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A study to co-relate Thyroid hormone and Lipid Profile with Fasting blood glucose in Type-2 Diabetes Mellitus Patients and Healthy individuals' sera by ELISA.

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Abstract: The study was planned to assess the prevalence of thyroid disorders in type 2 diabetes in S.N. Medical college, Agra and to correlate the thyroid hormone and fasting blood sugar with lipid profile in type-2 diabetes mellitus patients and healthy Individual. It is a case control study. Thirty patients of type 2 diabetes were included in the study along with 30 adults of the same age group and normal glucose levels as controls. All blood samples were taken from subjects who fasted for at least 12 h before the blood collection. Thyroid hormones were assessed through enzyme linked immunosorbent assay. The results showed that the TG in the high TSH group and the TSH group is higher than that of low TSH group. However, There were no significant differences in HDL-C, LDL-C, and TC among three groups (all P>0.05).There weren't significant differences between HDL-C, LDL-C and TC (all P>0.05). The test that we performed is thyroid hormone test and the result showed that the TSH is highly significant. And there were no significant difference in T3 and T4.

AIM: A study to co-relate thyroid hormone and fasting blood sugar with lipid profile in type-2 diabetes mellitus patients and healthy Individual sera by ELISA.

Keywords: lipid profile, type-2 diabetes mellitus patients, thyroid hormone.

Introduction:

Diabetes and thyroid diseases are the two most common diseases in the department of endocrinology, and the two diseases are closely related (1). Studies (2, 3) have shown that patients with T1DM or type 2 diabetes mellitus (T2DM) may have abnormal thyroid function. In addition to promoting the growth and development of tissue,

thyroid hormones can also affect the metabolism of sugar, fat and protein (4), and it's been reported that it participates in the development of T2DM(5,6).

Diabetes and thyroid disorders have been shown to mutually influence each other and an association between both conditions has been reported [7]. Thyroid disease is a pathological state that can adversely affect glycemic control in diabetics and has the potential to affect their health. Thyroid disease is found commonly in diabetes and is associated with advanced age, particularly in type-2 diabetes and underlying autoimmune disease in type-1 diabetes [8].

Insulin and thyroid hormones are intimately involved in cellular metabolism and thus excess or deficit of either of these hormones result in the functional derangement of the other. The

physiological and biochemical interrelationship between insulin and the influence of both insulin and iodothyronines on the metabolism of carbohydrates, proteins and lipids are recorded. Such records indicate that iodothyronines are insulin antagonists with high levels being diabetogenic while absence of the hormone inhibits the development of diabetes [9]. The thyroid hormone replacement is associated with a decrease in glycosylated hemoglobin (HbA1c) level, which is influenced by increased erythropoiesis rather than by changes in glucose level [10].

There is loss of vision in patients of Graves's disease who have superimposed diabetes and insulin in resistance increases the modularity of thyroid gland. Furthermore, it seems that unidentified thyroid dysfunction could negatively impact diabetes and its complications [11].

Lipid abnormalities are prevalent in DM patients because of IR which affects key enzymes and pathways in lipid metabolism: Apo protein production, regulation of lipoprotein lipase, action of cholesterol ester transfer proteins and hepatic and peripheral actions of insulin (12). Hyperglycemia and the high level of IR associated with T2DM has multiple effects on fat metabolism which results in the production of atherogenic dyslipidemia characterized by lipoprotein abnormalities: elevated very low density lipoprotein cholesterol (VLDL) elevated low density lipoprotein cholesterol (LDLc), elevated triacylglycerol (TAG) and decreased high density lipoprotein cholesterol (HDL-c) which are measured for cardiovascular risk prediction (13-17).

The duration of diabetes, degree of hyperglycemia, hypertension, dyslipidemia and smoking are the strongest risk factors for chronic complications of DM that lead to biochemical aberrations (18). Appropriate management targeting glycemic, hypertension and lipid control is important for decreasing morbidity and mortality, and improving long term quality of life for patients diagnosed with T2DM. Lifestyle changes such as nutrition therapy, weight loss, regular physical exercise, and appropriate education and self-management strategies are vital to improve outcomes (19, 20).

Lipid abnormalities in patients with diabetes, often termed "diabetic dyslipidemia", are typically characterized by high total cholesterol (T-C), high triglycerides (TG), low high density lipoprotein cholesterol (HDL-C) and increased levels of small dense LDL particles. Low density lipoprotein cholesterol (LDL-C) levels may be moderately increased or normal. Lipid abnormalities are common in people with T2DM and pre-diabetes [21, 22] but the pattern of the different lipids may vary between ethnic groups, economic levels, and access to health care [23, 24]. A recently published meta-analysis reported that abnormal levels of the above-mentioned lipid parameters reflect, to some extent, the risk of T2DM [25]. Furthermore, studies in people with T2DM have found an increased association between CAD and high TG and low HDL-C combined, compared to the two lipid parameters assessed separately [26,27].

Previous studies have reported conflicting results regarding the effect of serum lipids on the onset and progression of DR [28]. Dyslipidemia associated with diabetes is characterized by high serum levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C), and these are proposed to represent possible markers for DR progression and the occurrence of diabetic macular edema (DME) [29].

Dyslipidemia and hypertension are major modifiable risk factors for T2DM and related CAD, which account for more than 87% of disability in low- and middle-income countries [30,31]. Furthermore, prediabetes (an intermediate metabolic state between normoglycemia and T2DM) has also been found to be associated with an increased risk for cardiovascular disease [32].

Method:

The study population comprised 60 Patient with type-2 diabetes mellitus will be recruited from medicine OPD of S.N. Medical college and hospital, Agra age and sex matched healthy control with be included in the study. This was a case control study. Thirty Patient (in age group of 18-70 years) of type-2 diabetes and 30 adults of the same age group and normal glucose levels who acted as controls were recruited in the study. Approval of the institutional ethics committee was taken. Informed written consent was taken from all subjects. All the diabetic patients were confirmed diabetics, who had fasting blood glucose levels (FBG) of more than 126 mg/dL.

Specimen collection:

Four ml of venous blood sample collected and centrifuged, serum was aliquot and Stored at -20C^{o} for batch analyses of hormones, lipid and fasting blood glucose was Analyzed on the same day. 2ml of venous blood is taken

in NAF (sodium fluoride vacationer) for blood Glucose estimation. TSH, T3 and T4 were analyzed by sandwiched ELISA using J mitra (Qunti Microlisa KIT) kits.

Investigations:

TSH Qunti Microlisa is an enzyme immune assay based on sandwich ELISA. Microwells are coated with anti-TSH antibodies. Sample is added to the microwell followed by addition of enzyme conjugated (anti-TSH labelled with HRP). Binding of TSH is detected by enzyme conjugate. Incubation is followed by a washing step to remove unbound compound. The color reaction is started by addition of substrate and stopped after defined time. The color intensity is directly proportional to the concentration of TSH in the sample.

The results of thyroid function were classified on the use of the following as normal reference range:

- TSH: 0.39–6.16 mIU/L
- T3: 0.49–2.02 ng/mL
- T4 (Males): 44—108 nmol/L
- T4 (Females): 48—116 nmol/L
- Hypothyroidism—when T3, T4 were less and TSH greater than the reference ranges
- Hyperthyroidism—when T3, T4 were greater and TSH less than the reference ranges

Statistical analysis:

Results were analyzed using Graph pad prism9.4.1.681 and Microsoft excels programmers (2007) for statistical analysis of data. Quantitative variables were described as mean± SD. Independent t-test was used to compare mean values of each parameter among the groups. To observe possible relationships between parameters, Person's correlation coefficient was used. A two-tailed *p* value of <0.05 were considered indicative of a statistically significance difference.

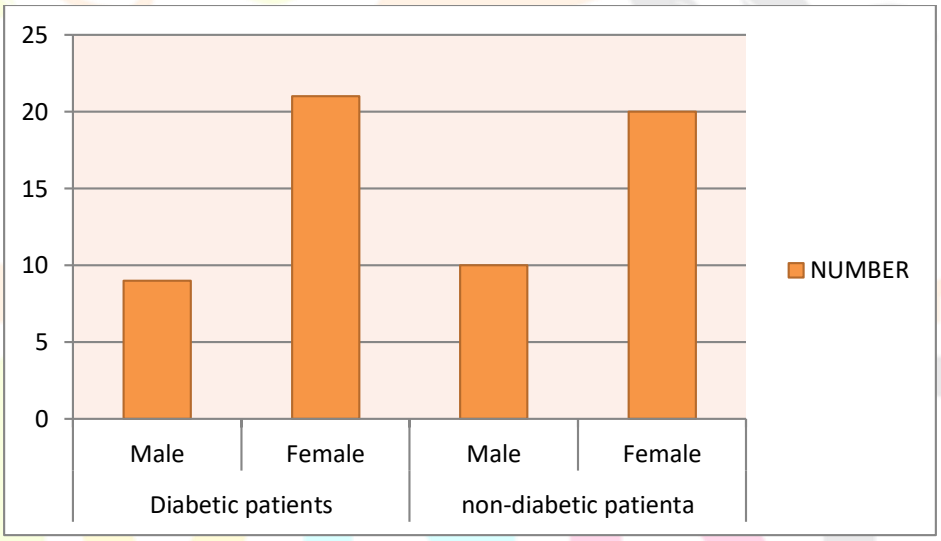
Results:

A total 60 patient included in the study, Age of the type-2 diabetic patients range From 18-70 years their blood sample were collected from the OPD after written and informed consent at S.N. Medical College and Hospital, Agra. Total 30 type II diabetic patients were considered as cases and age and sex match 30 healthy volunteers were considered as controls.

Both the diabetic and the control group are age and sex matched. The mean age (in years) of diabetic male group is 48.33±5.36 and female group is 44.23±13.27 (respectively; P=0.238975) and for the control male group it is 42±6.05 and female group is 37.95±8.80(respectively; P=0.152839)

S.NO.	GROUP	GENDER	NUMBER	AGE RANGE MEAN±SD RANGE	P-VALUE
1	Group(A) (T2DM)	Male	9	48.33±5.36	**0.238975**
		Female	21	44.23±13.27	
2	Group(B)(Non-Diabetic)	Male	10	42±6.05	**0.152839**
		Female	20	37.95±8.80	

TABLE: 1 Descriptive study on the baseline data of the study participants.



Graph1: Gender distribution of cases and control**.**

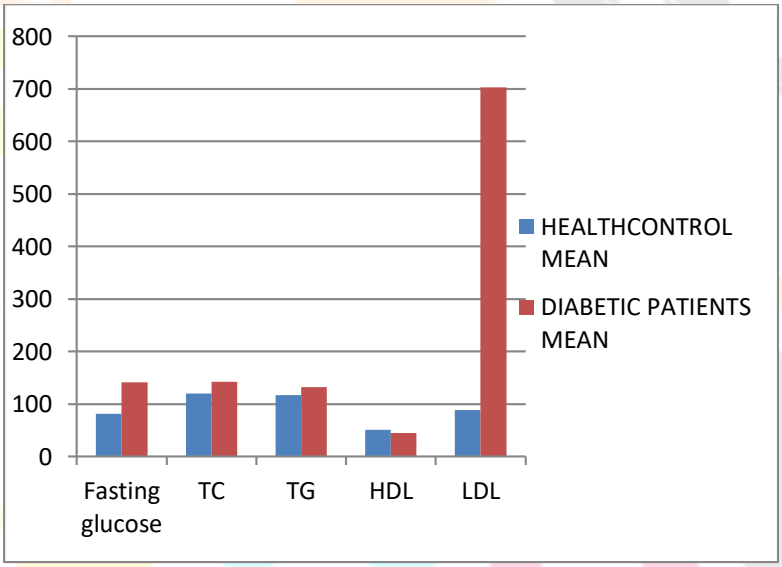
There is no significant difference found in Age and sex between diabetic patients and non-diabetic patients in my study.

Regarding the biochemical characteristics of the T2DM group and the non-diabetic group. Table 2 shows that T2DM study subjects had significant higher serum TC LDL and TG than non-diabetic subjects. However, T2DM

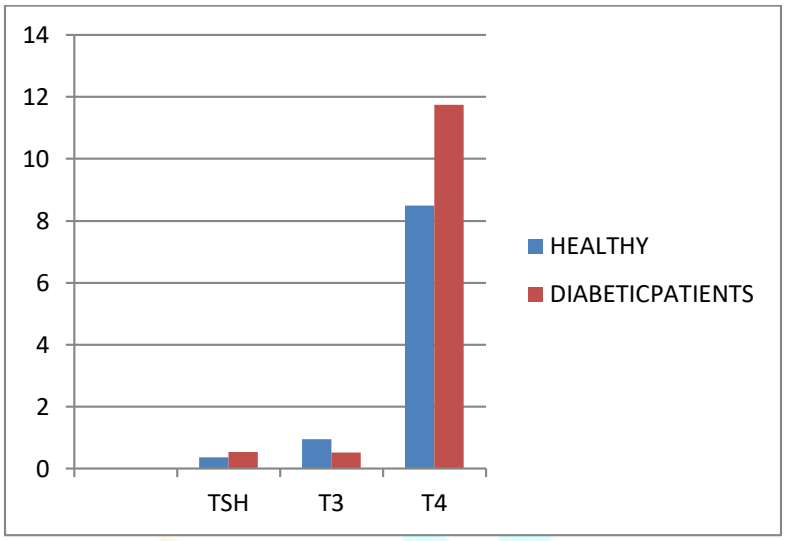
study subjects had significant were serum HDL. Than non-diabetics moreover, significant (P<0.05) were T3nd T4 and higher TSH were observed among T2DM than non-diabetic subjects (P<0.05).

S.NO.	PARAMETER	Group(A)(T2DM)	Group(B)(Non-Diabetic)	P-VALUE
1.	TC	142.46±31.07	119.833±31.6	0.007004048
2.	TG	132.1±33.66	117.313±21.512	0.048068261
3.	HDL	44.88±8.347	50.77±14.286	0.57359742
4.	LDL	702.71±22.558	88.78±21.224	0.016816201
5.	Fasting glucose	141.02±58.63	81.22±10.53	0.52123
6.	TSH	0.54±0.26	0.36±0.07	0.001335
7.	T3	0.51±0.12	0.94±0.53	0.000147
8.	T4	11.7535±352.605	8.49±6.27	0.055749

TABLE: 2 Biochemical characteristics of T2DM and non-diabetes study participants.



Graph2.1: Analysis of mean variance among case and control.



Graph2.2: Analysis of mean variance among case and control.

In Pearson correlation test, Table 3 shows that there were significant positive correlation between TSH and TG f T2DM study subjects and non-diabetes subjects.

S.NO	Tested parameter	Group(A)(T2DM)	Group(B)(Non-Diabetic)
		TSH(mlU/ml)	***TSH(mlU/ml)***
1.	TG	0.030525623	0.090756085

TABLE: 3 Pearson Correlation between TG and TSH among T2DM and non-diabetes study participants.

DISCUSSION:

Diabetic dyslipidemia is often characterized by high TC, high TG, low HDL cholesterol, and increased level of LDL. A lipid profile assessment in T2DM may be useful to reduce the risk of disease progression and also for early intervention. Diabetes mellitus (DM) and thyroid dysfunction (TD) often tend to coexist in patients. Both hypothyroidism and hyperthyroidism are more common in type 2 diabetes mellitus (T2DM) patients than in their nondiabetic counterparts.

The results showed that the TG in the high TSH group and the TSH group is higher than that of low TSH group. However, There were no significant differences in HDL-C, LDL-C, and TC among three groups (all P>0.05).There

weren't significant differences between HDL-C, LDL-C and TC (all P>0.05). The test that we performed is thyroid hormone test and the result showed that the TSH is highly significant. And there were no significant difference in T3 and T4.

Conclusion:-

Biochemical screening for plasma glucose is of paramount importance in all Type 2 diabetes mellitus patients, as well as in all patients with unexpected worsening of their lipid profile or vice versa because our data statistically suggest that the effect of plasma glucose is associated with lipid disorders that are characterized by increased Triglycerides level and decreased HDL, LDL, TC levels.

From this study, it can be concluded that fasting blood glucose level can be used as a invasive diagnostic, as well as a monitoring tool to assess the glycemic status of Type 2 diabetes mellitus patients.

From this study, it can be concluded that type 2 diabetes is most common in middle aged subjects. So, clinicians should remain highly suspicious in middle aged subjects with lipid profile for increase in atherogenic parameters which may enhance the risk for atherosclerosis leading to coronary artery disease.

Therefore, treatment and follow-up of type 2 diabetes mellitus patients should include the monitoring of lipid profile parameters in order to decrease the possible effect of changing in the level of these parameters on the risk of cardiovascular diseases in the patients of T2DM.

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