

Original Article



Study of Thyroid Function Status in Type 2 Diabetic Patients

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Abstract

Background: Thyroid dysfunction specially hypothyroidism may occur in type 2 diabetic patients. **Objective:** To observe thyroid function status in type 2 diabetic patients. **Materials and Methods:** This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College, Dhaka from July 2016 to June 2017. Total 60 subjects including male and female, age ranged from 40 to 60 years were included in this study, among them 30 were non-diabetic subjects and 30 were type 2 diabetic patients. **Results:** In this study, mean serum TSH level was significantly ($p < 0.001$) higher and serum FT_4 level was significantly ($p < 0.01$) lower in diabetic patients than that of apparently healthy non-diabetic subjects. Serum FT_3 level was lower in type 2 diabetic patients in comparison to that of non-diabetic subjects but the difference was not statistically significant. However, among the diabetic patients 10% were subclinical hypothyroid and 6.67% were hypothyroid. **Conclusion:** The present study reveals that hypothyroidism occurs in type 2 diabetic patients. So type 2 diabetic patients should measure thyroid hormone levels routinely to detect thyroid dysfunction.

Key words: Thyroid dysfunction, Type 2 diabetes mellitus.

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Introduction

Diabetes mellitus is a syndrome of impaired carbohydrate, fat and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin. In general, diabetes mellitus is of two types, type 1 diabetes caused by lack of insulin secretion and type 2 diabetes caused by decreased sensitivity of target tissues to the metabolic effect of insulin. The reduced sensitivity to insulin is often called insulin resistance.¹ The prevalence of diabetes mellitus is increasing throughout the world due to population growth, aging, urbanization, increase prevalence of obesity and physical inactivity.² Long term diabetes mellitus is associated with vascular complications like retinopathy, nephropathy, peripheral and autonomic neuropathy, cardiovascular and cerebrovascular diseases.³

In addition, thyroid dysfunction is another common endocrine disorder that is also increasing day by day⁴⁻⁶ and may occur in diabetic patients.⁷⁻⁸ Poor glycemic control affects the hypothalamus-pituitary-thyroid axis⁹ and it causes impairment of nocturnal TSH secretion, thyroid hormone secretion and their response to TRH stimulation.¹⁰ On the other hand, higher level of circulating insulin associated with insulin resistance causes proliferation of thyroid tissue and formation of thyroid nodules.¹¹ Moreover, alteration of the secretory activities of thyroid gland causes low thyroid hormone level.¹² Reduced activity of T4-5' deiodinase enzyme that causes peripheral conversion of thyroxin to triiodothyronine via 5' monodeiodination reaction is also responsible for low T₃ state in diabetic subjects.¹³

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Thyroid function is determined by serum TSH, FT₄ and FT₃ levels. Among them TSH level is usually regarded as the most useful investigation of thyroid function. Thyroid dysfunction means the altered serum TSH level with normal or altered thyroid hormones- T₄ and T₃. It may be hyperthyroidism or hypothyroidism.¹⁴ In diabetic patients, hypothyroidism is more common than hyperthyroidism.¹⁵ Some researchers observed that 32% of diabetic patients had abnormal thyroid hormone levels. Among them 22% had hypothyroidism and 10% had hyperthyroidism.¹⁶ In our country, another researcher found 16.3% thyroid dysfunction among type 2 diabetic patients. Among them 9% had hypothyroidism and 7% had hyperthyroidism.¹⁷ Moreover, subclinical hypothyroidism is very common in type 2 diabetic patients.¹⁸ It means raised serum TSH level and normal T₃ and T₄ concentration with no obvious signs or symptoms of thyroid disease.¹⁴ It has been observed that fasting blood sugar, HbA_{1c} and TSH levels were significantly higher among the diabetic patients in comparison to non-diabetic individual but T₃ and T₄ levels were similar in both groups.¹⁹ Hypothyroidism means low serum T₄ and elevated serum TSH levels.¹⁴ It may be also found in diabetic patients.²⁰

Some researchers suggested that, all the subjects with type 2 diabetic mellitus should measure TSH level yearly to detect asymptomatic thyroid dysfunction.¹⁹ As, it can aggravate classical risk factors such as dyslipidemia and lead to an increased risk of cardiovascular events and nephropathy in these patients.²¹⁻²²

Materials and Methods

This cross sectional study was carried out in the Department of Physiology, Sir Salimullah Medical College (SSMC), Dhaka from July 2016 to June 2017. A total number of 60 subjects age ranged from 40 to 60 years were included in this study and were divided into healthy non-diabetic subjects as control (30) group and type 2 diabetic subjects as study (30) group. The study protocol was approved by Institutional Ethics Committee of SSMC. Diabetic patients with renal disease, known thyroid abnormalities, any other endocrine abnormalities and pregnancy were excluded from this study. All the subjects belonged to middle socio-economic status. Type 2 diabetic patients were selected from the Out Patient Department of Endocrinology, Sir Salimullah Medical College and Mitford Hospital, Dhaka and the subjects were previously diagnosed. After selection, the subjects were thoroughly informed about the aim, objectives and procedure of the study and were encouraged for voluntary participation. An informed written consent was taken from each subject. Detail personal, medical, family, socio-economic, occupational histories were taken and thorough physical examination was done and all informations were recorded in a standard pre-fixed questionnaire. With all aseptic precautions 7 ml of venous blood was drawn by sterile disposable syringe from ante-cubital vein. Then 2 ml of whole blood was transferred to an EDTA tube for determination of HbA_{1c} level. The remaining blood was transferred to a clean and dry glass test tube and

was kept in slanted position till formation of clot. After centrifugation, supernatant serum was collected in labeled eppendroff test-tube and was used for different biochemical tests. For assessment of thyroid function, serum TSH, FT₄ and FT₃ levels were measured by chemiluminescent microparticle immunoassay method²³ in the Department of Biochemistry, Bangabandhu Sheikh Mujib Medical University, Dhaka. However, fasting plasma glucose level was estimated by glucose oxidase method²⁴ in the Department of Physiology, Sir Salimullah Medical College and HbA_{1c} levels were estimated by ion exchange high performance liquid chromatography method²⁵ in the Department of Biochemistry, BSMMU to observe their glycemic status. The statistical analysis was done by Unpaired 't' test by using Statistical Package of Social Science (SPSS) windows version-22.

Results

In this study, the mean (±SD) fasting blood glucose level of the subjects were 5.08 ± 0.64 and 7.28 ± 1.83 mmol/L and mean (±SD) HbA_{1c} level of the subjects were 5.04 ± 0.42 and 6.50 ± 0.96 % in group A and group B respectively. Both the levels were significantly (p<0.001) higher in diabetic patients in comparison to that of non-diabetic subjects (Table I).

Table I: Fasting blood glucose and HbA_{1c} levels in both groups (N=60)

Groups	n	Fasting blood glucose mmol/L	HbA _{1c} %
A □	30	5.08 ± 0.64	□ 5.04 ± 0.42
B □	30	7.28 ± 1.83	□ 6.50 ± 0.96
P value (A vs B) □		<0.001s □	<0.001s

S= Significant

Table II depicts that the mean (±SD) serum TSH levels of the subjects were 1.53 ± 0.77 and 3.79 ± 2.74 mIU/L in group A and group B respectively and the level was significantly (p<0.001) higher in diabetic subjects. Serum FT₄ levels were 13.29 ± 3.06 and 11.42 ± 1.78 pmol/L in group A and group B respectively and the level was significantly (p<0.01) lower in diabetic patients in comparison to that of non-diabetic subjects. Whereas, the mean (±SD) serum FT₃ levels were 4.18 ± 0.82 and 3.72 ± 0.99 pmol/L in group A and group B respectively and the level was lower in diabetic patients than that of non-diabetic subjects but the difference was not statistically significant.

Table II: Serum TSH, FT₄ and FT₃ levels in different groups (N=60)

Groups	n	TSH (mIU/L)	FT ₄ (pmol/L)	FT ₃ (pmol/L)
A □	30	1.53 ± 0.77	13.29 ± 3.06	4.18 ± 0.82
B □	30	3.79 ± 2.74	11.42 ± 1.78	3.72 ± 0.99
A vs B	P value	≤0.001***	0.004 ^S	0.057 ns

s= Significant
ns= not significant

In this study, among the diabetic patients, 83.33% were euthyroid, 10% were subclinical hypothyroid and 6.67% were hypothyroid. Results are shown in Figure 1.

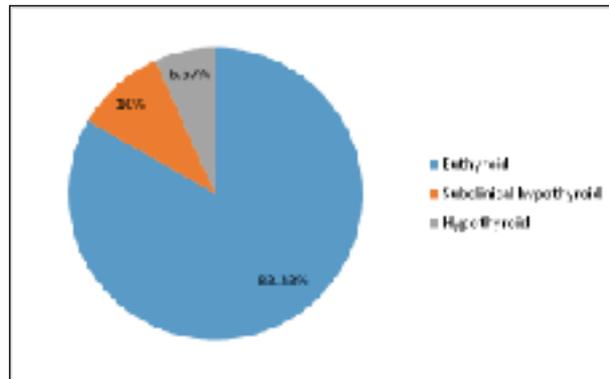


Figure 1: Distribution of thyroid dysfunction in diabetic patients (n=30)

Discussion

In this study, the mean serum TSH level was significantly higher in diabetic patients than that of non-diabetic subjects. These findings were in agreement with that of other researchers.^{26,27} Whereas the mean serum FT₄ level was significantly lower in diabetic patients than that of non-diabetic subjects. These findings are consistent with that of some other researchers of different countries.²⁸⁻²⁹ The mean serum FT₃ level was non-significantly lower in diabetic patients than that of non-diabetic subjects. Similar type of finding was reported by some other researchers in patients with type 2 diabetes.³⁰ Again, in the present study, among the diabetic patients, 83.33% were euthyroid, 10% were subclinical hypothyroid and 6.67% were hypothyroid. Various researchers of different countries found different findings.^{7,18}

The exact mechanism that is involved in thyroid dysfunction in type 2 diabetic patients is not yet clearly established. However several investigators of different countries proposed various suggestions on this aspect. Some researchers reported that metabolic control affects the HPT axis and nocturnal TSH peak become abolished and TSH response to TRH stimulation is blunted in poorly controlled diabetic patients that cause hypothyroidism in type 2 diabetic patients.¹⁰

Chronic hyperglycemia causes several structural changes of thyroid gland that include flattening of epithelial cells and almost empty rough endoplasmic reticulum cisternae, scanty exocytotic apical and endocytotic vesicles. Degenerative mitochondria and rough endoplasmic reticulum, reduced intracoloidal and intraepithelial thyroglobulins which are associated with marked alterations of their secretory activities and causes hypothyroidism in diabetic patients.¹²

Moreover, thyroid hormone binding inhibitor (THBI), inhibitor of extrathyroidal conversion (IEC) of thyroxine to triiodothyronine are responsible for abnormal thyroid function in diabetic patients.³¹

Conclusion

From this study it can be concluded that, hypothyroidism occurs in type 2 diabetic patients and this may be due to their poor glycemic control.

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