INTRODUCTION

Diabetes mellitus is the most common endocrine metabolic disorder. It is a chronic condition, characterized by hyperglycemia due to impaired insulin secretion with or without insulin resistance. The thyroid disease is common in general population and the prevalence increases with age. Hypothyroidism is by far the most common thyroid disorder in the adult population. It is usually autoimmune in origin, presenting as either primary atrophic hypothyroidism or Hashimoto’s thyroiditis. Thyroid diseases affect approximately 10 – 15 % of the patients with diabetes, whereas in non-diabetics, the prevalence is approximately 6 % because patients with one organ-specific autoimmune disease are at risk of developing other autoimmune disorders. Both have been shown to mutually influence each other and associations between both conditions have long been reported. On one hand, thyroid hormones contribute to the regulation of carbohydrate metabolism and pancreatic function, and on the other hand, diabetes affects thyroid function tests to variable extents.

Thyroid disease negatively affects diabetes control and has the tendency to affect patient treatment and the diagnosis of thyroid dysfunction in diabetic patients can be difficult. Poor glycemic control can produce features similar to hyperthyroidism, such as weight loss despite increased fatigued and appetite. On the other hand, severe diabetic nephropathy can be mistaken for hypothyroidism because patients with this condition may have edema, pallor, weight gain. Thyroid disease is found in most forms of diabetes especially in Type 2 DM and underlying autoimmune disease in Type 1 DM. The physiological and biochemical interactions between Insulin and the influence of both Insulin and Iodothyronines on the metabolism of carbohydrates, proteins and lipid are recorded. Such records indicate that Iodothyronines are insulin antagonist with high levels being diabetogenic, while the absence of the hormone inhibits the development of DM and hyperthyroidism which are metabolic disorders that affect the levels of carbohydrates, proteins and lipids. Thyroid gland secretes 2 iodine containing hormones: thyroxine (T4) and triiodothyronine (T3). The iodine necessary for the synthesis of these molecules comes from food or iodide supplements. Iodide ion is actively taken up by and highly concentrated in the thyroid gland, where it is converted to elemental iodine by thyroid peroxidase. The protein thyroglobulin serves as a scaffold for thyroid hormone synthesis. Thyroxine residues in thyroglobulin are iodinated to form moniodotyrosine (MIT) or diiodotyrosine (DIT) in a process known as iodine organification within thyroglobulin, 2 molecules of DIT combine to form T4 while 1 molecule each of MIT and DIT combine to form T3. Proteolysis of thyroglobulin liberates the T4 and T3, which are then released from the thyroid, after release T4 and T3 are transported in the blood by thyroxine-binding globulin, a protein synthesized in the liver. Thyroid function is controlled by the pituitary through the release of TSH. The ratio T4 : T3 secreted by the thyroid gland is approximately 10 : 1 consequently the gland secretes approximately 80 - 100 mcg of T4 and 10 mcg of T3 per day. However, only 10 % of circulating T3 is derived from direct thyroid secretion, the remaining 90 % being produced by peripheral conversion from T4. T4 can therefore be considered a pro-hormone that is converted in peripheral tissues (liver, kidney, brain) either to the active hormone T3 or to the biologically inactive reserve T3 in the circulation the hormones exist in both the active free and inactive protein bound forms. T4 is 99.98 % bound, with only 0.02 % circulating free. T3 is slightly less protein bound (99.8 %), resulting in a considerably higher circulating free fraction (0.2 %). The T4 and T3 are also eliminated by biliary secretion of their glucuronide and sulfate conjugates (15 – 20
%). The half-life of T₄ in plasma is about 6 - 7 days and that of T₃ 24-36 h in euthyroid adults. The apparent volume of distribution for T₄ is about 10 liters and for T₃ about 40 liters. Hence, we made an attempt to find the prevalence of thyroid dysfunction in type 2 DM patients which can help the medical practitioner to treat the patients with high glucose value.

MATERIALS AND METHODS
An Institutional Ethical committee clearance was obtained to conduct the study. We recruited Type 2 DM who were receiving insulin’s, anti diabetic drugs with more than 5 years of history of DM, and confirming with fasting plasma glucose levels of > 110 mg/dl on more than two occasions, who visited the medicine outpatient department at KIMS Hospital, Bangalore, India were screened and taken into the study after explaining about the study followed by taking the informed consent from the participants. The recruited Type 2 DM patient’s data were recorded in a well-designed data collection form. Blood sample was drawn with the help of nurse at outpatient department for TSH analysis and the same obtained value was recorded. Type 2 DM patient’s aged between 40 to 65 years with duration of more than 5 years of diabetics and on treatment with or without co-morbid complications where included in the study. Patients who were unable to give the informed consent, drug induced DM, very ill patients, known history of thyroid dysfunction and on treatment or had undergone thyroidectomy were excluded from the study.

Preparation of Data Collection Form
Well-designed data collection form was prepared and the required information was extracted from outpatient’s information sheet which includes all the detail of the patients like demographic data such as age, gender, weight, Blood pressure (B.P), personal history, family history, and medication history. Habits like smoking, alcohol consumption, food habits and menopausal status, if required. Past medical history, regarding the age at which patients was diagnosed of diabetes, the presence of cardiovascular disease, the presence of diabetic complications were recorded. Body Mass Index (BMI), have been calculated by obtaining the height (cm) (without shoes), body weight (kg) of the patients. Family history was also taken to know their prevalence of thyroid dysfunction, if any.

Collection of Blood Samples
After screening the type 2 DM patients by the medical practitioner the study was explained in their understandable language and informed consent was obtained to participate in the study. Blood samples for TSH were drawn after minimum of 8 - 10 h of fasting with the help of nurses from nursing station in outpatient department. The blood samples were sent to the NABL accredited laboratory for measuring the TSH value and the same was recorded into the data collection form.

RESULTS

As we have shown in Figure 1, we found that out of 30 hyperthyroid patients, 14 (6.27 %) female patient were in the age group of 40 - 60 years and only three (1.28 %) female patients were in the age group more than 60 years. We also found that in our study population, only 12 (5.38 %) male patients aged between 40 - 60 years and only one (0.44 %) male patient in the age group more than 60 years had Hyperthyroidism.

As we have shown in Figure 2, it was found that 17 (7.62 %) female patient were in the age group of 40 - 60 years and only one (0.44 %) female patients were in the age group more than 60 years. We also found that in our study population only five (2.24 %) male patient aged between 40 - 60 years and one (0.44 %) male patient in the age group more than 60 years had Hypothyroidism.

As we have shown in Figure 3, it was found that out of 223 patients recruited for the study, 169 (75.78 %) patients were found to have normal TSH values and the remaining 54 (24.21 %) patients were diagnosed to have thyroid dysfunction. Among which 30 patients (13.45 %) had

Figure 1: Age and Sex Distribution in Hyperthyroidism

Figure 2: Age and Sex Distribution in Hypothyroidism

Figure 3: TSH Value Distribution

Hyperthyroidism and 24 patients (10.76%) had Hypothyroidism, according to the obtained value.

**Figure 4: Treatment Pattern for Hypothyroidism in Type 2 Diabetes Mellitus Patients in both genders**

As we have shown in Figure 4, it was found that out of 24 patients suffering from Hyperthyroidism, 14 (58.33%) patients were treated with Levothyroxine and six (25%) patients with Tri-iodothyronine and the remaining four (16.66%) patients with the combination of Levothyroxine and Tri-iodothyronine.

**Figure 5: Treatment Pattern for Hyperthyroidism in Type 2 Diabetes Mellitus Patients in both genders**

As we have shown in Figure 5, it was found that out of 30 patients suffering from Hyperthyroidism, nine (30%) patients were treated with Propyl Thiouracil (PTU), 14 (46.66%) patients with Carbimazole and the rest seven (23.33%) patients with the combination of Propyl Thiouracil (PTU) and Carbimazole.

**DISCUSSION**

Study was done to get an overview of the current trends in thyroid dysfunction in patient with Type 2 DM that have been recruited at outpatient department of Medicine, KIMS Hospital Bangalore, India. In our study the prevalence of thyroid dysfunction in female population was more than male population and this was correlated with other studies conducted by Gurjeet Singh, et al; Saiful Islam, et al; Athanasia Papazafiropoulou, et al; Radaideh AR, et al; Mirella Hage et al. In these studies they found that diabetic patients had a high prevalence of thyroid disorders when compared with the general population, with female being more dominant than male. Our study included 223 diabetic patients among whom 124 (55.60%) patient were found to be male and 99 (44.32%) patients were female. Majority of patient 192 (86.09%) were in the age group of 40 - 60 years, followed by 31 (13.2%) patients of more than 60 years. Hypothyroidism was found to be more in female than males with the distribution of 18 (8.07%) in female patients compared with six (2.69%) in male patients, which is in agreement with the study conducted by Athanasia Papazafiropoulou, et al. In this study it was found out that the prevalence of subclinical hypothyroidism was 5.2% in male and 8.4% in female with Type 2 DM which is more dominant in female population. Our study population had the average Body Mass Index of 24.44 with average systolic of 124 mm/Hg and diastolic of 85 mm/Hg. It was found that out of 24 patients suffering from Hyperthyroidism, 14 patients were treated with Levothyroxine, six patients with Triiodothyronine and four patients with combination of Levothyroxine and Tri-iodothyronine. In case of patient suffering from Hyperthyroidism, it was found that out of 30 patients, nine patients were treated with Propyl-thiouracil, 14 patients with Carbimazole and seven patients with combination of Propyl thiouracil and Carbimazole. Our study showed that 17 (7.62%) female patient suffering from hypothyroidism were in the age group of 40 - 60 years and only one (0.44%) female patients were in the age group of more than 60 years. We also found that only five (2.24%) male patients aged between 40 - 60 years and one (0.44%) male patient in the age group of more than 60 years, which is in accordance with the study conducted by Mohammad Afkhami-Ardakani, et al. the prevalence of thyroid dysfunction is more in the age group of 45 - 55 years. Hyperthyroidism was also found to be more in female than in male with the gender distribution of 17 (7.62%) in female patients when compared with 13 (5.82%) in male patients which is in accordance with the result obtained from studies conducted by Dr. P. Pasupathi., et al. in the report of underlying study, it has been mentioned that female has higher prevalence of hyperthyroidism in comparison with male. Out of 223 Type 2 DM patients recruited 169 (75.78%) patients were found to have normal TSH values and the remaining 54 (24.21%) patients were diagnosed to have thyroid dysfunction. Among which 30 patients (13.45%) had hyperthyroidism and 24 patients (10.76%) had hypothyroidism that is in accordance with the study conducted by Engin Guney, et al., where they also showed a higher incidence of hyperthyroidism (1.5%) compared to hypothyroidism (1.1%).13 We also collected the data related to the duration of Type 2 DM in the patient recruited and found that average duration of Type 2 DM was found to be about 7.45 years, which is in agreement with the reports of Engin Güney., et al., in his study found that thyroid dysfunction has higher incidence rate in patient having 8.9 years of DM.

**Limitation**

Diabetic control was not assessed by the percentage of glycated Hemoglobin (HbA1C) in our study; thereby we could not show any correlation between diabetes control and thyroid hormone level after the duration of anti thyroid drugs. It was a short duration of study and the study population was comparably less to conclude any prevalence study. We could not also assess the medication adherence for anti thyroid drugs in recruited type 2 DM patients, because of the less duration of study.

**CONCLUSION**

Thyroid dysfunction is one of the reasons for poor glycemic control in diabetic patients. Under or inadequate treatment of thyroid dysfunction can negatively impact on the diabetics control. Hence, with these type of prevalence studies will...
help for better treatment of Type 2 DM with thyroid dysfunction. Therefore, regular screening for thyroid abnormalities in all diabetic patients will allow early treatment of subclinical thyroid dysfunction.

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REFERENCES

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