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Cross Sectional Evaluation of Thyroid Hormone Levels in Non-diabetic and Diabetic Patients in Bangladeshi Population

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ABSTRACT

Diabetes mellitus (DM) in many cases is found to be associated with disordered thyroid function. In this study 140 healthy non-diabetic subjects and 140 diabetic subjects were investigated for Fasting Blood Sugar (FBS), total triidothyronine (T3), total thyroxin (T4), free triidothyronine (FT3), free thyroxine (FT4) and thyroid stimulating hormone (TSH). Out of 140 diabetic subjects studied, 70% had euthyroidism (normal), 18.6% had hypothyroidism and 11.4% had hyperthyroidism. Serum T3, T4 and FT3 levels were low, TSH and FT4 levels were high in diabetic subjects whereas, in non-diabetic subjects all these levels were normal. All the diabetic subjects had high fasting blood sugar levels (10.82±2.72). Statically no significant differences were observed in serum T4 ($p = 0.791$) and BMI ($p = 0.477$) levels between non-diabetic and diabetic subjects. Fasting blood sugar was found to be significantly correlated with TSH, FT3 levels and others parameter were not that much significant. In this study, 30% diabetic patients were found to abnormal thyroid hormone levels. The prevalence of thyroid disorder was higher in women (17.1%) than in men (12.9%), while hyperthyroidism were higher in males (13.3%) than in females (10%) and hypothyroidism was higher in females (20%) than in males (16.7%).

Key words: Diabetes mellitus, dysfunction, hypothyroidism, hyperthyroidism, TSH, FT3, FT4

INTRODUCTION

Diabetes mellitus is one of the major health problems affecting populations in the world. It is characterized by increased glucose level in the blood, called hyperglycemia, resulting from interactions of both hereditary and environmental factors. Hyperglycemia is also occurred due to the combined effect of a defective insulin secretion by pancreatic beta-cells and insulin resistance or both. Thyroid disease is another common health problem in general population and its prevalence increases with age (Hegedus *et al*., 1983). Thyroid disease is reported to occur quite often in both type 1 and type 2 diabetes, with increases of 10-15%. Women are more rapidly affected than men and hypothyroidism is more common than thyrotoxicosis (Perros *et al*., 1995).

Hypothyroidism is the most common thyroid disease in the elderly population, especially in older women. It is known to be the source of some autoimmune diseases, Hashimoto's thyroiditis or primary atrophic hypothyroidism (Kamel, 1999). Type 1 diabetes and latent autoimmune thyroid disease in human may be associated with this disease (Johnson, 2006; Lott and Turner, 1975). In 1979 it was first showed that there was an association between thyroid dysfunction and diabetes (Feely and lsles, 1979). Since then a several number of studies have showed a correlation between diabetes and thyroid dysfunctions especially in type-2 diabetes with hypothyroidism being the most common disorder (Nobre *et al*., 2002). Johnson (2006) also showed that diabetes control may be affected in the presence of thyroid disorder. Worsening of glycemic control, increased insulin requirements etc., is found to be the result of hyperthyroidism. In fact, thyrotoxicosis may reveal latent diabetes (Wu, 2000). WHO estimates the prevalence of diabetes for all age groups worldwide was 2.8% in 2000 and will be 4.4% in 2030. Thus the total number of world population with diabetes is predicted to be increased from 171 million to 366 million within this period (Wild *et al*., 2004). The influence of endocrine and non-endocrine organs other than the pancreas in diabetes mellitus is documented. It is also recorded that in the metabolism of carbohydrates there is an interaction between insulin and iodothyronines (Dias *et al*., 1995). Diabetes in Bangladeshi populations are being increased alarmingly day by day and therefore, a comprehensive study is required to regulate this disease to a considerable extend. The present study was to evaluate the thyroid parameters in diabetes and non-diabetes subjects and observed that abnormalities of thyroid hormones were associated with diabetes.

MATERIALS AND METHODS

Blood samples were obtained from 280 subjects, 120 men and 160 women, attending the Z. H Sikder Women's Medical Collage and Hospital (Pvt) Ltd., Dhaka during April 2011-March 2012. Volunteers recorded personal information of the patients. Age of the subjects ranged from 30 to 60 years. Z. H. Sikder women`s medical collage and hospital (Pvt) Ltd., after approval of the ethical committee. These volunteers included non-diabetic patients attending hospital for routine checkups as advised by their physicians. The non-diabetic was non alcoholic, non smokers and not taking any drugs. Diagnosed diabetic patients constituting 140 in number with more than 6-10 years of duration and without the complications like retinopathy, neuropathy and nephropathy were selected.

Fasting serum samples were collected from all the study subjects. About 3-4 mL of venous blood was collected and centrifuged to separate serum from the cells as soon as the clot formed. Fasting serum glucose was estimated in an auto analyzer by glucose oxidase method (Lott and Turner, 1975). Serum was obtained from all patients for the measurement of T3, T4, TSH, FT3 and FT4 were measured by enzyme-linked immunosorbent assay (ELISA) method. Used reagents kit was procured from HumanGmbH, Germany.

Following guidelines are studied for the observation of thyroid dysfunction: The following guidelines for the observation of thyroid dysfunction were studied: (1) Normal-when FT3, FT4, T3, T4 and TSH were within the normal range. (2) Primary hypothyroidism-When FT3, FT4, T3 and T4 were less than normal value and TSH was more than 5.2 mIU/L. (3) Primary hyperthyroidism-when TSH was less than 0.2 mIU/L and FT4, FT3, T3, T4 was more than the normal values. (4) Subclinical hypothyroidism-When FT3, FT4, T3 and T4 were within normal value and TSH was more than 5.2 mIU/L. 5) Subclinical hyperthyroidism-when TSH was less than 0.2 mIU/L and FT3, FT4, T3, T4 were within the normal range.

Statistical analysis: SPSS 17 (Chicago, IL, USA) software package was used for data analysis and p values less than 0.05 were considered as statistically significant. In the analysis, the relationship between thyroid function test in non-diabetic and diabetic variables was examined by Pearson correlation coefficients. Microsoft excels programmed and independent-samples t-test was used for t-test. The results were presented as Mean±SD values.

RESULTS

In this study, the total of 280 subjects participated, among which 57.1% were women and 42.9% were men, in the age group 30-60. Study subjects non-diabetic and diabetic mean age were 41.56±7.90 and 42.96±10.22, respectively (Table 1). Both were 140 in non-diabetic and diabetic subjects. In diabetic, 98 euthyroid (normal), 10 Subclinical hypothyroid, 16 primary hypothyroidism, 8 Subclinical hyperthyroid and 8 Primary hyperthyroid subjects were included in this study (Table 2).

In the study of BMI, it was observed that non-diabetic and diabetic patients had 22.79±2.54 and 22.26±2.34 kg m^{-2}, respectively. Fasting blood sugar (FBS), T3, T4, TSH, FT3 and FT4 were estimated in non-diabetic and diabetic patients. As presented in (Table 3), Mean±SD) values of FBS ($p = <0.001$) and TSH ($p = 0.044$) were significantly higher in diabetic patients than in non-diabetic patients. T3 ($p = 0.031$), T4 ($p = 0.791$), FT3 ($p = 0.031$) and FT4 ($p = 0.015$) concentrations were significantly lower in comparison to the non-diabetic patients. The mean value of serum fasting sugar was clearly higher in diabetic patients (10.82±2.72) than in non-diabetic patients (5.43±0.63).

The Pearson's correlations (r) between thyroid function parameters are shown in Table 4. Non-diabetic subjects fasting blood sugar showed no significant correlations with thyroid parameters but diabetic patients showed more frequently a significant correlation (Table 4). In this study, fasting blood sugar is found to be correlated with TSH ($p = 0.020$) and FT3 ($p = 0.041$) but T3, T4 and FT4 had no significance in diabetic subjects.

Table 1: Gender and age distribution in non-diabetic and diabetic subjects

Group	Sex	No. of patients	Mean age (years)	p-value
Non Diabetic subjects (N = 140)	Male	60	41.56±7.90	0.001
	Female	80		
Diabetic subjects (N = 140)	Male	60	42.96±10.22	
	Female	80		

Table 2: Different types of thyroid disorder on gender-wise of non-diabetic and diabetic subjects

	Hypothyroidism		Hyperthyroidism	
Sex-wise subjects distribution	Subclinical hypothyroidism	Primary hypothyroidism	Subclinical hyperthyroidism	Primary hyperthyroidism
Non diabetic				
Male	0	0	6	0
Female	2	0	2	2
Diabetic				
Male	4	6	4	4
Female	6	10	4	4

Table 3: Comparison of thyroid hormones in non-diabetic and diabetic subjects using independent samples t-test, (Values are Mean±SD)

Investigations	Non diabetic	Diabetic	p-value
BMI (kg m^{-2})	22.79±2.54	22.26±2.34	0.477
FBS (mmol L^{-1})	5.43±0.63	10.82±2.72	<0.001
T3 (ng mL^{-1})	1.72±0.90	1.32±0.92	0.031
T4 (μg dL^{-1})	9.41±2.67	8.24±2.71	0.791
TSH (μIU mL^{-1})	2.46±2.01	3.27±5.54	0.044
FT3 (pg mL^{-1})	2.86±0.97	2.61±0.67	0.001
FT4 (ng dL^{-1})	1.17±0.32	1.39±0.44	0.015

Table 4: Pearson's correlation between FBS and thyroid function test parameters among non-diabetic and diabetic subjects

	Non diabetic		Diabetic	
Thyroid function test parameters	r	p-value	r	p-value
Age (year)	-0.230	0.050	-0.002	0.737
BMI (kg m^{-2})	0.056	0.647	-0.195	0.105
T3 (ng mL^{-1})	0.008	0.947	0.078	0.522
T4 (μg dL^{-1})	-0.070	0.565	-0.131	0.279
TSH (μIU mL^{-1})	0.011	0.926	0.398	0.020
FT3 (pg mL^{-1})	0.059	0.626	0.245	0.041
FT4 (ng dL^{-1})	-0.108	0.373	0.073	0.564

r-pearson's correlation coefficient, correlation is signification at the 0.05 level

DISCUSSION

Diabetes is one of the most common diseases in Bangladeshi population where there are about seven million people is suffering from this disease. In our study the overall thyroid disorders in general population of Bangladesh are 8.6%, which is lower than a previous study in Iran (Afkhami-Ardekani *et al*., 2009). Now it has been reported that, both type 1 type 2 diabetes mellitus are strongly associated with thyroid disease and it has important clinical implications for treatment (Kadiyala *et al*., 2010). Our observation is in agreement with these reports. In this study, it was found that the prevalence of hypothyroidism was more (20%) than the studies of (Swamy *et al*., 2012) where hypothyroidism were found to be 12.3 and 12.06%, respectively (Papazafiropoulou *et al*., 2010; Swamy *et al*., 2012). The incidence of hyperthyroidism was lower in females (10%) than in males (13.3%), but the number of subjects in hypothyroid state was higher in females (20%) than in males (16.7%). These findings agree with the report of (Radetti *et al*., 1994; Sacks, 1999; Udiong *et al*., 2007). In this study, fasting blood sugar showed significant correlation with TSH and FT3 level but did not show with T3, T4 and FT4 levels. This may suggests that absence or marginal role of blood sugar concentration in thyroid disorder and further studies with glycosylated hemoglobin (HbA1c) and biochemical parameters (such as, Lipid profile, renal function, liver function tests) may be needed to find the role of glycemic status in creating thyroid disorder. It is a cross sectional study with pronominal sample size and hence a follow up study may be required to corroborate these findings. It can be concluded that diabetics is at increased risk for hypothyroidism and fasting blood sugar indicates their risk factor.

CONCLUSION

Thyroid dysfunctions are rather prevalent in female population of Bangladesh. This study shows high incident of abnormal thyroid hormones in diabetic subjects. Thus, there seems to be a good comparison between hypothyroidism and diabetes subjects. Glycosylated hemoglobin levels would need to be measured to evaluate the level of control of diabetes. Moreover, a significant correlation between them could be established by our study.

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