

Thyroid Dysfunction in Patients with Uncontrolled Type 2 Diabetes Mellitus

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Abstract

Background: Diabetes mellitus, particularly type 2, and thyroid dysfunction are the most common endocrine disorders. In addition, thyroid dysfunction is associated with poor glycemic control, and there is increased incidence of thyroid dysfunction in type 2 diabetics. **Objectives:** This study had been designed to find the frequency of thyroid dysfunction in patients with uncontrolled type 2 diabetes mellitus, the frequency of different types of thyroid dysfunction in this group of patients, the effect of having thyroid dysfunction on the glycemic control, and the glycemic control in patients with well-treated thyroid dysfunction. **Patients and Methods:** This study is a cross-sectional study which included 500 patients with type 2 diabetes mellitus who had been randomly selected from the patients attending the National Center for Diabetes/Al-Mustansiriyah University and the outpatient clinic of Al-Yarmouk Teaching Hospital during the period between August 1, 2016, and July 31, 2017. All of the patients underwent a full history and physical examination, in addition, all of them were sent for random plasma glucose, glycated hemoglobin, and “thyroid-stimulating hormone.” **Results:** This study showed that 364 patients (72.8% of the sample) had poor glycemic control. Thyroid dysfunction was diagnosed in 67 patients (18.4% of those with poor glycemic control), 43.28% of them were known to have thyroid dysfunction, and the rest of them were discovered to have thyroid dysfunction during the study. Hypothyroidism, including both subclinical and primary types, was diagnosed in 26 patients. Statistical analysis showed that significant association between poor glycemic control and thyroid dysfunction calculated Chi-square was 10.67 and $P = 0.001086$. **Conclusions:** This study showed that thyroid disorders are not uncommon in patients with uncontrolled type 2 diabetes mellitus. Hypothyroidism is the most common type of thyroid dysfunction and having thyroid dysfunction whether in the form of hypo or hyperfunction is associated with poor glycemic control and controlling thyroid state result in better glycemic control.

Keywords: Hyperthyroidism, hypothyroidism, thyroid, type 2 diabetes mellitus, uncontrolled

INTRODUCTION

The most frequent two endocrine diseases that an endocrinologist face in his clinical practice is type 2 diabetes mellitus and thyroid dysfunction.^[1] The relation between thyroid dysfunction and diabetes mellitus is well known; as from the pathophysiology point of view, thyroxine and insulin are both involved in the regulation of the cellular metabolism and one of them works in a counterregulatory way against the other.^[2] In addition to this bad effect of thyroid dysfunction on the glucose hemostasis, many studies found that the frequency of thyroid dysfunction is higher in diabetic population compared to nondiabetics.^[1,3,4] The prevalence of thyroid dysfunction in the nondiabetic population appeared to be 6.6%–9.5%.^[5,6] On the other hand, studies about the frequency of thyroid dysfunction in patients with type 2

diabetes showed a frequency ranging between 12.3% in Greek patients with type 2 diabetes^[7] and 16% in diabetic patients in Saudi Arabia.^[8]

Glucose metabolism is affected by thyroid hormones in many ways. Thyroid overactivity is recognized for a long time to promote poor glycemic control; in the hyperthyroid state, the half-life of insulin is decreased. The cause for this reduced half-life most probably due to an increased degradation and an enhanced secretion of biologically inactive insulin precursors.^[6] Although hypothyroidism can cause reduced rate of hepatic glucose production, it had been shown that subclinical as well as

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clinical hypothyroid states are associated with increased insulin resistance.^[6]

This study had been designed to as follows:

1. Find the frequency of thyroid dysfunction and its types in patients with uncontrolled type 2 diabetes
2. Study the association between thyroid dysfunction and the poor glycemic control in patients with type 2 diabetes
3. Study the association between controlled thyroid dysfunction and the glycated hemoglobin level.

PATIENTS AND METHODS

This study is a cross-sectional study which included 500 patients with type 2 diabetes mellitus who had been randomly selected from the patients attending the National Center for Diabetes/ Al-Mustansiriyah University and the outpatient clinic of Al-Yarmouk Teaching Hospital during the period between August 1, 2016, and July 31, 2017. All of the patients underwent a full history and physical examination; in addition, all of them were sent for random plasma glucose, glycated hemoglobin, and “thyroid-stimulating hormone” (TSH). Those who had abnormal TSH level, whether increased or undetected, were sent for full thyroid function tests.

All of the data had been entered into the computer using SPSS Statistics for Windows, (Version 17.0. Chicago, SPSS Inc., USA) through which all statistical analysis had been done including Chi-square and *t*-tests with a selected level of statistical significant $P = 0.05$.

RESULTS

Of the 500 type 2 diabetics included in this study, only 136 patients (27.2% of the sample) had good glycemic control in the form of hemoglobin A1c (HbA1c) level of 7% or less (mean $\pm$ standard deviation [SD], $6.84 \pm 0.36\%$, range 6.12%–6.98%), while the rest of the sample, 364 patients (72.8% of the sample) had uncontrolled type 2 diabetes as they had an HbA1c level of more than 7% (mean $\pm$ SD, $10.82 \pm 1.79\%$, range 7.3%–13.8%).

In patients with uncontrolled diabetes, 67 patients discovered to have thyroid dysfunction (18.4% of those with uncontrolled diabetes), 29 of them already had the diagnosis of thyroid dysfunction (43.28% of those with thyroid dysfunction and uncontrolled type 2 diabetes), and 38 patients from the same group had the diagnosis of thyroid dysfunction during this study (56.72%).

In patients with good glycemic control, nine patients discovered to have abnormal thyroid function (6.61% of those with good glycemic control). Seven of them already had been diagnosed and treated as cases of thyroid disorders (77.78% of those with abnormal thyroid function and good glycemic control), and the other two patients were diagnosed during this study (22.28%).

Hypothyroidism was the most frequent type of thyroid dysfunction among those with uncontrolled diabetes

as 39 patients (58.21% of the uncontrolled diabetics and thyroid dysfunction) had either subclinical hypothyroidism (26 patients, 38.81% of them) or primary hypothyroidism (13 patients, 19.4% of them). This study showed that there is a statistical association between having thyroid dysfunction and uncontrolled diabetes mellitus, calculated Chi-square was 10.67 and $P = 0.001086$. Table 1 shows the types of thyroid dysfunctions that had been observed during this study.

Only 6 of the 29 patients with uncontrolled diabetes and already diagnosed with thyroid dysfunction (20.68%) were biochemically euthyroid. On the other hand, 5 of 7 patients with good glycemic control and already had the diagnosis of thyroid dysfunction were euthyroid at the time of the study (71.43%). Statistically, it is noticed that there is association between proper treatment and control of the thyroid dysfunction and the control of diabetes, the Chi-square statistic is 6.8415 and $P = 0.008907$. Figure 1 shows the frequency of controlled thyroid function test among patients who already had been diagnosed and treated for the thyroid dysfunction.

Furthermore, it had been found that the mean glycated hemoglobin of patients with uncontrolled diabetes was $8.65 \pm 1.04\%$ and $11.03 \pm 1.70\%$ in those who were biochemically euthyroid and those with abnormal thyroid functions tests, respectively. It had been found that there is the statistically significant difference in the HbA1c mean between those who had controlled thyroid dysfunction and those who had abnormal thyroid functions, $t = 3.35028$ and $P = 0.000674$.

Table 1: Types of thyroid dysfunction that had been observed during the study

	Uncontrolled DM (<i>n</i> =364) (%)	Controlled DM (<i>n</i> =136) (%)
Subclinical hypothyroidism	26 (38.81)	3 (33.33)
Primary hypothyroidism	13 (19.40)	2 (22.22)
Subclinical hyperthyroidism	16 (23.88)	1 (11.11)
Primary hyperthyroidism	12 (17.91)	3 (33.33)
Total	67 (100.00)	9 (100)

The Chi-square statistic is 10.6753. $P=0.001086$. DM: Diabetes mellitus

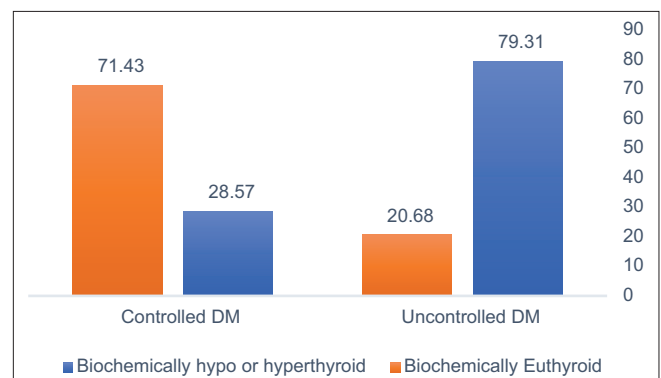


Figure 1: The frequency of controlled thyroid function test among patients who already had been diagnosed and treated for the thyroid dysfunction

Regarding the gender distribution, this study showed that 51 of the 67 patients with thyroid dysfunction and uncontrolled diabetes mellitus were female (76.12%) including 30 patients with hypothyroidism and 21 patients with hyperthyroidism, female-to-male ratios were 3.18:1, 3.75:1, and 3:1, respectively.

Regarding the age distribution, the mean age of those with controlled diabetes was 54.2 ± 16.2 years old (range between 28 and 72 years old), and the mean age of the uncontrolled patients was 53.8 ± 17.1 years old (range between 31 and 73 years old). There was no significant difference in the mean age between the two groups. Table 2 shows the age distribution of the included patients according to the type of thyroid dysfunction.

DISCUSSION

In this study, it had been found that thyroid dysfunction is not uncommon in patients with uncontrolled type 2 diabetes, and the frequency was 18.4% of those with poor glycemic control. It is important to mention that about 43.28% of them had already diagnosed to have thyroid dysfunction or history of it, therefore, the new cases were 38 of 67 cases (56.72%). The frequency of thyroid dysfunction in this study was 7.6% of all type 2 diabetics, but this frequency is markedly increased if we consider the sample of patients with bad control to be 18.4% among them. This frequency is comparable to other studies findings. Perros *et al.* reported of frequency of thyroid dysfunction as high as 31.4% among females with type 1 diabetes to be as low as 6.9% among men with type 2 diabetes.^[9] The latter is close to the frequency demonstrated by this study. However, it is less than what had been reported by Radaideh *et al.* in Jordan whose study showed a prevalence of about 12.5% of those with type 2 diabetes.^[10] This difference can be explained by the differences in health systems and the referral of complicated cases to the tertiary center of endocrinology in Amman as most of their cases were already diagnosed to have thyroid dysfunction before the inclusion in the study.

Type 2 diabetics with hypothyroidism constitute the most frequent thyroid dysfunction, and it had been found that 58.21% of the uncontrolled patients had hypothyroidism and subclinical hypothyroidism had been observed in about two-thirds of them (26 patients, 38.81% of patients with

poor glycemic control and thyroid dysfunction). Akbar *et al.* showed similar findings in Saudi Arabia.^[8] This finding is also consistent with several studies finding including Palma *et al.* study^[1] and Radaideh study.^[10] This study showed that there is a statistical association between having thyroid dysfunction and uncontrolled diabetes mellitus, calculated Chi-square was 10.67 and $P = 0.001086$. More recent studies showed the same increased risk of having hypothyroidism in patients with type 2 diabetes mellitus.^[11] In a meta-analysis published by Han C, it showed that the prevalence of subclinical hypothyroidism ranged between 4.69% and 18.86% despite whether the patients had poor or good glycemic control.^[12] In this study, the frequency of subclinical hypothyroidism was 7.14% of those with uncontrolled diabetes mellitus, a frequency that is similar to what had been observed in several studies included in the Han C meta-analysis.

This study found that hypothyroidism tends to occur more frequently in patients whose age was older than 50 years old. About 66.67% of hypothyroid patients were in their sixth and seventh decades of life. Hypothyroidism was more frequent in old patients compared to hyperthyroidism which is more frequent among younger patients (mean age was 59.8 ± 8.6 years old and 39.3 ± 5.7 years old, respectively). There was a statistically significant difference between the two means ($P = 0.0001$, calculated $t = 10.9877$). Similar tendency had been observed in several other studies.^[8,10,12-16]

The frequency of thyroid dysfunction in females was higher than its frequency in males as 76.12% of those with abnormal thyroid function were females. This is in concordance with the findings of other similar studies.^[8,10,11,17]

Although it is important to relate the status of thyroid function and the glycemic control, in this study, it had been found that glycemic control in patients who already diagnosed as cases of thyroid dysfunction and treated is much better with a statistically significant difference between their HbA1c means. It had been shown that the mean HbA1c in patients who had the diagnosis of thyroid dysfunction before the inclusion in this study and have been treated to get euthyroid state was 8.65% compared to a mean HbA1c of about 11.03% that had been discovered in patients who had the diagnosis during the study and had not started treatment yet. Barmpari *et al.* found in a recent study that the poorest glycemic control was observed in type 2 diabetic patients with hypothyroidism compared to those who had not or had been well treated with thyroxine replacement.^[11]

CONCLUSIONS AND RECOMMENDATIONS

This study showed that as follows:

1. Thyroid disorders are not uncommon in patients with type 2 diabetes mellitus and it is more common in those with poor glycemic control
2. Hypothyroidism, whether an overt or subclinical type, was the most frequent type of thyroid dysfunction and its frequency increased by age and more frequent in females

Table 2: Patients' distribution according to their age and type of thyroid dysfunction

Age group (year-old)	Hypothyroidism, n (%)	Hyperthyroidism, n (%)
Younger than 30	0	3 (10.72)
30-39	5 (12.82)	13 (46.43)
40-49	8 (20.51)	10 (35.71)
50-59	11 (28.21)	2 (7.14)
60 or older	15 (38.46)	0
Total	39 (100)	28 (100)

3. Patient who have already the diagnosis of thyroid dysfunction before being included in this study with well control of their thyroid status had lower HbA1c levels compared to newly diagnosed and untreated patients
4. It is worthy to check for the thyroid disorders in patients with uncontrolled type 2 diabetes mellitus because early diagnosis and treatment can affect positively the health of diabetic patients
5. It is recommended to do larger studies to investigate the effect of having thyroid dysfunction on the incidence of chronic complications and the effect of controlling thyroid dysfunction on the glycemic control of patients with type 2 diabetes mellitus.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Palma CC, Pavesi M, Nogueira VG, Clemente EL, Vasconcellos Mde F, Pereira LC Júnior, *et al.* Prevalence of thyroid dysfunction in patients with diabetes mellitus. *Diabetol Metab Syndr* 2013;5:58.
2. Silva Rdo C. Importance of thyroid function evaluation in patients with diabetes mellitus. *Arq Bras Endocrinol Metabol* 2005;49:180-2.
3. Feely J, Isles TE. Screening for thyroid dysfunction in diabetics. *Br Med J* 1979;1:1678.
4. Umpierrez GE, Latif KA, Murphy MB, Lambeth HC, Stentz F, Bush A, *et al.* Thyroid dysfunction in patients with type 1 diabetes: A longitudinal study. *Diabetes Care* 2003;26:1181-5.
5. Gharib H, Tuttle RM, Baskin HJ, Fish LH, Singer PA, McDermott MT, *et al.* Subclinical thyroid dysfunction: A joint statement on management from the American Association of Clinical Endocrinologists, the American Thyroid Association, and the Endocrine Society. *J Clin Endocrinol Metab* 2005;90:581-5.
6. Hage M, Zantout MS, Azar ST. Thyroid disorders and diabetes mellitus. *J Thyroid Res* 2011;2011:439-63.
7. Papazafropoulou A, Sotiropoulos A, Kokolaki A, Kardara M, Stamataki P, Pappas S, *et al.* Prevalence of thyroid dysfunction among Greek type 2 diabetic patients attending an outpatient clinic. *J Clin Med Res* 2010;2:75-8.
8. Akbar DH, Ahmed MM, Al-Mughales J. Thyroid dysfunction and thyroid autoimmunity in Saudi type 2 diabetics. *Acta Diabetol* 2006;43:14-8.
9. Perros P, McCrimmon RJ, Shaw G, Frier BM. Frequency of thyroid dysfunction in diabetic patients: Value of annual screening. *Diabet Med* 1995;12:622-7.
10. Radaideh AR, Nusier MK, Amari FL, Bateiha AE, El-Khateeb MS, Naser AS, *et al.* Thyroid dysfunction in patients with type 2 diabetes mellitus in Jordan. *Saudi Med J* 2004;25:1046-50.
11. Barmpari ME, Kokkorou M, Micheli A, Alexiou I, Spanou E, Noutsou M, *et al.* Thyroid dysfunction among Greek patients with type 1 and type 2 diabetes mellitus as a disregarded comorbidity. *J Diabetes Res* 2017;2017:6505814.
12. Han C, He X, Xia X, Li Y, Shi X, Shan Z, *et al.* Subclinical hypothyroidism and type 2 diabetes: A Systematic review and meta-analysis. *PLoS One* 2015;10:e0135233.
13. Shao F, Li X, Zhang Z, Luo Y. Study of the impact of subclinical hypothyroidism on chronic complications of type 2 diabetes mellitus. *J Clin Res* 2014;31:1291-3.
14. Shen Y, Bi H. Impact of subclinical hypothyroidism on chronic complications of type 2 diabetes. *Wuhan Univ J* 2012;33:415-9.
15. Zhang D, Zhang L, Zhang Y, Zeng Y, Li L, Lei M. Association of subclinical hypothyroidism with diabetic chronic complications in type 2 diabetic patients. *Chin J Diabetes* 2014;22:25-9.
16. Centeno Maxzud M, Gómez Rasjido L, Fregenal M, Arias Calafiore F, Córdoba Lanus M, D'Urso M, *et al.* Prevalence of thyroid dysfunction in patients with type 2 diabetes mellitus. *Medicina (B Aires)* 2016;76:355-8.
17. Al-Murshidi M. A cross-sectional study to evaluate the prevalence of thyroid disorders between diabetic patients in Hillah city. *Med J Babylon* 2016;13:154-9.