Research Paper
*Impact Factor - **2.262***
Peer Reviewed Journal

IJMDRR
E- ISSN –2395-1885
ISSN -2395-1877

A COMPARATIVE STUDY AMONG TYPE-2 DIABETICS AND NON-DIABETICS TO STUDY THE HYPOTHYROID STATUS IN A TERTIARY MEDICALCARE CENTRE

Ms. Maneesha P.,[1] Dr. Vijatha Thomas,[2] Dr.PrasadaRao N.,[3] Dr.Arun T Mithrason[4]
[1] *II MBBS, Karpagam Faculty of Medical Science & Research, Coimbatore.*
[2] *Assistant Professor, Department of Biochemistry, Karpagam Faculty of Medical Science & Research, Coimbatore.*
[3] *Professor & HOD, Department of Biochemistry, Karpagam Faculty of Medical Science & Research, Coimbatore.*
[4] *Associate Professor, Department of Community Medicine, Karpagam Faculty of Medical Science & Research, Coimbatore.*

Abstract
This study was done to compare the hypothyroid status of type-2 diabetics with non-diabetics. Sixty subjects were included in the study attending diabetic clinic / medicine opin Karpagam Faculty of Medical Sciences and Research hospital, Coimbatore. Study subjects were divided into 2 groups. Group I consisted of 30 known diabetics (type-2) with fasting blood glucose level more than 126 mg/dL, on treatment. Group II consisted of 30 healthy subjects with fasting blood glucose level below 110 mg/dL. After getting informed consent, blood samples were collected for estimation of fasting blood glucose, TSH, T_3 and T_4 level.50% of subjects in group I had hypothyroidism, of which, 23.3% had overt hypothyroidism and 26.7% had subclinical hypothyroidism. No case of hyperthyroidism was reported in either group. Significantly higher levels of TSH were seen in our study, when group I and group II subjects were compared (p value- 0.01). No significant correlation was seen between fasting blood glucose levels and parameters of thyroid profile. Females had higher incidence of hypothyroidism compared to males in diabetic group.

Keywords: Hypothyroidism, Hyperthyroidism, Subclinical hypothyroidism, Type-2 diabetes.

Introduction

Diabetes mellitus is a common endocrine disorder worldwide. It is characterized by increase in blood glucose levels, either due to insulin resistance, or, due to defective insulin secretion by pancreatic β-cells or both. Worldwide over 382 million people were estimated to have diabetes in 2013 and by 2035 this number is expected to rise to 592 million. India has 65.1 million people with type 2 diabetes and it will increase to 109 million by 2030 [1].Sedentary life style, dietary modifications, ethnicity, hypertension and obesity are the factors that have led to this increase in the incidence of diabetes mellitus, especially in the 21st century.

The influence of other endocrine hormones like thyroidhormones on diabetes mellitus is documented [2].The first report showing the prevalence of type-2 diabetes and hypothyroidism was published in 1979 [3]. Since then various studies have been done all over the world that showed thyroid dysfunction among type 2 diabetes mellitus. Metab Al-Geffari et al in their study found overall prevalence of hypothyroidism in diabetic subjects was 28.5% [4]. In another study done by R. Anil Kumar et al, to find the prevalence of thyroid dysfunction among south Indian type 2 diabetes individuals, found thyroid dysfunction to be present in 24% of diabetics compared to 13% of control, of which 12% had overt hypothyroidism and 0.75% had hyperthyroidism [5].

Thyroid hormones are insulin antagonists and both are involved in cellular metabolism. Excess or deficit of either one can result in functional disarrangement of the other. Diabetes mellitus influence thyroid function at two sites, one at the level of hypothalamic control of TSH release and the other at T_4 to T_3conversion. Increase in blood glucose causes reversible reduction of the activity and hepatic concentration of 5-deiodinase enzyme. Low serum levels of T_3, and,low, increased or normal levels of T_4 are seen with elevated serum TSH. While thyroid hormones regulate metabolism, diabetes can alter it [5,6].

Researchers have found that one of the reasons for diabetic patients to have inadequate control on blood glucose levels might be an underlying thyroid dysfunction, which if controlled might automatically facilitate the control of diabetes [7]. Only clinical assessment might not be able to detect all the cases of thyroid dysfunctions since large percentage of thyroid disorders are subclinical [8,9,10] which can only be diagnosed by biochemical assessment.

The present study was done to find out the thyroid status among type-2 diabetics and also to find the association between hypothyroid and type-2 diabetes.

Materials and Methods

A cross-sectional study was conducted in Karpagam Faculty of Medical Sciences and Research, Coimbatore consisting of 60subjects attending diabetic clinic / medicine op. Study subjects were divided into 2 groups. Group I consisted of 30 known diabetics with fasting blood glucose level more than 126 mg/dL and postprandial blood glucose level more than 140 mg/dL, on treatment. Group II consisted of 30 healthy subjects with fasting blood glucose level below 110 mg/dL. Male and female in the age group 30- 50 yrs were included in the study. Those subjects with known thyroid disorders, history of other illness, hyperlipedemia, other physical illness and physiological stress which induce alteration on the thyroid hormone were excluded from the study. Informed consent of the subject was recorded in a preformat designed for the study. Approval from the Institutional Ethical committee was taken.

4 ml of venous blood was collected from the entire subject in the study group. Two ml of blood was collected in fluoride vial for estimation of blood glucose by glucose-oxidase peroxidase method in Transasia ERBA EM-360. Another 2 ml was collected in plain vial for the measurement of serum TSH, T3 and T_4 level by ELFA (Enzyme-linked fluorescent assay) in Biomeniux-minividas.

Classification of thyroid disorder was on following criteria:

- Euthyroid when T_3, T_4 and TSH are in the normal range (0.72-2.02ng/mL, 4.3-12.5µg/dL, 0.4-4.2 µIU/mL).
- Overt hypothyroidism when TSH >4.2µIU/mL, T_4< 4.3 µg/dL and T_3<0.72 ng/mL
- Subclinical hypothyroidism whenT_3 and $T_4$are within normal range, but, TSH>4.2µIU/mL
- Hyperthyroidism when TSH<0.4 µIU/mL

Statistical analysis was done using SPSS 19.0. The results obtained are expressed as mean ± SD, and, p-Value <0.05 is taken as significant. Pearson's correlation was used to correlate between fasting blood glucose (FBG) and thyroid profile (T_3, T_4, TSH).

Results

A total of 60 subjects were included in the study attending diabetic clinic / medicine op, in Karpagam Faculty of Medical Science & Research, Coimbatore. They were divided into 2 groups. Group I consisted of 30 known diabetics with fasting blood glucose level more than 126 mg/dL and group II consisted of 30 healthy subjects with fasting blood glucose level below 110 mg/dL. In group I, 33.3% of subjects were between 20-30 yrs, 26.6% of subjects were between 30-40 yrs and 40% of subjects were between 40-50 yrs of age. In group II, 26.6% of subjects were between 20-30 yrs, 20% of subjects were between 30-40 yrs and 52% of subjects were between 40-50 yrs of age (Table 1). Mean age of the subjects were 45 ± 16.4 yrs and 37.9 ±13.9 yrs in group I and group II respectively (Table 2).Group I comprised of 10% males and 90% of female subjects. Group II comprised of 33.3% male and 66.7% of female subjects (Table 1).

Table 1: Baseline characteristics of study population in the study

Characteristic		**Group I(%)**	**Group II (%)**
AGE	20-30 yrs	33.3	26.6
	30-40 yrs	26.6	20
	40-50 yrs	40	52
SEX	Male	10	33.3
	Female	90	66.7

Table 2: Mean age in years of subjects in group I and group II.

Groups	**Mean ± SD age in years**
Group I	45.03±16.4
Group II	37.9±13.9

Table 3 shows mean ± SD of various laboratory parameters in group I and group II. Fasting blood glucose of group I (157.9±42.2 mg/dl) was higher compared to group II (101 ± 11.4 mg/dL) (Fig 1). Free T_3 levels were lower in group I subjects (1.1 ± 0.4ng/ml) compared to group II subjects (1.3 ± 0.7 ng/ml) (p-value 0.17). Mean free T_4levels were comparable in both the groups (group I: 5.8 ± 2.4 µg/dL, group II: 5.8 ± 3 µg/dL) (p-value 0.96). Mean TSH for group I was significantly high (6.9±8.6 µIL/ml) compared to group II (2.4±1.7 µIL/ml)(p-value 0.01).No significant correlation was seen between FBG and free T_3 (r=0.01, p-value 0.95), FBG and free T_4 (r=-0.16, p-value 0.41), and, FBG and TSH (r=-0.006, p-value 0.97) in group I subjects (Table 4).

Fig 1: Fasting blood glucose level in group I and group II

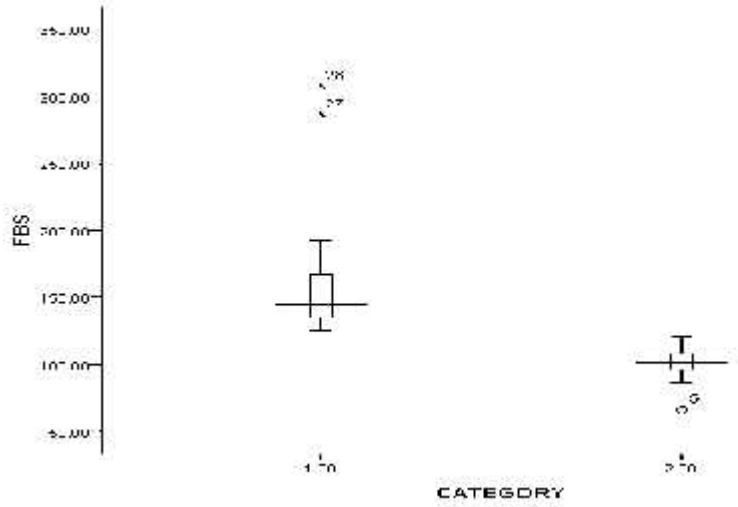


Table 3: Comparison of parameters in group I & group II

Parameter	Group I (N=30) Mean ± SD	Group II (N=30) Mean ± SD	p- Value
FBS	157.9±42.2	101 ± 11.4	0.00
Serum T_3	1.1 ± 0.4	1.3 ± 0.7	0.17
Serum T_4	5.8 ± 2.4	5.8 ± 3	0.96
Serum TSH	6.9±8.6	2.4±1.7	0.01*

(*p Value<0.05 is significant)

Table 4: Pearson's correlation between FBG and thyroid profile in group I

Relationship between	r- Values	p- Value
FBG vs T_3	0.01	0.95
FBG vs T_4	-0.16	0.41
FBG vs TSH	-0.006	0.97

Figure 2 shows the hypothyroid status in each group. In group I, out of 30 diabetic subjects, 15 (50%) subjects were euthyroid and 15(50%) subjects were hypothyroid. In group II, out of 30 normal subjects, 26 (86.7%) subjects were euthyroid and 4 (13.3%) subjects were hypothyroid.No case of hyperthyroidism was seen in either group. The prevalence of overt hypothyroidism and subclinical hypothyroidism in group I was 23.3% and 26.7% respectively. The prevalence of overt hypothyroidism and subclinical hypothyroidism in group II was 6.7% and 6.7% respectively (Fig 3).

Fig 2: Hypothyroid status of subjects in group I and group II.

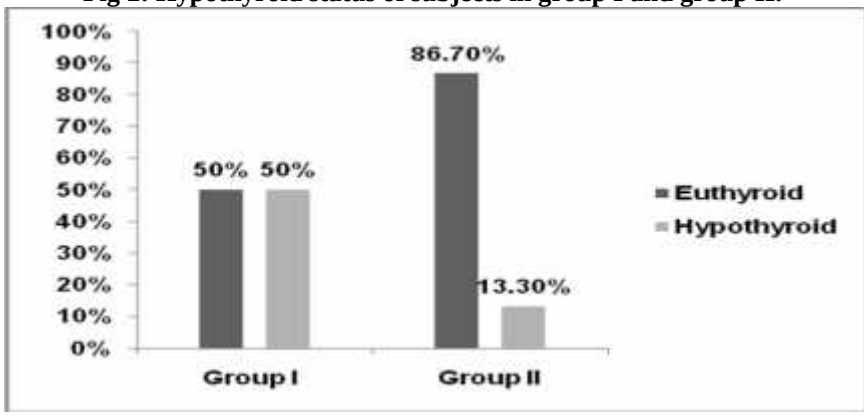
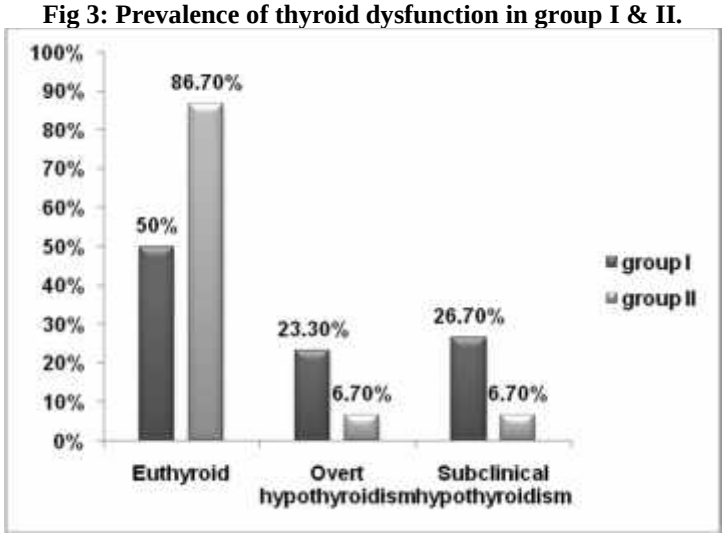


Fig 3: Prevalence of thyroid dysfunction in group I & II.



In group I, prevalence of hypothyroidism in male and female were 6.7% and 43.3%respectively (Fig 4). 20% of females and 3.3% of males had overt hypothyroidism, whereas, 23.3% of females and 3.3% of males had subclinical hypothyroidism in group I. (Fig 5)

Fig 4: Gender wise prevalence of hypothyroidism in group I.

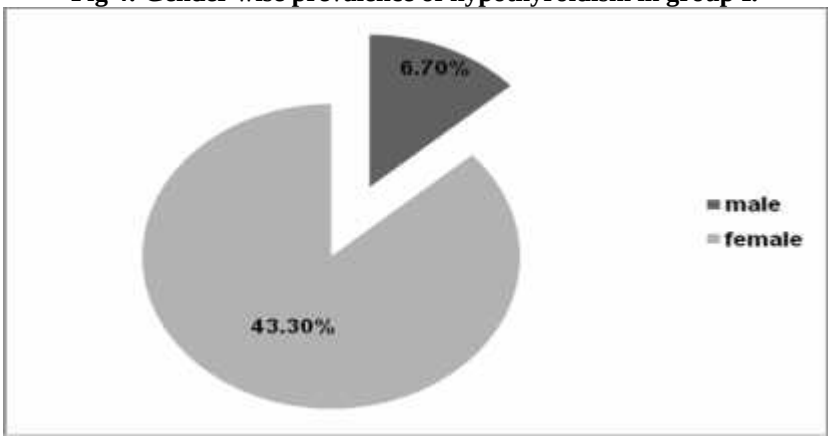
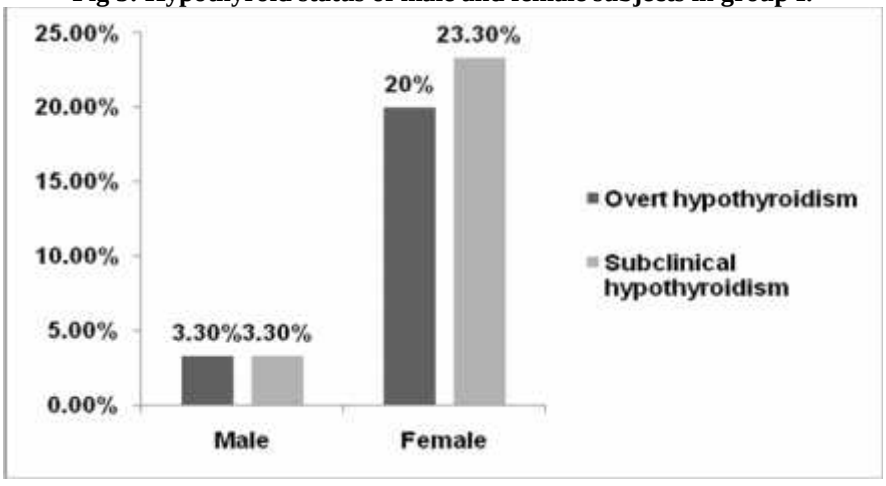


Fig 5: Hypothyroid status of male and female subjects in group I.



Discussion

In the present study, among 30 diabetic subjects in group I investigated, 50% i.e., 15 subjects had hypothyroidism and among 30 non diabetic subjects in group II, only 13.3% i.e., 4 subjects had hypothyroidism. No case of hyperthyroidism was reported in either group. This shows the high incidence of hypothyroidism in diabetics which is also supported by many studies. Swamy et al in their study found the prevalence of hypothyroidism in diabetics was 12.06% [11].Papazafiropoulou A. et al in another study found the prevalenceof hypothyroidism to be 13.4% [12]. The prevalence of overt hypothyroidism in the present study was 23.3% and subclinical hypothyroidism was 26.7% among 30 diabetic subjects in group I. Gurjeet Singh et al, in 2011 reported prevalence of hypothyrodism in 23.5% (15% subclinical and 8.75% overt hypothyroidism) among 80 type II diabetes patients studied [13]. Laloo Demitrost et al, in another study done in 202 type 2 diabetes patients from Manipur reported 27.7% prevalence of hypothyroidism (16.3% subclinical and 11.4% overt hypothyroidism) and 3.5% prevalence of hyperthyroidism [14].

In patients with diabetes, hypothyroidism may influence metabolic control through effects on glucose metabolism which includes reduction in hepatic glucose output, gluconeogenesis and peripheral glucose utilization. Therefore, there is increase susceptibility to hypoglycaemia thus complicating diabetes management [1,15,16]. Frequent hypoglycaemic episodes were documented in patients with diabetes and subclinical hypothyroidism [1,17].

The abnormal thyroid hormone level may be due to various anti-diabetic drugs the diabetics were receiving. Oral hypoglycemic agents like phenylthiourea suppress the level of FT_4 and T_4, and increase the level of TSH [18,19,20,21]. Insulin which is an anabolic hormone, inhibits hepatic conversion of T_4 to T_3, thus, increasing the levels of FT_4 while decreasing the levels of T_3 [5,12,13].

The abnormal hormone level in diabetes may also be due to the presence of thyroid hormone binding inhibitor, which inhibits extrathyroidal conversion of T_4 toT_3, and dysfunction hypothalamo-pituitary- thyroid axis. These situations would be aggravated in poorly controlled diabetes on thyroid hormone concentration [18,24,25]. Celani et al in their study suggested that subclinical hypothyroidism also result from hypothalamus-pituitary-thyroid axis disorders [24].

Significantly higher levels of TSH were seen in our study, when group I and group II subjects were compared (p value- 0.01). Similar findings were reported in other studies [14,26,27]. No significant correlation was seen between fasting blood glucose levels and parameters of thyroid profile. Further studies with glycated hemoglobin may be necessary to know the role of glycaemic status leading to thyroid dysfunction.

In the present study, hypothyroid state was higher in females compared to males. In group I, subjects with diabetics, 20% females had overt hypothyroidism compared to 3.3% of males and 23.3% of females had subclinical hypothyroidism compared to 3.3% of males. Laloo Demitrost et al in their study observed 16.3% had subclinical hypothyroidism of which 10 were males and 23 were females, 11.4% had overt hypothyroidism of which, 6 were males and 17 were females [14]. Vikram et al in another study done on 50 diabetic subjects, found 2 males and 2 females with primary or overt hypothyroidism and 3 males and 4 females with subclinical hypothyroidism [27].

Limitation of this study was the small sample size. Therefore, further study may be required to substantiate the findings.

Conclusion

In the present study, the prevalence of thyroid dysfunction was higher in group I subjects with type 2 diabetes mellitus, than, that in group II consisting of healthy individuals. Also, more number of females wasfound to be hypothyroid, compared to males in group I. Thus we found a close association between diabetes and thyroid dysfunction. Therefore, a routine assay of thyroid hormone is necessary in all diabetic patients and especially those difficult to manage, so that adequate attention and treatment can be provided.

Acknowledgement

The study was approved by Short term studentship-Indian Council of Medical Research (STS-ICMR) 2015. We also acknowledge the great support of biochemistry laboratory staff, Karpagam Faculty of Medical Science & Research Hospital, Coimbatore, for their co-operation and skilful technical assistance.

References

1. Anil Kumar, K.R.Narasimha setty, R. Lalitha, Sureka B. Shetty. Prevalence of thyroid dysfunction among type 2 diabetes subjects in South India. International journal of clinical cases and investigations. 2014; Volume 5 (issue 6), 93:100.

2. Kahn RC, Catanese VM, Hung W, Kahn CR, Lnuix DL, Reb RW, Robertson G L, Wartofski L. Secondary forms of diabetes mellitus. In: Becker KL, Bilezikian JP, Bremna JW, editors. Secondry forms of diabetes mellitus. Principles and practice of endocrinology and metabolism. Philadelphia: JP Lippincott Company; 1990. pp. 1087–93.
3. Feely J, Isles TE. Screening for thyroid dysfunction in diabetics. Br Med J 1979;1(6179):1678.
4. Metab Al-Geffari, Najlaa A. Ahmad, Ahmad H. Al-Sharqawi, Amira M. Youssef, Dhekra Al Naqeb, Khalid Al-Rubeaan. Risk Factors for Thyroid Dysfunction among Type 2 Diabetic Patients in a Highly Diabetes Mellitus Prevalent Society. International Journal of Endocrinology. Jan 2013, Vol. 2013: 1-6
5. Bharat, Hijam D, Gangte D, Lalnunpui, Premchand, Ibetombi Devi and Gyaneshwar W Singh. (2013) Thyroid Status in Diabetes Mellitus. J GlycomicsLipidomics 3: 106. doi:10.4172/2153-0637.1000106
6. Shah SN (2007) Thyroid disease in diabetes mellitus. J Assoc Physicians India. 2007; 32 (12): 1057-1059.
7. M Mouradian , N Abourizk. Diabetes mellitus and thyroid disease. Diabetes Care, 6(5), 1983: 512-520
8. Perros P, McCrimmon R J, Shaw G, Frier B M. Frequency of thyroid dysfunction in diabetic patients: value of annual screening. Diabet Med 1995, 12 (7): 622-627.
9. Gray RS, Irvine WJ, Toft AD, Seth J, Cameron EHD, Clarke BF. Unrecognized thyroid failure in diabetes mellitus. J Clin Lab Immunol1979; 2: 221–224.
10. Feely J and Isles T E. Screening for thyroid dysfunction in diabetics. Br Med J, 1979; 1: 1678.
11. Swamy RM, Naveen Kumar, Srinivasa K, Manjunath GN, Prasad Byrav DS, VenkateshG. Evaluation of hypothyroidism as a complication in Type II Diabetes Mellitus. Biomedical Research 2012; 23 (2) 170-172.
12. Papazafiropoulou A. Prevalence of thyroid dysfunction among greek Type 2 diabetic patients attending an outpatient clinic. Journal of Clinical Medicine Research 2010; 2 (2):75-78.
13. Gurjeet Singh, Vikas Gupta, Anu Kumar Sharma and Neeraj Gupta. Evaluation of Thyroid dysfunction among type 2 diabetic Punjabi Population. Advances in bioresearch.2011;2(2): 03-09
14. LalooDemitrost, Salam Ranabir. Thyroid dysfunction in type 2 diabetes mellitus: A retrospective study. Indian J Endocrinol Metab. 2012 December; 16(Suppl 2): S334–S335.
15. Somwaru LL, Arnold AM, Joshi N, Fried LP, Cappola AR. High frequency of and factors associated with thyroid hormone overreplacement and underreplacement in men and women aged 65 and over. J ClinEndocrinolMetab 2009; 94: 1342–5.
16. Dr.Ravishankar, S.N, Dr.Champakamalini, Dr.Venkatesh, Dr.Mohsin. A prospective study of thyroid-dysfunction in patients with Type 2 diabetes in general population. Clinical practice. 2013, Vol. 5 No. 1:2.
17. Vigersky RA, Filmore-Nassar A, Glass AR. Thyrotropin suppression by metformin. J ClinEndocrinolMetab 2006; 91: 225–7.
18. Udiongcej, udohae, etukudoh me. Evaluation of thyroid function in diabetes mellitus in calabar, nigeria. Indian j clinbiochem. 2007;22:74–78.
19. Carreras-González G, Pérez A (2007) Thyroid autoimmunity at onset of type 1diabetes as a predictor of thyroid dysfunction. Diabetes Care 30.
20. Smith AF, Becket GJ, Walker SW, Rae PWH. Abnormalities of thyroid function. Lecture Notes on Clinical Chemistry. Sixth edition. Oxford: Black-well Science Ltd. 1998; 91-104.
21. Whitley RJ. In: Teitz text book of Clinical Chemistry. 3rd Edition. Burtis C, Ashwood AR, editors. Philadelphia: Saunders & Company; 1984. pp. 1495–529.
22. Díez JJ, Sánchez P, Iglesias P. Prevalence of thyroid dysfunction in patients with type 2 diabetes. ExpClinEndocrinol Diabetes. 2011; 119:201–7.
23. Boehringer Mannheim. Extrathyroidal factor affecting thyroid hormone concentration. Rational approach to thyroid diagnosis, GmbH, Boehringer Mannheim. 1984; 2-4
24. Celani MF, Bonati ME, Stucci N (1994) Prevalence of abnormal thyrotropin concentrations measured by a sensitive assay in patients with type 2 diabetes mellitus. Diabetes Res 27: 15-25.
25. Suzuki J, Nanno M, Gemma R, Tanaka I, Taminato T, Yoshimi T. The mechanism of thyroid hormone abnormalities in patients with diabetes mellitus. Nippon NiabunpiGakkiZasshi. 1994; 7(4): 465-70.
26. Smithson MJ. Screening for thyroid dysfunction in a community population of diabetic patients. Diabet Med. 1998;15:148–50.
27. Vikram B Vikhe, Shubhangi A Kanitkar, Krunal K Tamakuwala, Anu N Gaikwad, MeenakshiKalyan, Rajani R Agarwal. Thyroid dysfunction in patients with type 2 diabetes mellitus at tertiary care centre.National journal of medical research.2013, Vol:3, Issue 4, 377-380.