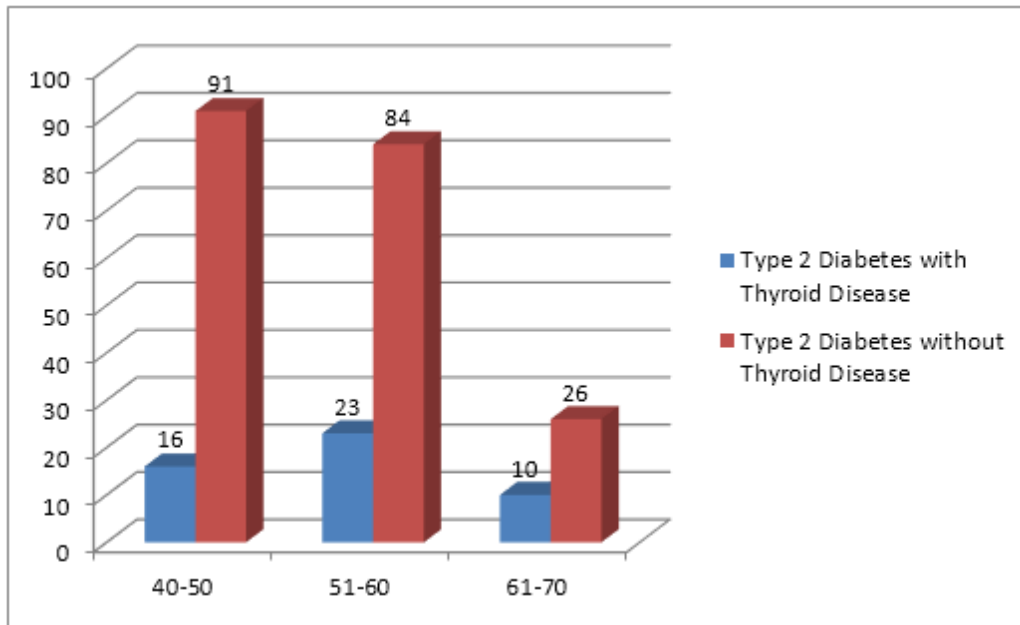
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THYROID DSYFUNCTION:

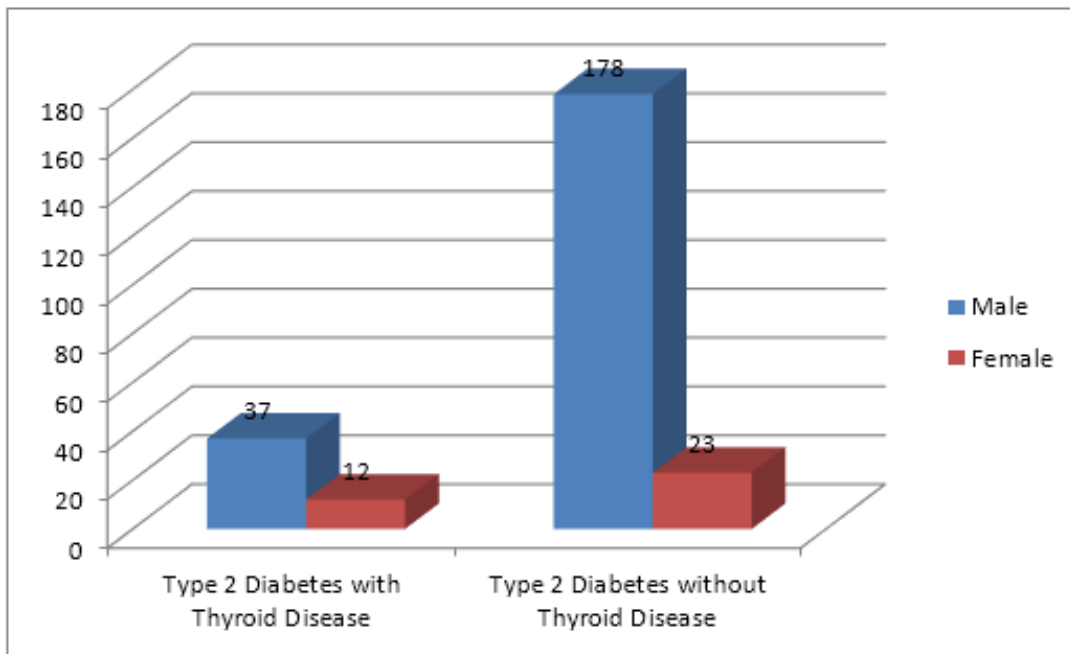


Graph 1: ASSOCIATION OF SEX WITH TYPE 2 DIABETES AND THYROID DISEASE

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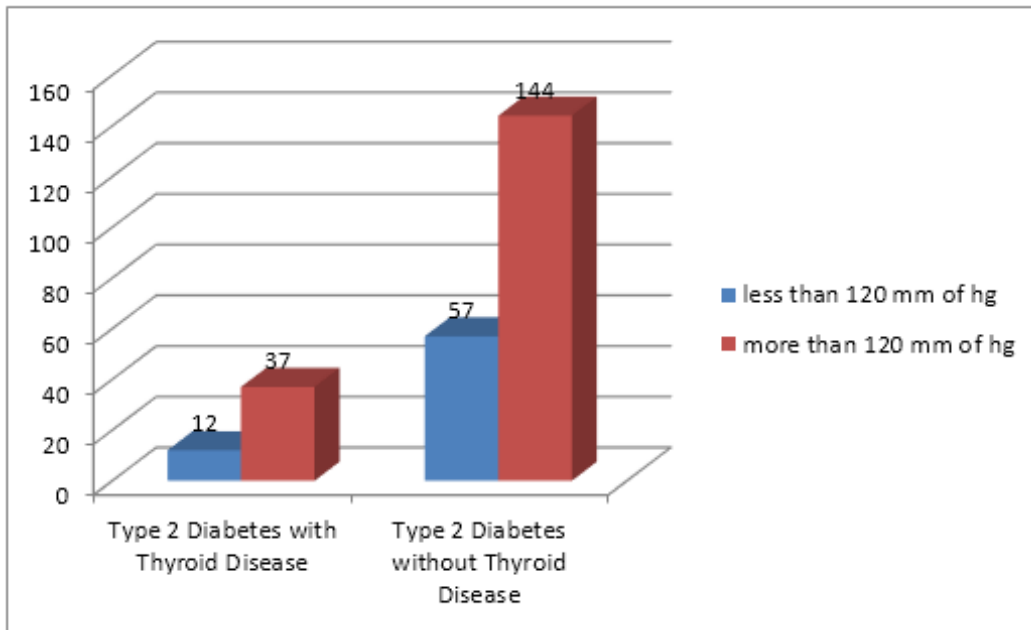


Graph 2: ASSOCIATION OF AGE WITH TYPE 2 DIABETES AND THYROID DISEASE

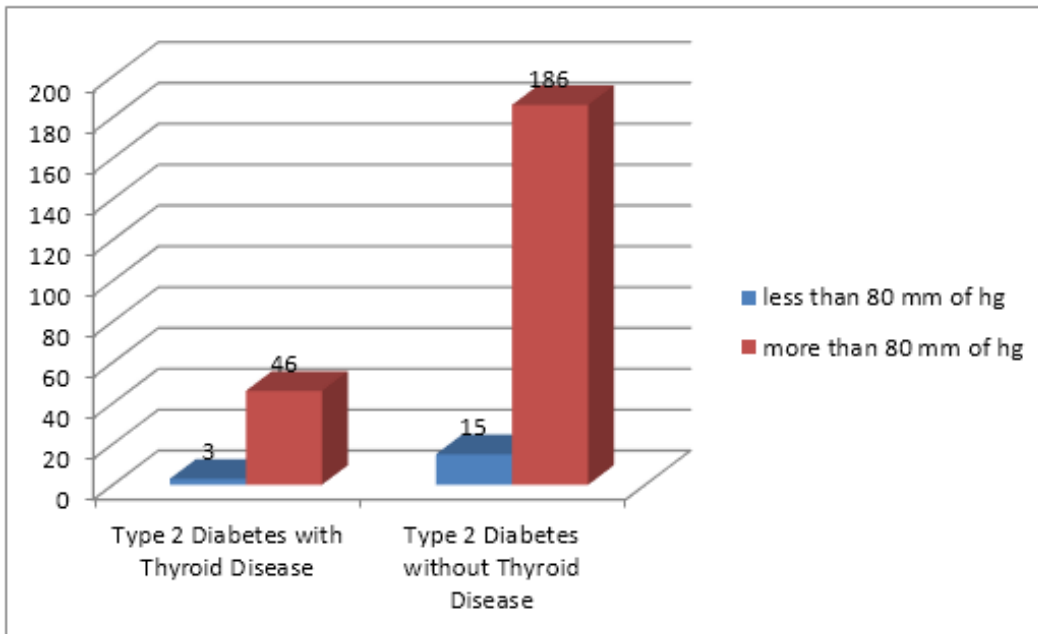


Graph 3: ASSOCIATION OF BODY MASS INDEX WITH TYPE 2 DIABETS AND THYROID DISEASE

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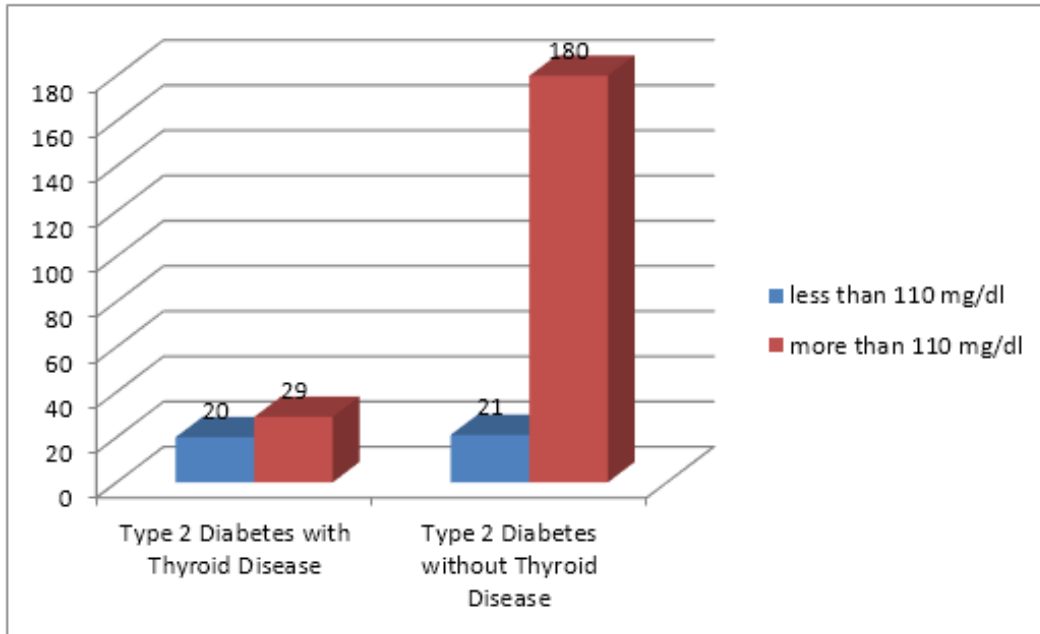


Graph 4: ASSOCIATION OF SYSTOLIC BLOOD PRESSURE WITH TYPE 2 DIABETES AND THYROID DISEASE

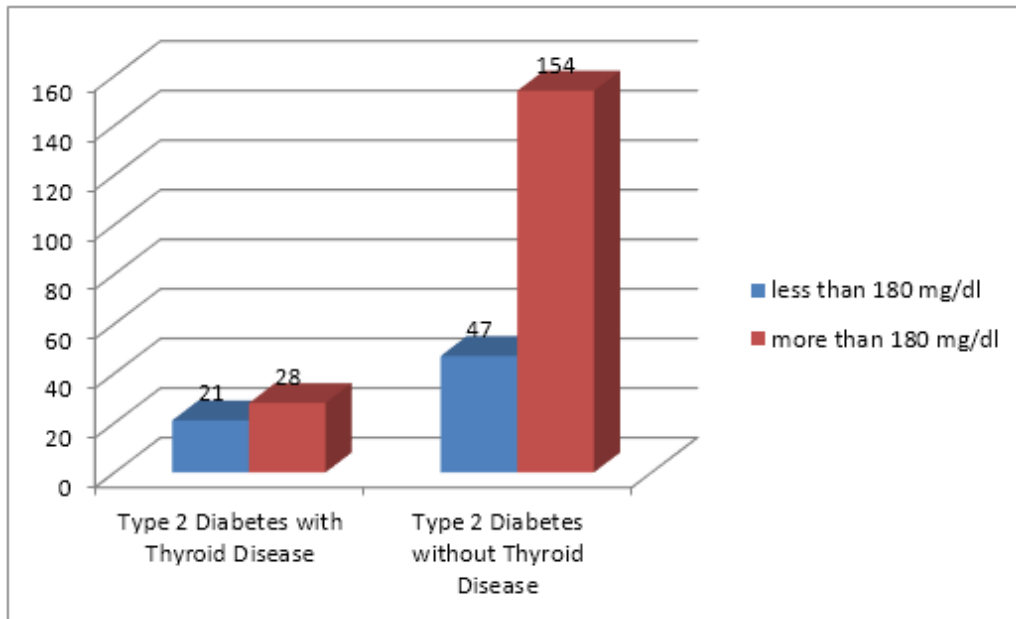


Graph 5: ASSOCIATION OF DIASTOLIC BLOOD PRESSURE WITH TYPE 2 DIABETES AND THYROID DISEASE

ORIGINAL ARTICLE

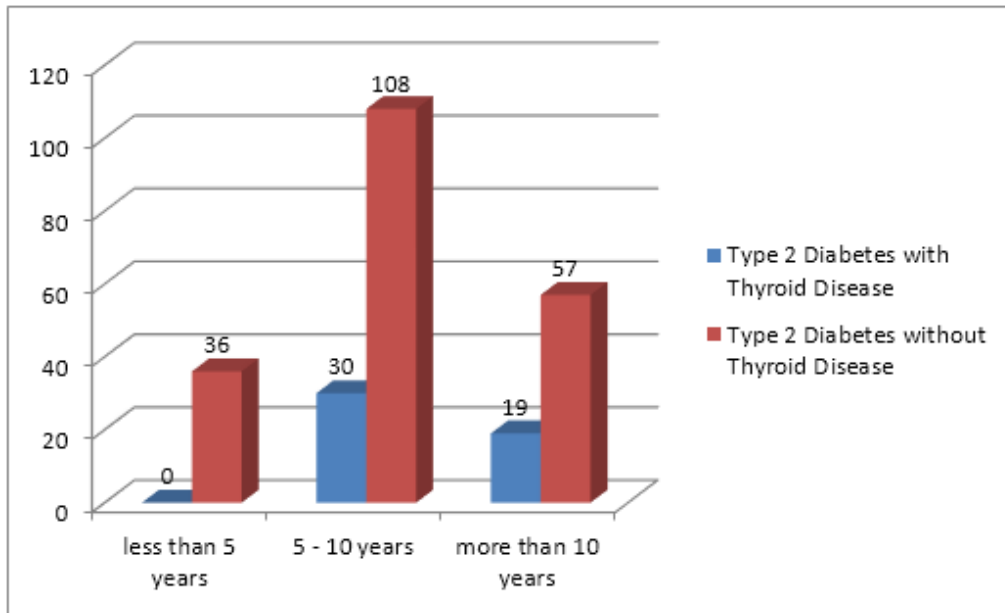


Graph 6: ASSOCIATION OF FASTING BLOOD SUGAR WITH TYPE 2 DIABETES AND THYROID DISEASE

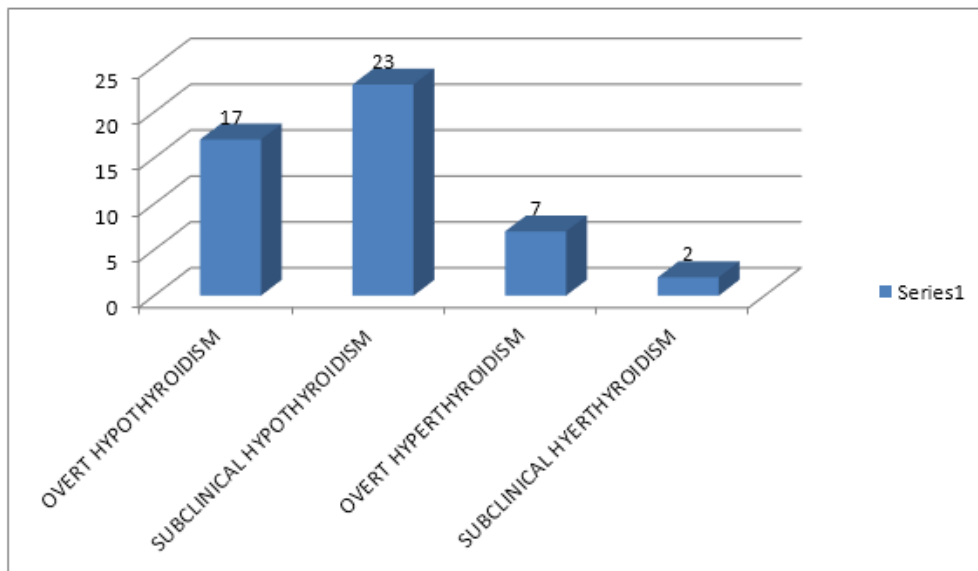


Graph 7: ASSOCIATION OF POST LUNCH BLOOD SUGAR WITH TYPE 2 DIABETES AND THYROID DISEASE

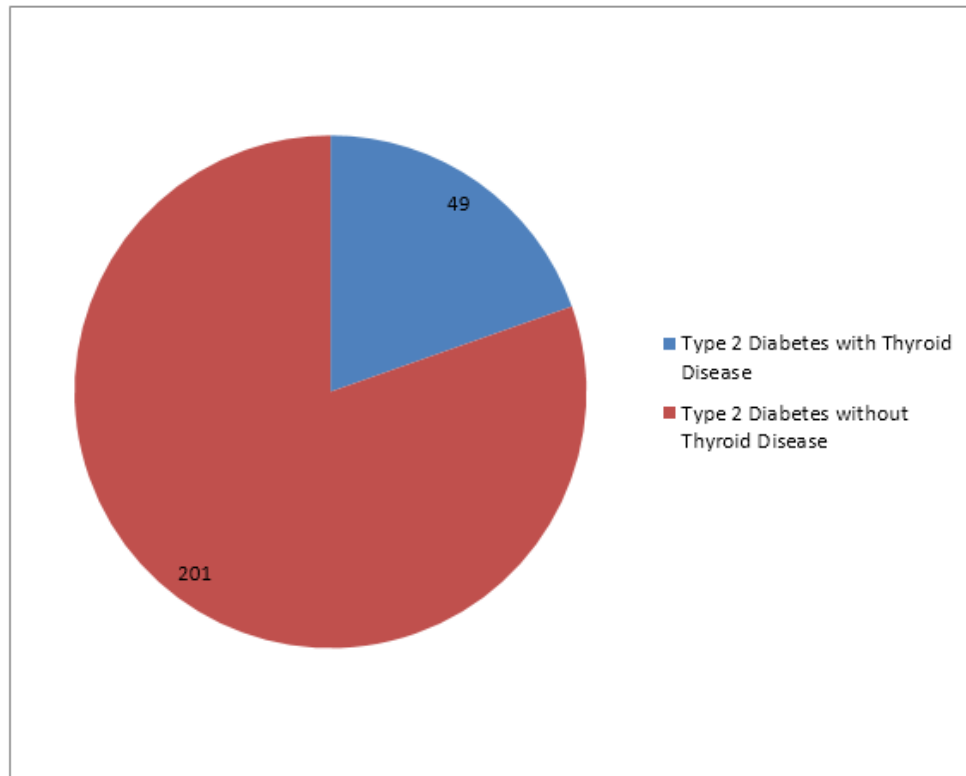
ORIGINAL ARTICLE



Graph 8: ASSOCIATION OF DURATION OF DIABETES TREATMENT IN TYPE 2 DIABETES AND THYROID DISEASE



Graph 9: Various Thyroid disorders found in Association with Type 2 Diabetes



Graph 10: TYPE 2 DIABETES AND THYROID DISEASE

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