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Gratis

Research Article

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The Prevalence of Thyroid Dysfunction in Saudi Patients with Type 1 Diabetes Mellitus

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Abstract

Background and objective: It is well known that patients with diabetes have a higher prevalence of thyroid disorders. We therefore conducted this study to assess the prevalence of thyroid dysfunction among patients with T1DM.

Design: A cross-sectional study was performed in Jeddah, Saudi Arabia between January, 2018 to March, 2019. We included 105 (51.0%) patients with T1DM and 101 (49.0%) patients matched for age and sex with no history of T1DM were analyzed as the control group. Thyroid stimulating hormone (TSH), free thyroxin (FT4) and HbA1cb (%) were measured.

Results: A total of 105 (51%) patients with T1DM and 101 (49%) patients with no history of T1DM as control were included in this study. Average age of patients with of T1DM compared to patients without T1DM was (15.7 ± 2.2 and 16.2 ± 1.7 respectively, p=0.06). Mean TSH was higher in patients with than without T1DM (3.9 ± 8.1 vs. 2.1 ± 1.5 respectively) p=0.03. There was a higher prevalence of thyroid dysfunction among T1DM in comparison to control group (21% vs. 6.9%, p=0.005). Compared patients with and without T1DM, there was higher prevalence of clinical (31.8% vs. 28.6%) and subclinical (59.1% vs. 42.9%) hypothyroidism and clinical (0% vs. 14.3%) and subclinical hyperthyroidism (9.1% vs. 14.3%, p=0.03). Average age of patients with of T1DM with thyroid dysfunction than patients without thyroid dysfunction was statistically non-significant (15.6 ± 2.5 and 15.7 ± 2.1 respectively, p=0.9). Moreover, there was more frequent of females compared to males in patients with T1DM with thyroid dysfunction (68.2% vs. 31.8%, p=0.3). Mean HbA1c (%) of patients with of T1DM with thyroid dysfunction than patients without thyroid dysfunction was not different (8.6 ± 2.6 and 8.5 ± 1.7 respectively, p=0.8). In addition, there was statistically non-significant difference between HbA1c and subtypes of thyroid dysfunction.

Conclusion: Thyroid dysfunction particularly hypothyroidism is highly prevalent in a cohort of Saudis with T1DM.

Keywords: Thyroid dysfunction, Type 1 diabetes, Saudi Arabia

Introduction

Diabetes Mellitus (DM) and thyroid diseases are the most two common endocrinopathies in clinical practice [1]. Thyroid gland is one of the important organ in human body and the burden of thyroid diseases in the general population is enormous [2,3]. Thyroid dysfunctions have increased recently and are considered the commonest endocrine diseases [4]. DM is the commonest endocrine disorder in adults across the world. It is well known that diabetics have higher prevalence of thyroid disorders [5]. Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disease result in destruction of pancreatic beta cells lead to the clinical form of the disease [6]. Unfortunately a recent study reported increasing in the incidence of the disease by 2-5% globally [7]. However the prevalence in Saudi Arabia is higher in compare to other communities [8]. Further, the association of Autoimmune Thyroid Disease (AITD) with T1DM has been well documented across

populations, with it being most prevalent immunological disease in patients with T1DM [9-14]. The prevalence of thyroid dysfunction in general population was estimated to be 6.6% that is higher in diabetes because of the increased age of diabetic patients as well as the autoimmune link [4]. As insulin and thyroid hormones being intimately involved in the cellular metabolism thus excess or deficit of either of these hormones could result in functional derangement of the other [15]. On the other hand, the patients suffering from an autoimmune disease might be exposed to other autoimmunity diseases.

AITD is the most prevalent immunological diseases in patients with T1DM [10,16-25]. AITD and T1DM have a common genetic background and similar pathogenesis; hence, they could occur in the same individual [26]. The association between T1DM and AITD was firstly described in the early 1970s [17,18]. Hashimoto's thyroiditis and Graves' disease are the major AITD that occur with increased frequency in patients with T1DM [25,27]. Subclinical hypothyroidism is the most common endocrinopathy among the different studies [28-32]. In contrast, the prevalence of overt or subclinical hyperthyroidism is much lower, 0.3% and 1% respectively [28-30,33]. Cross-sectional studies have reported a prevalence of hypothyroidism in 12-24% of female and 6% of male patients with T1DM [10,16-19]. On the other hand, hyperthyroidism occurs in 1-2% of patients with DM [16,34].

There are limited studies in Saudi Arabia estimating the prevalence of thyroid dysfunction in patients with T1DM and most of them have been done in adults. We therefore conducted the study to assess the prevalence of thyroid dysfunction among patients with T1DM.

Methods

This cross-sectional study was performed in Jeddah, Saudi Arabia between January, 2018 to March, 2019. T1DM was diagnosed on the basis of American Diabetes Association criteria and 101 (49.0%) patients matched for age and sex with no history of T1DM were analyzed as the control group. Patients enrolled into the study were between 12 to 19 years old and had a health profile in the diabetes Centre at King Fahad Armed Forces Hospital [35]. Individuals with history of recent or acute illness and history of taking drugs affecting thyroid function were excluded. Thyroid Stimulating Hormone (TSH) was measured with a Chemiluminescent Immunoassay method (CMIA) (Architect i2000 system, Abbott, USA). Serum free thyroxin (FT4) was estimated by radioimmunoassay. The assays have intra- assay precision of 4.3%. TSH levels between 0.22-4.2 mIU/L and Free T4 12.0-22.0 pmol/L were regarded normal [36]. High performance liquid chromatography was used. HbA1c was expressed as percentage. Hypothyroidism was defined as elevated TSH >4.2 mIU/l and decreased serum levels of FT4. Subclinical hypothyroidism was defined as elevated TSH >4.2 mIU/l and normal circulating FT4. Hyperthyroidism was defined as TSH <0.22 mIU/l with elevated FT4. Subclinical hyperthyroidism was defined as TSH <0.22 mIU/l and normal circulating FT4 [37]. HbA1c was expressed as percentage. High performance liquid chromatography was used.

Statistical analysis

Data are presented as means ± Standard Deviation (SD) or numbers (%). Quantitative variables were compared between two groups by using the Student's test. Differences in categorical variables were analyzed using the chi-square test. The relationship between continuous variables was assessed using coefficients of correlation. *P* value <0.05 indicates significance. The statistical analysis was conducted with SPSS version 23.0 for Windows.

Results

A total of 105 (51%) patients with T1DM and 101 (49%) patients with no history of T1DM as control were included in this study. Average age of patients with of T1DM compared to patients without T1DM was (15.7 ± 2.2 and 16.2 ± 1.7 respectively, p=0.06) (Table 1). There was more prevalent of females compared to males in patients with T1DM (58.1% vs. 41.9%, p =0.4). Mean TSH was higher in patients with T1DM than those without T1DM (3.9 ± 8.1 vs. 2.1 ± 1.5 respectively, p =0.03).

Table 1: Demographic characteristics of the patients with and without type 1 diabetes [mean ± standard deviation or number (%)].

Parameters		Type 1 diabetes	Non-Type 1 diabetes	P value
Numbers		105 (51)	101 (49)	
Age (years)		15.7 ± 2.2	16.2 ± 1.7	0.06
Gender	Male	44 (41.9)	51 (50.5)	0.4
	Female	61 (58.1)	50 (49.5)	
TSH (mIU/l)		3.9 ± 8.1	2.1 ± 1.5	0.03
FT4 (pmol/l)		13.7 ± 2.4	13.4 ± 3.1	0.4
Thyroid dysfunction		22(21)	5(6.9)	0.005

Table 2 showed the distribution of types of thyroid dysfunction in both individuals with and without diabetes.

There was higher prevalence of thyroid dysfunction among T1DM in comparison to control group (21% vs. 6.9%, *p*=0.005). Compared patients with and without T1DM, there was higher prevalence of clinical (31.8% vs. 28.6%) and subclinical (59.1% vs. 42.9%) hypothyroidism and clinical (0% vs. 14.3%) and subclinical hyperthyroidism (9.1% vs. 14.3%), *p*=0.03.

Table 3 showed the clinical characteristics of individuals with type T1DM with and without thyroid dysfunction. Average age of patients with of T1DM with thyroid dysfunction than patients without thyroid dysfunction was statistically non-significant (15.6 ± 2.5 and 15.7 ± 2.1 respectively, *p*=0.9). Moreover, there was a difference between age and subtypes of thyroid dysfunction (Figure 1). Moreover, there was more frequent of females compared to males in patients with T1DM with thyroid dysfunction (68.2% vs. 31.8%, *p*=0.3). Mean HbA1c (%) of patients with of T1DM with thyroid dysfunction than patients without thyroid dysfunction was not different (8.6 ± 2.6 and 8.5 ± 1.7 respectively, *p*=0.8). In addition, there was statistically non-significant difference between HbA1c and subtypes of thyroid dysfunction (Figure 2). A positive correlation was observed between TSH and HbA1c (r =0.124, *P* = 0.2) (Figures 3). Also, a negative correlation was observed between FT4 and HbA1c (r = −0.083, *P*=0.5) (Figure 4).

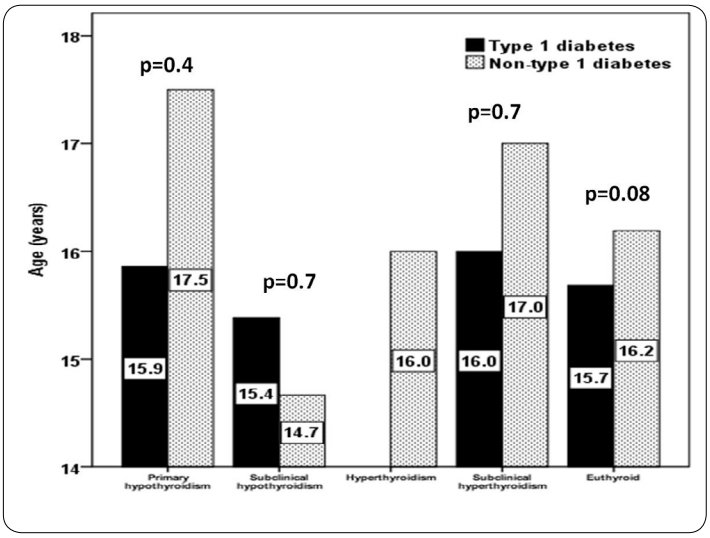

Figure 1: The mean age (years) of different thyroid dysfunction in patients with and without type 1 diabetes.

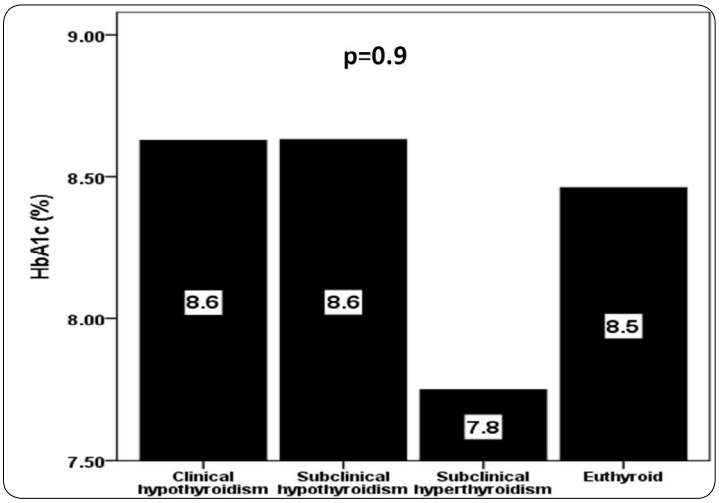

Figure 2: The mean HbA1c (%) of different types of thyroid dysfunction in patients with type 1 diabetes.

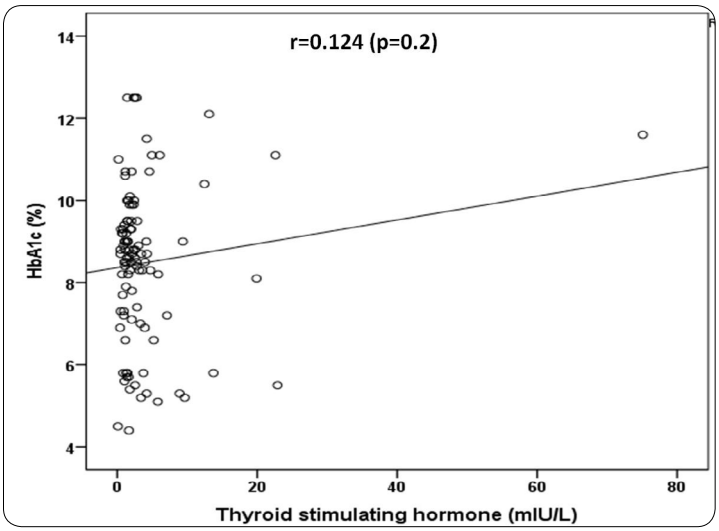

Figure 3: Correlation of thyroid stimulating hormone concentration (mIU/L) and HbA1c (%) in patients with type 1 diabetes.

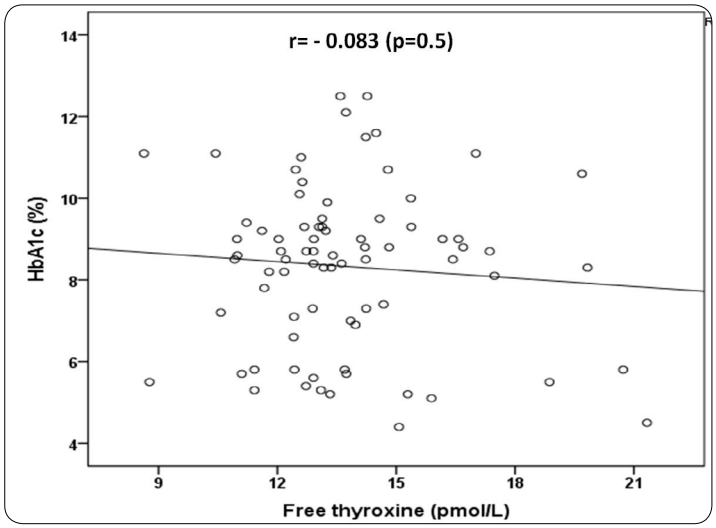

Figure 4: Correlation of free thyroxine (pmol/L) and HbA1c (%) in patients with type 1 diabetes.

Table 2: Distribution of types of thyroid dysfunction in both diabetics and non-diabetic groups.

Parameters			Non-Type 1 diabetes		P value
	No.	%	No.	%	
Clinical hypothyroidism	7	31.8	2	28.6	0.03
Subclinical hypothyroidism	13	59.1	3	42.9	
Total	20	90.9	5	71.4	
Clinical hyperthyroidism	0	0	1	14.3	
Subclinical hyperthyroidism	2	9.1	1	14.3	
Total	2	9.1	2	28.6	
Total	22	100	7	100	

Table 3: Clinical characteristics of individuals with type 1 diabetes with and without thyroid dysfunction [mean ± standard deviation or number (%)].

Parameters		Type 1 diabetes		P value
		with thyroid dysfunction	without thyroid dysfunction	
Numbers		22 (21)	83 (79)	
Age (years)		15.6 ± 2.5	15.7 ± 2.1	0.9
Gender	Male	7 (31.8)	37 (44.6)	0.3
	Female	15 (68.2)	46 (55.4)	
HbA1c (%)		8.6 ± 2.6	8.5 ± 1.7	0.8
TSH (mIU/l)		11.9 ± 15.5	1.8 ± 1.0	<0.0001
FT4 (pmol/l)		13.4 ± 2.9	13.9 ± 2.2	0.4

Discussion

There is a great difference in the prevalence of the thyroid diseases in the general population, ranging from 6.6% to 13.4% [38,39]. Diseases of the thyroid are of great importance because most are amenable to medical management. In the present study, there was a significant higher prevalence of thyroid dysfunction among patients with T1DM in comparison to control group (21.0% versus 6.9%). This was in concordance with Bergesio et al. who found that patients with immune-mediated T1DM are also prone to AITD [40]. In Arab countries, a figure of 8% was reported from Saudi Arabia [41]. A possible explanation for this association could be that, the same susceptibility and genotypes are involved in the pathogenesis of these diseases.

We found that hypothyroidism was the commonest type of thyroid dysfunction among patients with T1DM (90.9%) in comparison to hyperthyroidism in control group (28.6%), p=0.2. This was in concordance with the study in Saudi Arabia where hypothyroidism was the commonest type of thyroid dysfunction among patients with T1DM (67.7%) in comparison to hyperthyroidism in control group (61.3%) [42]. Gemma et al. in Spain on 176 patients with T1DM; who found that, 18 of these patients (14.2%) developed thyroid dysfunction during their follow-up where primary hypothyroidism occurred in 94.4% and hyperthyroidism in 5.6% within the thyroid dysfunction group [43]. Also, this was in concordance with the findings of Ban et al. who reported that the majority of cases (80%) occurred as a subclinical and clinical hypothyroidism (50% vs. 30%) [44].

In this study, 31.8% vs. 68.2% of patients with T1DM with thyroid dysfunction; in comparison, to 44.6% vs. 55.4% in T1DM without thyroid dysfunction group were males and females respectively (p=0.3). In the study done in Saudi Arabia, 10.3% vs. 89.7% of diabetic patients with thyroid dysfunction; in comparison, to 12.9% vs. 87.1% in control group were males and females respectively and this difference was statistically insignificant [42]. This result was also in concordance with the findings of Colorado study, where 25,862 were screened for thyroid diseases [45]. The study has documented a higher prevalence of thyroid disease in women than men, with prevalence rates ranging from 4% to 21%, vs. 2.8% to 16% respectively. Also, the results were agreed with the finding of Souza et al. who studied the prevalence of thyroid dysfunction among Brazilian adolescent regarding their

gender found that the prevalence was higher among females [46].

In this study, there was a non-significant difference between T1DM with and without thyroid dysfunction groups as regard to age (p=0.9) which was in concordance to Alkot et al. [42]. However, this was against the study of Kordonouri et al. who found that, T1DM with thyroid dysfunction were significantly older than those without thyroid dysfunction [47]. However, this result disagreed with that of Verge et al. [48].

We found non-significant difference between HbA1cand T1DM with and without thyroid dysfunction groups in concordance to a study by Glastras et al. [49]. Other found that DM was less controlled when associated with thyroid dysfunction detected by HbA1c [42]. In a study by Franzese, it was founded that thyroid dysfunction can affect the metabolic control in T1DM [50]. It is reported that DM appears to influence thyroid function in at least two sites, one at the level of hypothalamic control of TSH release and the other at the conversion of thyroxine to triiodothyronine in the peripheral tissues [51]. Perros et al. reported that "the thyroid hormones, triiodothyronine and tetraiodothyronine are insulin antagonists that also potentiate the action of insulin indirectly". TRH synthesis decreases in DM, and this could be responsible for the occurrence of low thyroid hormone levels in diabetics [16]. In the literature, it is well known that thyroid hormones directly control insulin secretion, thus affecting the control of DM. In hypothyroidism, there is a reduction in glucose induced insulin secretion by beta cells, and the response of beta cells to glucose or catecholamine is increased in hyperthyroidism due to increased beta cell mass. Moreover, insulin clearance is increased in thyrotoxicosis [52,53].

We aimed to identify the prevalence of thyroid dysfunction in Saudis patients with T1DM. Furthermore, due to the cross sectional nature of this study, the observed population reflects a selected yet comprehensive group of patients rather than the general population. Our study could be limited by the question of clustering of cases within the study region and the effect that might have on our estimates, in addition, the current study population may appear limited in size and therefore may underestimate the true frequency of hypothyroidism in patients with T1DM. In addition, the study shares the limitations of all cross sectional studies.

We conclude that despite the limitations of this hospital-based cross sectional study, thyroid dysfunction particularly hypothyroidism is highly prevalent in cohort of Saudis with T1DM. This observations remains to be validated by population-based studies. In the absence of registry data, larger cooperative studies involving diverse population samples from multiple centers could help to provide further information on the true frequency nationally.

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