INTRODUCTION

Diabetes Mellitus (DM) and thyroid diseases are two common endocrinopathies seen in general population (Sathish and Mohan, 2003). Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to the absolute deficiency (type 1 diabetes) or relative deficiency of insulin (type 2 diabetes and gestational diabetes) with different other specific types due to the genetic defect of β-cell function or insulin, pancreatic diseases, drug induced, viral infections, increased production of hormonal antagonist to insulin and specific syndrome (ADA, 2007).

According to recent estimates approximately 285 million people worldwide (6.6%) in 20-79 year age group will have diabetes in 2010 and this is expected to rise to 438 million (7.8%) in 2030. With an estimated 50.8 million people living with diabetes, India will have world’s largest diabetes population followed by China and U.S with an estimated 43.2 and 26.8 million people respectively in 2010 (IDF, 2009).

Type 1 diabetes is an autoimmune disease where the host immune system destroys the insulin producing β-cells in the pancreas (Health Institute, 2009). This type of diabetes accounts for 10-15% of all people with the disease. It can appear at any age, although commonly under 40 and is triggered by environmental factors such as virus, diet or chemicals in people genetically predisposed. People with type 1 diabetes must inject themselves with insulin several times a day and follow careful diet and exercise plan.

Type 2 diabetes is the most common form of diabetes affecting 85-90% of all people with disease. This type of diabetes is characterized by insulin resistance and relative insulin deficiency (Bello-Sani et al., 2007). This disease is strongly genetic in origin but lifestyle factors such as excess weight, inactivity, high blood-pressure and poor diet are major risk factors for its development (Laakso and Letho, 1997).

Next to diabetes, thyroid disease is other common endocrine problem present in India. It is second only to diabetes as the most common condition to affect the endocrine system. Thyroid is a butterfly-shaped gland located in the neck just below the Adam’s Apple and above the collar-bone. It produces two hormones, thyroxin (T4) and triiodothyronine (T3) which enters the blood stream and affect the metabolism of the heart, liver, muscles and other organs.

Thyroid gland operates as a part of feed back mechanism involving the hypothalamus and the pituitary gland which are located in the brain. The hypothalamus secretes thyrotropin-releasing hormone (TRH), which stimulates the anterior pituitary gland to secrete thyrotropin or thyroid stimulating hormone (TSH). TSH increases iodide uptake and oxidation that leads to organification and coupling, which are necessary steps to produce the thyroid hormones T4 and T3. TSH also stimulates growth and vasculature of the
thyroid that could potentially lead to goiter if excessive. Of thyroid hormones secreted 90% is T₄ and 9% is T₃. T₃ is derived from deiodination of T₄; therefore 80% of circulating T₃ is obtained from T₄. Excessive T₄ and to a small degree T₃ circulating in the serum inhibits secretion of TSH and TRH, thereby completing the feedback cycle (Jennal, 2006).

There are two main disorders of thyroid gland, hypothyroidism or an under active thyroid gland and hyperthyroidism or an overactive thyroid gland (Porterfield, 1997). Deficiency of thyroid hormone during pregnancy time can lead to structural and physiological impairment resulting in brain damage or severe neurological impairment in neonates (Hossein et al., 2005). Children with hypothyroidism show bone maturation delays as well as delayed or absent puberty also show delayed lung maturation and stunted growth. Hypothyroidism in adults can lead to dullness, decreased reflexes, lethargy, delayed cognitive function and excessive sleep, as well as psychological disturbances.

In hypothyroidism, protein synthesis and protein degradation is decreased, which results in decrease percentage of protein body weight. Alternately, in hyperthyroidism there is increase in protein synthesis and degradation, resulting in wasting (Jamerson, 2001).

Thyroid disorders are widely common with variable prevalence among the different populations. In the Colorado study involving 25,862 participants attending a state health fair, 9.5% of the studied population were found to have an elevated TSH while 2.2% had a low TSH (Canaris et al., 2000). In the NHANES III survey on 17,353 subjects from the US population, hypothyroidism was found in 4.6% and hyperthyroidism in 1.3% of subjects (Hollowell, 2002). It is estimated that about 54 million people in India are having goiter, about 2.2 million having cretin and about 6.6 million children with mild neurology defects due to thyroid dysfunction. The incidence of both hyper and hypothyroidism are very high in women as compared to men (Ratio 10:1 for hyper and 20:1 for hypothyroidism).

It has long been known that thyroid hormones act differentially in liver, skeletal muscle and adipose tissue, the main targets of insulin action. While thyroid hormones oppose the action of insulin and stimulate hepatic gluconeogenesis and glycogenolysis (Raboudi et al., 1989, Weinstein et al., 1994) they up regulate the expression of genes such as GLUT-4 and phosphoglycerate kinase, involved in glucose transport and glycolysis respectively, thus acting synergistically with insulin (Clement et al., 2002, Viguere et al., 2002) in facilitating glucose disposal and utilization in peripheral tissues.

Thyroid disease is a pathological state that adversely affects diabetic control and is commonly found in most forms of DM which is associated with advanced age in type 2 diabetes and autoimmune disease in type 1 diabetes. DM appears to influence thyroid functions at two sites; firstly at the level of
hypothalamic control of TSH release and secondly at the conversion of T₄ to T₃ in the peripheral tissue. Marked hyperglycemia causes reversible reduction of the activity and hepatic concentration of T₄-5 deiodinase, low serum concentration of T₃, elevated levels of reverse T₃ and low, normal or high levels of T₄ (Shah, 2007).

Hyperthyroidism may be present in diabetic patients with or without thyroid enlargement in the presence of unexplained weight loss, supraventricular tachycardia, increased body temperature, heat intolerance, tremor, unexplained increase in insulin requirement, ketoacidosis and uncontrolled diabetic state despite strict antidiabetic treatment (Kozak and Coopan, 1997). In addition to hyperthyroidism, poor glycemic control can produce similar features such as weight loss and fatigue. Severe diabetic nephropathy can be mistaken for hypothyroidism because patients may have edema, fatigue, pallor and weight gain (Ayala et al., 2000). Sulfonylurea has an important goiterogenic affect on thyroid gland and this may affect the prevalence of goiter in diabetic patients (Granner, 2000).

In euthyroid diabetic patient serum T₃ levels and basal TSH levels with its response to TRH is influenced by glycemic status and poorly controlled diabetes may induce reversible ‘low T3 state’ (Donckier, 2003). Hyperthyroidism is diabeticogenic factor and long term thyrotoxicosis has been shown to cause B-cell dysfunction. In hypothyroidism there is reduction in the rate of glucose absorption. gluconeogenesis and glucose production (and utilization) and glycogen synthesis (and degradation) leading to increased glycogen level. Additionally, insulin half-life will be prolonged with increase in its level and reduction in insulin requirement. Glucose level will be stabilized during treatment of hypothyroidism but the risk of recurrent hypoglycemia will increase if insulin dose is not decreased. In hyperthyroidism there is elevation in the rate of glucose absorption, production (and utilization) and glycogen synthesis (and degradation) leading to decreased glycogen level (Donckier, 2003) but insulin resistance, degradation and requirements are increased and there is increased secretion with exaggerated effects of glycogen and adrenaline on the liver. All these changes may lead to diabetic ketoacidosis in state of insufficient insulin supply.

The NHANES III observed an increased frequency of thyroid dysfunction with advancing age and a higher prevalence of thyroid disease in women compared to men and in diabetic subjects compared to non diabetic (Hollowell et al., 2002). Several reports documented a higher than normal prevalence of thyroid dysfunction in the diabetic population. Perros et al. (1995) demonstrated an overall prevalence of 13.4% of thyroid diseases in diabetics with highest prevalence in type 1 female diabetics (31.4%) and lowest prevalence in type 2 male diabetic (6.9%). 16% of Saudi patients with type 2 diabetic were found to have thyroid dysfunction (Akbar et al., 2006). In Jordan, a study reported that thyroid dysfunction was present
in 12.5% of type 2 patients (Radaideh et al., 2004). However, thyroid disorders were found to be more common in subjects with type 1 diabetes compared to those with type 2 diabetes. Since type 1 diabetes also has autoimmunity as a pathophysiological detonator it is not unusual to find patients with concomitant diabetes and thyroid dysfunction. Some genetic factors might contribute to the co-occurrence of autoimmune thyroid diseases (AITD) and type 1 diabetes (Pearce and Merrimam, 2009). More over the association between type 1 diabetes and AITD is considered one of the variants of the autoimmune polyglandular syndrome.

Thyroid hormones are insulin antagonistic, both insulin and thyroid hormones involved in cellular metabolism and excess or deficit of any one can result in functional derangement of the other (Sugrue et al., 1999).

The relationship between diabetes mellitus and thyroid dysfunction has not been extensively studied in Punjab although the prevalence of diabetes mellitus is very high and increasing. Due to the lack of adequate information about the two conditions preventive management is difficult to play and yet there could be many diabetic patients who may have thyroid dysfunction which may greatly affect their glycemic control. Malfunctions like thyroid diseases, lipid abnormalities, renal diseases, liver diseases which can occur in diabetes mellitus and that cause metabolic disturbances can further complicate management of patients and escalate the cause of diabetes mellitus treatment. For all these reasons we will study the prevalence of thyroid disorders, levels of lipid abnormalities, renal abnormalities, liver abnormalities among Punjabi diabetic population. Estimation of lipid abnormalities needs to be targeted because persistence hyperglycemia causes glycosylation of all proteins especially collagen, cross-linking and matrix proteins of arterial wall which eventually causes endothelial cell dysfunction contributing further to atherosclerosis. Atherosclerosis is the most common complication of the diabetes mellitus with largest number of ischemic events occurring in people with type 2 diabetes. However the risk of atherosclerosis is also high in type 1 diabetes and may manifest at younger age. Coronary heart disease is a major cause of death in patients with type 1 diabetes. Early detection of renal functions in subjects with diabetes is of vital importance as appropriate interventions have been shown to retard the progression of end stage renal disease and chronic kidney diseases which are the major public health problems in subjects with diabetes. Estimation of liver diseases among diabetes is necessary because liver pathology among diabetes is similar to that of alcoholic liver disease, including fatty liver, steato hepatitis, fibrosis and cirrhosis. Elevated serum activity of two enzymes, serum glucomate oxaloacetate transaminase and serum glutamate pyruvate transaminase is the most frequently measured indicators of liver disease and occur in diabetes more frequently than in general population.
Keeping the above in view the objectives of the present study will be

I. To estimate & compare the levels of thyroid hormones (T3, T4, FT3, FT4 and TSH) in diabetics (Type 1 and Type 2) and non diabetics subjects.

II. To evaluate the prevalence of thyroid dysfunctions in diabetic and non diabetic control subjects not previously diagnosed having thyroid dysfunction.

III. To investigate diabetic related complication (dyslipidemia, renal function & liver function) in the targeted group population.

IV. To evaluate the association between thyroid dysfunction, lipid profile, renal disorders, liver disorder and glycosylated hemoglobin in diabetic subject.

V. To investigate the correction between HbA1C and thyroid hormones, lipid profile, renal profile and liver function.

**REVIEW OF LITERATURE**

**Diabetes mellitus and thyroid**

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.

Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the β-cells of the pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. The basis of the abnormalities in carbohydrate, fat, and protein metabolism in diabetes is deficient action of insulin on target tissues. Deficient insulin action results from inadequate insulin secretion and/or diminished tissue responses to insulin at one or more points in the complex pathways of hormone action. Impairment of insulin secretion and defects in insulin action frequently coexist in the same patient, and it is often unclear which abnormality, if either alone, is the primary cause of the hyperglycemia. Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, sometimes
with polyphagia, and blurred vision. Impairment of growth and susceptibility to certain infections may also accompany chronic hyperglycemia. Acute, life-threatening consequences of uncontrolled diabetes are hyperglycemia with ketoacidosis or the nonketotic hyperosmolar syndrome. Long-term complications of diabetes include retinopathy with potential loss of vision; nephropathy leading to renal failure; peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal, genitourinary, and cardiovascular symptoms and sexual dysfunction. Patients with diabetes have an increased incidence of atherosclerotic cardiovascular, peripheral arterial, and cerebrovascular disease. Hypertension and abnormalities of lipoprotein metabolism are often found in people with diabetes.

The vast majority of cases of diabetes fall into two broad etiopathogenetic categories (type 1 and type 2). In type 1 diabetes, the cause is an absolute deficiency of insulin secretion. Individuals at increased risk of developing this type of diabetes can often be identified by serological evidence of an autoimmune pathologic process occurring in the pancreatic islets and by genetic markers. In type 2 diabetes which is much more prevalent, the cause is a combination of resistance to insulin action and an inadequate compensatory insulin secretory response. In the latter category, a degree of hyperglycemia sufficient to cause pathologic and functional changes in various target tissues, but without clinical symptoms, may be present for a long period of time before diabetes is detected. During this asymptomatic period, it is possible to demonstrate an abnormality in carbohydrate metabolism by measurement of plasma glucose in the fasting state or after a challenge with an oral glucose load.

Occasionally other endocrine disorders such as abnormal thyroid hormone levels are found in DM. The thyroid gland plays, a pivotal role in tissue metabolism and development, and in doing so affects various organ systems.

Thyroid stimulating hormone (TSH) secreted by the thyrotrone cells of the anterior Pituitary, plays a pivotal role in the control of the-thyroid axis and serves as the most useful physiologic marker of thyroid hormone action. TSH is a 31-kDa Hormone composed of α and β subunits; the α subunit is common to the other glycoprotein hormones such as luteiuing hormone, follicle-stimulating hormone, human chorionic gonadotropin (hcg), whereas the TSH β subunit is unique to TSH. The extent and nature of carbohydrate modification are modulated by thyrotrophin-releasing hormone (TRH) stimulation and influence the biologic activity of the hormone. The thyroid axis is a classic example of an endocrine feedback loop. Hypothalamic TRH stimulates pituitary production of TSH, which, in turn, stimulates thyroid hormone synthesis and secretion. Thyroid hormones feed back negatively to inhibit TRH and TSH production.
STUDIES ON TYPE 1 DIABETES AND THYROID DYSFUNCTION

Cardoso et al. (1995) determined thyroid function and the prevalence of thyroid autoimmunity in IDDM Africans and the results were compared with those of a non diabetic group and a group with non-insulin-dependent diabetes mellitus (NIDDM). Thyroid hormone levels were significantly lower in IDDM patients than in the control population and the NIDDM population. Subclinical hypothyroidism was present in 21% of the 28 IDDM patients, whereas one patient was hypothyroid and another hyperthyroid. Of the 60 NIDDM patients, 5 (8.3%) had subclinical hypothyroidism. Forty-six percent of the IDDM patients had significant levels of serum thyroid autoantibodies (TAAB). This was significantly higher than the 1.4% and 1.7%, respectively in the controls and NIDDMs. Presence of TAAB in the patients was strongly associated with thyroid dysfunction, female preponderance, and duration of diabetes mellitus.

Lorini et al. (1996) assessed Th-Ab thyroid autoantibodies (MsA and TgA) cross-sectionally in 212 children and adolescents (93 girls and 119 boys) aged 1.2-21 years with IDDM from 0-18 years, and longitudinally in 90/212 (43 girls and 47 boys) at diagnosis and during a 3-10 year follow-up. In the cross-sectional study, the found that Th-AAb were present in 22/93 girls (23.7%) and 13/119 boys (10.9%). In the longitudinal study Th-AAb were observed at diagnosis in 6 patients, and during the follow-up in 9 girls. In 11/15 Th-AAb positive patient’s anti-nuclear antibodies were also present. Thyrotoxicosis also occurs with increased frequency in diabetic children than in the general population.

Chang et al. (1998) in their study among 243 type 1 diabetic patients found, 53 (21.8%) were positive for antiTPO. Among the type 1 diabetic patients with thyroid autoimmunity, anti-TPO tended to occur in those of older age or with long-standing disease. The frequency of anti-GAD was 45.6% (99 of 217), without gender preponderance (males: females, 18.0% vs 27.6%). Thus the reported that the presence of anti-TPO in 21.8% of type 1 diabetic patients confirmed the strong association of ATD and type 1 diabetes mellitus without ethnic differences.

Maugendre et al. (2000) during their study showed that thyroperoxidase (TPO) antibodies were present in 45 of the 258 diabetic patients (17%) whereas thyroglobulin (Tg) antibodies were found in 19 patients (7%), including 13 cases with TPO antibodies. They found that prevalence of TPO antibodies was not influenced by such factors as gender, duration of disease, age at screening and at diabetes diagnosis, positivity of familial history. Thyroglobulin (Tg) antibodies were found in 19 patients (7%), including 13 cases with TPO antibodies. All patients without TPO antibody (n=213), including Tg-positive patients displayed TSH values in normal range. From the 45 TPO-positive patients, They studied 11 shows thyroid dysfunction. During their 5-year follow-up, only 2/45 patients became anti-TPO negative whereas thirteen of the 45
In a study by Rattarasarn et al. (2000), 50 Thai type 1 diabetic patients were examined for thyroid autoimmunity. Thyroglobulin (Tg-Ab) and thyroproxidase antibodies (TPO-Ab) were positive in nine (18%) and 15 (30%) patients respectively, whereas eight patients (16%) were positive for both antibodies. None of 34 patients without thyroid antibodies had thyroid dysfunction. They followed up eight patients with positive thyroid antibodies but without clinical thyroid dysfunction and 21 patients without thyroid antibodies for up to 3 years and found that two patients of the first group developed hypothyroidism, whereas none of the latter developed thyroid dysfunction.

Kordonouri et al. (2002) reported the results of 7097 type 1 diabetic patients and found that in 1,530 patients, thyroid antibody levels were elevated on at least one occasion, whereas 5,567 were antibody-negative during the observation period. Thyroid-stimulating hormone (TSH) levels were higher in patients with thyroid autoimmunity (3.34 pU/ml, range 0.0-615.0 pU/ml) than in control subjects (1.84 pU/ml, range 0.0-149.0 pU/ml) (P < 0.001). Even higher TSH levels were observed in patients with both anti-TPO and anti-TG (4.55 uU/ml, range 0.0-197.0 pU/ml). Thus, they found that thyroid autoimmunity seems to be particularly common in girls with diabetes during the second decade of life and may be associated with elevated TSH levels, indicating subclinical hypothyroidism.

Umpierrez et al. (2003) in cross-sectional studies have reported that risk of thyroid dysfunction in patients with type 1 diabetes is two to threefold higher than in the general population. They analyzed the incidence of thyroid dysfunction over time in a cohort of 58 patients (26 men and 32 women) and prospectively followed for 18 years and reported that 18 patients had hypothyroidism, and 1 patient experienced transient hyperthyroidism. They found that hypothyroidism was more common in female (41%) than in male (19%) subjects and in patients with positive TPO antibodies. Patients who were TPO positive were 17.91 times as likely to develop hypothyroidism as patients who were TPO negative (95% CI 3.89-82.54). There were no differences in BMI, lipid profile, and HbA1c between patients with and without thyroid dysfunction.

Shomon (2003) have confirmed the linkage between autoimmune thyroid disease and type 1 diabetes, suggesting that diabetes patients should receive regular screening for thyroid dysfunction.

Hawa et al. (2006) in their study evaluated disease-associated autoantibodies in both type 1 diabetes and thyrotoxicosis attending the Central Hospital of Yaounde in Cameroon. The collected samples from a total of 101 subjects, 47 of whom clinically had established type 1 diabetes, 18 had thyrotoxicosis and 36 normal
subjects and tested for diabetes-associated glutamic acid decarboxylase (GAD) and tyrosine phosphatase (IA2) autoantibodies, thyroiditis-associated thyroglobulin (Tg) and thyroid peroxidase (TPO) autoantibodies. They reported that out of 47 patients with type 1 diabetes, 16 (34%) had GAD autoantibodies (Abs), 3 (6.4%) had IA2 Abs, and 2 (4.3%) had TPO Abs. Of 18 patients with thyrotoxicosis 4 (22.2%) had GAD Abs, 5 (27.8%) showed IA2 Abs, while 8 patients (44.4%) were TPO Abs positive. No patients in either group had Tg Abs. Among normal subjects, 2 (5.6%) showed GAD Abs, and one of these was also IA2 Abs positive, but none had thyroid autoantibodies.

Volzke et al. (2007) studied the spectrum of thyroid disorders in 224 adult type 1 diabetic subjects and compare them with results obtained from a sample of 3481 general adult population. The concluded that type 1 diabetic subjects had a higher risk of known thyroid disease, a lower risk of goiter and nodules and a higher risk of anti-TPO-Ab >200 IU/mL compared to the reference population. Furthermore, diabetic subjects had lower serum FT3 levels than the non-diabetic references.

Araujo et al. (2008) investigate the prevalence of thyroid autoantibodies in 214 children, adolescents, and young adult with type 1 diabetes from north eastern Brazil as well as their significance for the development of thyroid disorder. They found that anti-TPO antibody test was positive in 54 out of the 214 patients studied, resulting in an overall prevalence of 25.2%, with females were predominance (72%) over males (28%). A total of 55.5% patients with positive anti-TPO antibodies had abnormal TSH levels. Korner et al. (2008) investigate the prevalence of thyroid autoimmunity as well as the frequency of autoimmune thyroid disease in patients with type 1 diabetes mellitus and compare the prevalence of autoimmune thyroid disease in patients with type 1 diabetes mellitus and in those with type 1 diabetes mellitus and celiac disease. Their results concluded that frequency of autoantibody positivity was significantly higher in diabetic patients suffering from celiac disease (type 1 diabetes mellitus: 43 (16%), type 1 diabetes mellitus + celiac disease: 16 (33.3%, p < 0.01). Hypothyroidism due to thyroiditis was also more prevalent in patients with type 1 diabetes mellitus and celiac disease.

Monajemzadeh et al. (2009) investigated the prevalence of thyroid dysfunction among children and adolescents with newly diagnosed type 1 diabetes in Iran for which they had compared 75 newly diagnosed type 1 diabetic subjects with 105 healthy control children. They reported the prevalence of thyroid dysfunction in diabetics was 14.6% (9.3% were subclinical hypothyroidism, 4% hypothyroidism and 1.3% subclinical hyperthyroidism) which were higher than normal controls.
STUDIES ON TYPE 2 DIABETES AND THYROID DYSFUNCTION

Bazrafshan et al. (2000) in their study of 210 type 2 diabetics assessed the relationship between thyroid dysfunction and NIDDM. They observed disorders included goiter (30%), sub-clinical hypothyroidism (13%), clinical hypothyroidism (4%), and clinical hyperthyroidism (0.5%). They divided the patients into two groups according to HbA1c: Group 1 with HbA1c<8 and group II with HbA1c≥8 and found that a significant difference was observed in TSH serum concentration between group I and II whereas the concentration of T4 and T3 were not significantly different between the two groups. The mean concentration of HbA1c in patients with hypothyroidism was significantly higher than those that of non-hypothyroid subjects. A significant positive correlation was observed between HbA1c concentration and TSH levels by them.

Bal et al. (2003) studied 184 cases of DM-II without known clinical thyroid disease for assessing the thyroid dysfunction and tried to correlate it with complications of DM-II. They found that thyroid diseases were present in 78 (40.4%) cases (50 males, 28 females), but autoimmune thyroiditis were present in 32 (17.4%) cases (8 males, 24 females). There was positive correlation with age of patient in TD group but no correlation was found with complication of diabetes.

Radaideh et al. (2004) investigated the prevalence of thyroid dysfunction and autoimmunity in 908 type 2 diabetic patients and compared with 304 non-diabetics, of those 282 had performed thyroid antibodies. They reported the overall prevalence of thyroid disease to be 12.5% out of which fifty-three (5.9%) of diabetic patients were known to have thyroid disease, and five-nine (6.6%) new thyroid disease cases were diagnosed with most common cases were of subclinical hypothyroidism (4.1%). In the control group, the prevalence of thyroid disease was 6.6% with most common cases were also of subclinical hypothyroidism (5%). Positive TPOab was found in 8.3% of T2DM patients (N=600) versus 10.3% in the control group (N=282). Positivity for both TPOab and Tgab was found to be 2.5% of T2DM versus 6% of the control subjects.

Pimenta et al. (2005) evaluated thyroid function and morphology in all diabetic outpatients and reported that the diabetic patients (n=256) differed from controls (n=75) by presenting a greater frequency of thyroid disorders (51.6% vs. 38.7%; P<0.05). In diabetic patients with thyroid disorders there was a higher frequency of women. Thus they thyroid evaluations in all diabetic patients.

Akbar et al. (2006) investigated the association between thyroid dysfunction and thyroid autoimmunity in 100 Saudi type 2 diabetics 100 age- and sex-matched controls. They reported that GAD65ab were found in 26% diabetics and 2% controls, thyroid autoimmunity were detected in 10% diabetics vs. 5% controls.
while thyroid dysfunction was found in 16% and 7% respectively in GAD65ab-positive diabetics, thyroid autoimmunity was observed in 27% vs. 4% GAD65ab-negative diabetics and thyroid dysfunction was reported in 42% and 7% respectively.

Udiong et al. (2007) determine the incidence of abnormal thyroid hormone levels in diabetics in Calabar, Nigeria for which they selected 161 diabetic subjects and 105 non-diabetic controls. The reported TSH levels (1.80 ± 1.62) in diabetics were significantly lower (p=0.016) than the level in non-diabetic controls (2.34 ± 1.24). Male diabetics had lower (p < 0.05) levels of TSH (1.192 ± 0.68 mIU/ml) than diabetic females (1.90 ± 1.70 mIU/ml). The level of T3 in diabetic males (125 ± 97ng/ml) was higher than the level in females (98 ± 75ng/dl). The reported a high incidence (46.5%) of abnormal thyroid hormone levels among the diabetics in Nigeria (hypothyroidism 26.6%, hyperthyroidism, 19.9%) with prevalence of hypothyroidism was higher in women (16.8%) than in men (9.9%), while hyperthyroidism was higher in males (11%) than in females (8%).

Pashupati et al. (2008) investigated the effect of diabetes mellitus on thyroid hormone levels and other biochemical variables. They reported significant increase in the levels of blood glucose, HbA1C, serum cholesterol, triglyceride, low-density lipoprotein (LDL-C), very low-density lipoprotein (VLDL-C), urea, creatinine, and microalbuminurea was observed in diabetic patients compared to non-diabetic subjects whereas the levels of total protein, albumin, and high-density lipoprotein (HDL-C) were significantly decreased in diabetics. Moreover the level of TSH was significantly decreased whereas the levels of T4 and FT4, were significantly increased in diabetic patients compared to control subjects. However, the T3 and FT3 levels did not differ significantly between groups. The reported 28% had low plasma thyroid hormone levels, 17% had high thyroid hormone, and 55% had euthyroid levels.

Islam et al. (2008) investigated thyroid hormone levels in fifty-two uncontrolled diabetic patients and fifty controls subjects. They reported Patients with type 2 diabetes had significantly lower serum FT3 levels compared to the control group but no significant differences observed in serum FT4 and TSH levels between the control and study subjects.
MATERIAL and METHODS

Source of samples

The subjects for present study will be selected from the cases presenting with diabetes mellitus in the outpatient departments of medicine in civil hospitals of Amritsar, Jalandhar and Kapurthala.

Inclusion criteria

The study will be divided into two groups as diabetic and non diabetic groups.

a. Diabetic – 100 diabetic (20 type 1 and 80 type 2) aged between 17-57 years either previously or newly diagnosed subjects will be included in the study.

b. Non diabetic – 100 healthy non diabetic subjects aged between 18-58 years.

Exclusion criteria

a. Patient suffering from any type of thyroid diseases such as hypo and hyperthyroidism.

b. Patient suffering from any type of rheumatoid arthritis, tuberculosis, collagen diseases, liver diseases, renal diseases, cardiac failure and gout.

c. Very ill patients with complication of diabetes mellitus.

Investigations want to perform

Routine

1. Haemoglobin (Hb) %, Total Leucocyte Count (TLC), Differential Leucocyte Count (DLC)

2. Blood Urea and Serum Creatinine

3. Serum Glutamate Oxaloacetate Transaminase (SGOT) and Serum Glutamate Pyruvate Transaminase (SGPT)

4. Lipid Profile

Diabetes Related

1. Fasting plasma glucose (FPG) level.

2. Glycosylated Haemoglobin (HbA1C)
Thyroid Related

1. Total triiodothyronine (T₃)
2. Total Thyroxine (T₄)
3. Free triiodothyronine (FT₃)
4. Free thyroxine (FT₄)
5. Thyroid stimulating Hormone (TSH)

References


