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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) and thyroid dysfunction are the common disorders in human being and diabetes mellitus in many cases is found to be associated with disordered thyroid function. This evaluation study was conducted at the Z. H Sikder Women's Medical Collage and Hospital (Pvt) Ltd., Gulshan branch, Dhaka, Bangladesh. 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%).

Keywords: **Diabetes Mellitus, Dysfunction, Hypothyroidism, Hyperthyroidism, TSH, FT3, FT4**

1. Introduction

Diabetes mellitus is one of the major health problems affecting populations in the world. It is characterized by hyperglycemia resulting from variable interactions of hereditary and environmental factors and is due to a combination of insulin resistance (impaired glucose disposal mediated insulin) and defective insulin secretion by pancreatic β-cells or both. Hepatic gluconeogenesis, rapid gastrointestinal absorption of glucose and insulin resistance increase diabetes mellitus. Thyroid disease is another common health problems 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 usually the source of autoimmune, primary atrophic hypothyroidism or Hashimoto's thyroiditis (Kamel, 1999). Type 1 diabetes and latent autoimmune thyroid disease in human may be associated with this disease (Johnson, 2006; Lott and Turner, 1975). The first report published in 1979 showed the association 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). The presence of thyroid disorder may affect diabetes control (Johnson, 2006). Hyperthyroidism is usually associated with worsening glycemic control and increased insulin requirements. 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 4.4% in 2030. Total number of people with diabetes is expected to increase from 171 million in 2000 to 366 million in 2030 (Wild et al. 2004). The influence of endocrine and non-endocrine organs other than the pancreas in diabetes mellitus is documented. The physiological and biochemical interaction between insulin and the influence of both insulin and iodothyronines in the metabolism of carbohydrates was recorded (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.

2. Materials and Method

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., Gulshan, Dhaka during April 2011-March 2012. Volunteers recorded personal information of the patients. Age of the subjects ranged from 30 years to 60 years. Z. H. Sikder women`s medical collage & 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 (Mohammad et al. 2009). Serum was obtained from all patients for the measurement of T3, T4, TSH; FT3 & FT4 were measured by enzyme-linked immunosorbent assay (ELISA) method. Used reagents kit was procured from HumanGmbH, Germany. The 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, & T4 were less than normal value and TSH was more than 5.2mIU/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, & T4 were within normal value and TSH was more than 5.2mIU/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).

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

Group	Sex	No. of patients	Mean age in Yrs	P-value
Non Diabetic subjects (N=70)	Male Female	60 80	41.56 ± 7.90	0.001
Diabetic subjects (N=70)	Male Female	60 80	42.96 ± 10.22	

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

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

In the study of BMI, it was observed that non-diabetic and diabetic patients had 22.79 ± 2.54 and 22.26 ± 2.34kg/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).

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

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

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

Thyroid function test parameters	Non diabetic		Diabetic	
	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)	0.008	0.947	0.078	0.522
T4 (µg/dl)	-0.070	0.565	-0.131	0.279
TSH (µIU/ml)	0.011	0.926	0.398	0.020
FT3 (pg/ml)	0.059	0.626	0.245	0.041

FT4 (ng/dl)	-0.108	0.373	0.073	0.564

r- Pearson's correlation coefficient

3. Results & 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 (Kadiyala et al. 2010). 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 (Papazafiropoulou, 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 Papazafiropoulou and Swamy et al. 2012) where hypothyroidism were found to be 12.3% and 12.06% respectively (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 (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.

4. 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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