

## Prevalence of Thyroid Dysfunction among Type2 Diabetic Patients (T2D) in Makkah And Jeddah-KSA

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### ABSTRACT

**Background:** The association between diabetes mellitus (DM) and thyroid dysfunction is well known. However, the prevalence of having DM with thyroid dysfunction is extremely variable from one study to another. Clinical relevance of thyroid disorders in diabetic patients leads to serious consequences with metabolic compensation of diabetes.

**Objectives:** to find the prevalence of thyroid dysfunction in T2D retrospectively through the data available in our diabetic centers among those who attended the diabetic clinics for routine checkup.

**Patients and methods:** This is a retrospective cohort study conducted from January to August 2017 at three diabetic centers in Makkah and Jeddah, Kingdom of Saudi Arabia. Nine hundred and seventy-nine patients aged between 30 and 65 years, of both genders with T2D were randomly selected. The participants' data were collected from their files, using a data collection checklist prepared for the study.

**Results:** The study included 979 T2D patients. The prevalence of thyroid dysfunction among T2D patients was 13.1%. Mean age among T2D patients with thyroid dysfunction was 48.8 years whereas the mean age among T2D patients with hypertension was 58.5 years. Females were significantly more presented with T2D and thyroid dysfunction. Again, T2D associated with thyroid dysfunction and hypertension was significantly more in females than males. Duration of diabetes was significantly more among patients having T2D, thyroid dysfunction and hypertension than those with only T2D and thyroid dysfunction. Oral antidiabetics (OADs) were more frequently used than combination of OADs and insulin while diet and exercise only were less, however thyroid dysfunction was more among them. Majority of our participants with T2D and thyroid dysfunction reported the occurrence of T2D first

**Conclusion:** The prevalence of thyroid disorder is quite high among T2D patients. Prevalence was higher in female patients and relatively younger ages. Early detection of thyroid dysfunction in patients with T2D is of great importance and consequences.

**Keywords:** Thyroid dysfunction, Type 2 diabetes, Saudi Arabia.

### INTRODUCTION

Diabetes mellitus (DM) is one of the most common endocrine disorders worldwide, according to the World Health Organization. The prevalence of DM in adults worldwide was estimated to be 4.0% in 1995 and is predicted to rise to 5.4% by the year 2025 which means that the number of adults with DM in the world would increase from 135 million in 1995 to 300 million in the year 2025<sup>(1)</sup>.

In Saudi Arabia, DM has become one of the most common reasons of hospital admissions due to its cardiac, renal, and vascular complications. A study was conducted in Saudi Arabia has found that the overall prevalence of DM in adults in KSA is 23.7%<sup>(2)</sup>. Furthermore, DM have been linked to other chronic endocrine disorders by different mechanisms, among which is overproduction of the counter-regulatory hormones that may induce hyperglycemia and other metabolic disturbances, particularly thyroid dysfunctions<sup>(3)</sup>.

The association between DM and thyroid dysfunction is well known<sup>(4, 5)</sup>. The prevalence of having DM with thyroid dysfunction is extremely variable from one study to another. Other studies have discussed the impact of thyroid dysfunction in the control of diabetes and the severity of its complication<sup>(6,7)</sup>.

Clinical relevance of thyroid disorders, in diabetic patients, leads to serious consequences with metabolic compensation of diabetes according to a study in 2005. In spite of that, little attention has been paid to the diagnosis of thyroid dysfunction in diabetics<sup>(8)</sup>. Thyroid disease should be screened at the diagnosis of type 2 diabetes (T2D) and then annually to detect asymptomatic thyroid dysfunction. Diabetic patients have susceptibility to different types of thyroid dysfunction, whether hypothyroidism or hyperthyroidism; at the same time, patients with thyroid dysfunction are susceptible to suffer from either Type 1 or Type 2

diabetes<sup>(9)</sup>. Recommendations were provided by a study conducted in 2005 for thyroid disease screening and diagnosis in patients with diabetes mellitus based on the authors' experiences<sup>(8)</sup>.

Our aim is to find the prevalence of thyroid dysfunction in T2D retrospectively through the data available in our diabetic centers among those who attended the diabetic clinics for routine checkup.

## PATIENTS AND METHODS

This is a retrospective cohort study conducted from January to August 2017 at three diabetic centers in Makkah and Jeddah, Kingdom of Saudi Arabia. Nine hundred and seventy-nine patients aged between 30 and 65 years, of both genders with T2D were randomly selected from Makkah and Jeddah diabetic centers.

The main objective of the study was to determine the prevalence of thyroid dysfunction in T2D patients.

The participants' data were collected from their files after taking the consent from the authorized responsible team.

The inclusion criteria were T2D patients with or without thyroid dysfunction and/or hypertension. Patients with type 1 diabetes (T1D), gestational diabetes and having chronic diseases such as cerebrovascular accidents (CVA), renal disease, hepatic disease and another endocrine dysfunction were excluded from the study.

Data collection checklist was prepared for the study including data about gender, age, history of T2D, hypothyroidism, hyperthyroidism, which occurred first T2D or thyroid dysfunction, hypertension and drug history. Laboratory investigations include documentation of complete blood count, fasting blood glucose, hemoglobin A1C%, thyroid stimulating hormone "TSH", free thyroxine "T4", aspartate aminotransferase "AST", alanine aminotransferase "ALT" and creatinine levels.

### *Statistical analysis*

Descriptive statistics, Chi-square test and one-way ANOVA were used to compare the differences between groups. Least significance difference test (LSD) was applied for post-hoc

comparisons. P value of <0.05 was considered as statistically significant. All statistical methods were performed using SPSS for windows (version 22, SPSS Inc.).

**The study was done after approval of ethical board of Umm ALQURA university.**

## RESULTS

The study included 979 T2D patients. Table 1 presents the background characteristics of them. The mean ( $\pm$  SD) of the overall age was  $53 \pm 12.4$  years. The mean age of patients with T2D and thyroid dysfunction was ( $48.8 \pm 12$ ) years whereas the mean age among T2D patients associated with hypertension was ( $58.5 \pm 10.5$ ) years. The difference was statistically significant,  $p < 0.001$ . The difference was significant between group of T2D + HTN and both of groups of T2D and T2D+ TD ( $p < 0.001$ ) and between group of T2D+HTN+TD and both of groups of T2D and T2D+ TD ( $p < 0.001$ ) using LSD test. More than half of the patients (51.9%) were males. Females were more significantly presented with a combination of T2D and thyroid dysfunction compared to males (13.8% versus 3.7%) and in a combination of T2D, hypertension and thyroid dysfunction (8.3% versus 1%),  $p < 0.001$ . Duration of diabetes was higher among patients presented with a combination of T2D, hypertension and thyroid dysfunction than among those presented with a combination of T2D and thyroid dysfunction ( $11.4 \pm 7.8$  versus  $7.8 \pm 6.5$  years),  $p < 0.001$ . The difference was significant between group of T2D + HTN and both of groups of T2D and T2D+ TD ( $p < 0.001$ ) and between group of T2D+HTN+TD and both of groups of T2D and T2D+ TD ( $p < 0.001$ ) using LSD test. Oral antidiabetic drugs (OADs) were the most frequently used (60.5%), followed by a combination of OADs and insulin (26%) whereas diet and exercise accounted for only (2.4%). Diet/exercise was more reported among patients presented with T2D and thyroid dysfunction (21.6%) than other lines of treatment,  $p < 0.001$ . The prevalence of thyroid dysfunction among T2D patients was 13.1% as illustrated in figure 1. As evident from figure 2, majority of patients presented with a combination of T2D and thyroid dysfunction (96.1%) reported that T2D came first followed by thyroid dysfunction.

**Table 1: Characteristics of type 2 diabetic patients**

|                                     | T2D<br>N=552        | T2D +HTN<br>N=299 | T2D+TD<br>N=84      | T2D+HTN+TD<br>N=44 | ALL<br>N=979 |
|-------------------------------------|---------------------|-------------------|---------------------|--------------------|--------------|
| <b>Age (years)<sup>∞</sup></b>      |                     |                   |                     |                    |              |
| Mean                                | 50.6 <sup>a,b</sup> | 58.5 <sup>a</sup> | 48.8 <sup>a,b</sup> | 54.8 <sup>b</sup>  | 53           |
| SD                                  | 12.6                | 10.5              | 12                  | 9.6                | 12.4         |
| F-value*                            | 33.03               |                   |                     |                    |              |
| p-value                             | <0.001              |                   |                     |                    |              |
| <b>Gender</b>                       |                     |                   |                     |                    |              |
| Male (N “%”)                        | 322 (63.4)          | 162 (31.9)        | 19 (3.7)            | 5 (1.0)            | 509 (51.9)   |
| Female (N “%”)                      | 230 (48.8)          | 137 (29.1)        | 65 (13.8)           | 39 (8.3)           | 471 (48.1)   |
| Pearson Chi-square                  | 67.59               |                   |                     |                    |              |
| p-value                             | <0.001              |                   |                     |                    |              |
| <b>Duration of T2D(Years)</b>       |                     |                   |                     |                    |              |
| Mean                                | 7.8 <sup>a,b</sup>  | 11 <sup>a</sup>   | 7.8 <sup>a,b</sup>  | 11.4 <sup>b</sup>  | 8.9          |
| SD                                  | 6.5                 | 7.1               | 6.5                 | 7.8                | 6.9          |
| F-value*                            | 17.28               |                   |                     |                    |              |
| p-value                             | <0.001              |                   |                     |                    |              |
| <b>Treatment of T2D<sup>°</sup></b> |                     |                   |                     |                    |              |
| Diet/ Exercise                      | 15 (65.2)           | 3 (13.0)          | 5 (21.7)            | 0 (0.0)            | 23 (2.4)     |
| OADs                                | 337 (57.8)          | 163 (28.0)        | 57 (9.8)            | 26 (4.5)           | 583 (60.5)   |
| Insulin                             | 75 (70.1)           | 22 (20.6)         | 7 (6.5)             | 3 (2.8)            | 107 (11.1)   |
| OADs+Insulin                        | 117 (46.6)          | 105 (41.8)        | 14 (5.6)            | 15 (60.0)          | 25 (26.0)    |
| Pearson Chi-square                  | 37.59               |                   |                     |                    |              |
| value                               | <0.001              |                   |                     |                    |              |

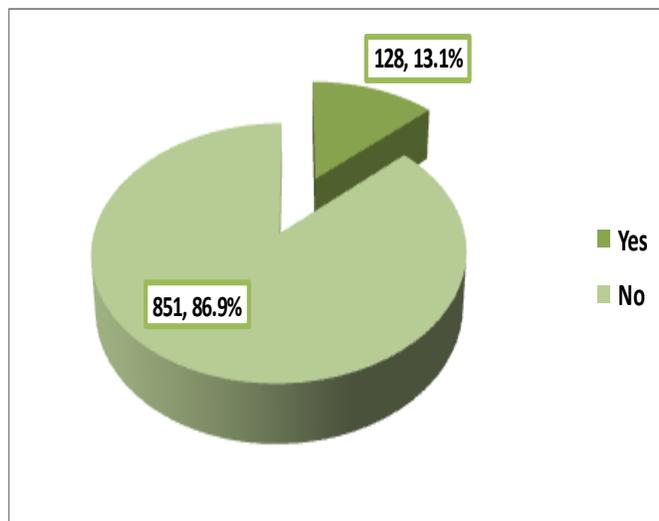
T2D: Type 2 diabetes      HTN: Hypertension      TD: Thyroid dysfunction

\*One-way analysis of variance test (ANOVA)    <sup>∞</sup>Available in 932 patients

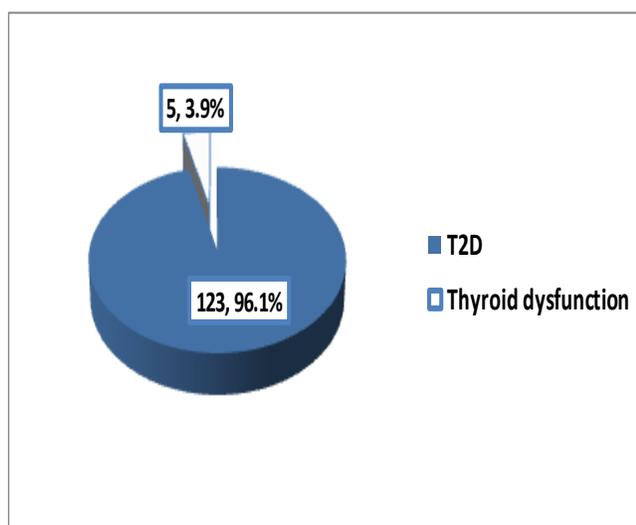
OADs: Oral Antidiabetic Drugs

<sup>°</sup>Data on treatment was available in 964 cases.

<sup>a,b</sup> Least significance difference post hoc test



**Figure 1: Prevalence of thyroid dysfunction among T2D patients.**



**Figure 2: Which occurred first among the participants? Type 2 diabetes or thyroid dysfunction**

## DISCUSSION

Type 2 diabetes (T2D) mellitus is a public health problem in the Kingdom of Saudi Arabia (KSA)<sup>(2)</sup>. Although, several patients of T2D are presented with thyroid dysfunction, the prevalence of thyroid dysfunction in these patients has not been studied in Western region, KSA. The present study aimed to estimate the prevalence of thyroid dysfunction among T2D through a retrospective cohort approach by reviewing the data available for T2D patients in three diabetic centers in two big cities in the Western region of the Kingdom (Makkah and Jeddah).

In the present study, the prevalence of thyroid dysfunction was 13.1%. Different rates have been reported from different parts of the world. In Spain, prevalence of thyroid dysfunction among T2D was 32.4%<sup>(10)</sup> while in Argentina, it was 48%<sup>(11)</sup>. In Brazil, the prevalence of TD in all diabetic patients was 14.7%. The most frequently thyroid dysfunction in this study was subclinical hypothyroidism, presented in 12% of patients with T2D<sup>(12)</sup>. In India, the prevalence of thyroid dysfunction among T2D patients was 31.2% (subclinical hypothyroidism “16.3%”, hypothyroidism “11.4%”, subclinical hyperthyroidism “2%” and hyperthyroidism “1.5%”)<sup>(13)</sup>. In another Indian study, the prevalence of thyroid dysfunction among T2D patients was very high (30 %) with subclinical hypothyroidism being the most common<sup>(14)</sup>. In Jordan, the overall prevalence of thyroid disease in T2D was 12.5% and the most common was subclinical hypothyroidism<sup>(15)</sup>. In Saudi Arabia, Akbar *et al.*<sup>(16)</sup> investigated the association between thyroid dysfunction, thyroid autoimmunity, and T2D and observed that thyroid autoimmunity in diabetics was 10% while thyroid dysfunction was found in 16% diabetics. In Greece, the prevalence of thyroid dysfunction in T2D was 12.3%<sup>(17)</sup>.

Our study also documented that females were more significantly presented with a combination of T2D and thyroid dysfunction compared to males (13.8% versus 3.7%). The same has been reported in a study carried out in Greece<sup>(5)</sup>. Thus, prevalence of thyroid disorder in diabetic patients is strongly influenced by female gender. Again, in this study, mean age among T2D patients with thyroid dysfunction was (48.8±12) years. In India,<sup>(13)</sup> most cases of thyroid dysfunction were seen in the age group of 45-64 years. In the current study, duration of diabetes was higher among patients presented with a combination of T2D, hypertension and thyroid dysfunction than among those presented with a combination of T2D and thyroid dysfunction. However, in Spain, Díez *et al.* showed that there were no significant relationships between the presence of thyroid dysfunction and duration of diabetes<sup>(10)</sup>. Diet and/or exercise as a line of DM management was more reported among patients presented with T2D and thyroid dysfunction (21.6%) than other lines of treatment. In India, no association was reported between thyroid dysfunction and type of DM treatment<sup>(13)</sup>.

In conclusion, the prevalence of thyroid disorder is quite high among type 2 DM. Prevalence was higher in female patients and relatively younger ones. Early detection of thyroid dysfunction in patients with T2D is of great importance and consequences.

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