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To cite this article: Mohamed Abdelraouf Korani & Ahmed Sonbol (2018) Study of risk factors for erectile dysfunction in patients with type 2 diabetes mellitus: Correlation to serum testosterone level, Alexandria Journal of Medicine, 54:4, 319-321, DOI: [10.1016/j.ajme.2018.01.002](https://doi.org/10.1016/j.ajme.2018.01.002)

To link to this article: <https://doi.org/10.1016/j.ajme.2018.01.002>



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Published online: 17 May 2019.



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## Alexandria Journal of Medicine

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Original Article

## Study of risk factors for erectile dysfunction in patients with type 2 diabetes mellitus: Correlation to serum testosterone level

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## ARTICLE INFO

## Article history:

Received 7 November 2017

Revised 21 November 2017

Accepted 17 January 2018

Available online 13 February 2018

## Keywords:

Type 2 diabetes mellitus

Erectile dysfunction

Serum testosterone

## ABSTRACT

**Background:** Diabetes mellitus (DM) is one of the most frequent etiologies of erectile dysfunction (ED). Risk factors of ED in type 2 diabetes mellitus (T<sub>2</sub> DM) include patient age, disease duration, sedentary life and glycemic control. Subnormal testosterone concentrations contribute to ED as testosterone regulates nearly every component of erectile function.

The aim of the work was to study the age of the patient, duration of diabetes mellitus, body mass index (BMI), glycosylated hemoglobin (HbA1c) and urinary albumin creatinine ratio (uACR) in type 2 male diabetic patients as risk factors for erectile dysfunction and their relation to serum testosterone level.

**Patients and methods:** This study was conducted on 100 male type 2 diabetics selected from inpatient department and out patient clinics of the Internal Medicine Department in Menoufia University Hospital. The patients were divided into two groups: Group 1: 50 patients with type 2 DM with erectile dysfunction and Group 2: 50 patients with type 2 DM without erectile dysfunction. The study groups were subjected to thorough history with special emphasis on age of the patients, disease duration and investigations including testosterone level, glycosylated hemoglobin, and uACR. The patients answered the abridged 5-item version of the International Index of Erectile Function (IIEF-5) questionnaire.

**Results:** Total serum testosterone was significantly lower in diabetics with ED compared to those without ED. HbA1c, diabetes duration and uACR were independently negatively correlated with testosterone level.

**Conclusion:** The diabetes duration, glycemic control and uACR contribute to erectile dysfunction in type 2 diabetics, and they were independently and negatively correlated with total serum testosterone level.

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## 1. Introduction

The long term complications of diabetes include dysfunction of different organs and sexual dysfunction.<sup>1</sup>

ED is defined as the persistent inability to achieve or maintain penile erection sufficient for satisfactory sexual performance.<sup>2</sup> Persistence of ED over 3 months has been suggested as a reasonable clinical guideline.<sup>3</sup>

There are a lot of risk factors for ED in diabetic patients.<sup>4</sup> Sub-normal testosterone levels were found in diabetic men and contribute to ED.<sup>5</sup>

This study was designed to study the patient's age, diabetes duration, HbA1c, uACR and BMI as risk factors for ED in type 2 male diabetics and their correlation to serum testosterone level.

## 2. Patients and methods

This study was conducted on 100 male type 2 diabetic patients aged above 40 years and with duration of diabetes more than 5 years. The patients selected from inpatient and outpatient clinics of the Internal Medicine department in Menoufia University. The protocol of the study was approved by the ethical committee of Faculty of Medicine. The selected patients gave consent for participation in the study before they were exposed to examination and investigations. The study was done from June 2017 to August 2017.

The diabetic patients were divided into two groups:

Group 1: 50 male patients with type 2 diabetes with erectile dysfunction.

Group 2: 50 male patients with type 2 diabetes without erectile dysfunction.

Exclusion criteria included advanced liver or renal diseases, malignancy, use of medications that cause hypogonadism or those

Peer review under responsibility of Alexandria University Faculty of Medicine.

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<https://doi.org/10.1016/j.ajme.2018.01.002>

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**Table 1**  
Comparison between the studied groups according to demographic and laboratory data.

Parameter	Group 1 (n = 50)	Group 2 (n = 50)	Test of significance	P
Age (years)	53.54 ± 5.61	49.51 ± 7.32	t = 3.09	.002
Duration of diabetes (years)	9.49 ± 3.20	7.06 ± 2.82	Mw = 2.83	.005
Body mass index (kg/m <sup>2</sup> )	32.39 ± 5.4	28.70 ± 5.13	t = 3.503	.001
Glycated hemoglobin (%)	10.20 ± 2.37	8.30 ± 1.70	t = 4.606	<.001
Urinary albumin creatinine ratio (mg/g/cr)	480.20 ± 118	26.35 ± 90.35	Mw = 9.021	<.001
Total serum testosterone (ng/dl)	194 ± 107.65	453 ± 101.37	Mw = 8.031	<.001

Mw: Value for Mannwhitney test t: student test.

\* Statistically significant at P ≤ .05.

**Table 2**  
Correlation between total serum testosterone and studied parameters.

Parameter	Total Serum testosterone (ng/dl)	
	rs	P
Age (years)	0.091	.490
Duration of diabetes (years)	−0.402	.001
Body mass index (kg/m <sup>2</sup> )	−0.316	.014
Glycated hemoglobin (%)	−0.333	.009
Urinary albumin creatinine ratio (mg/g/cr)	−0.925	<.001

rs: Spearman Coefficient.

\* Statistically significant at P ≤ .05.

receiving testosterone or steroid, history of head trauma, pelvic trauma and surgery.

Patients of the study were subjected to thorough history taking with special emphasis on the age, duration of diabetes mellitus and detailed drug history. Complete physical examination was done including weight and height to calculate body mass index.

Investigations included liver profile, complete blood picture, glycosylated hemoglobin, blood urea and creatinine, complete urine analysis, urine albumin creatinine ratio and total serum testosterone level were done.

The patients were asked to answer the abridged 5 – item version of the International Index of Erectile Function (IIEF-5) questionnaire.<sup>6</sup> This questionnaire consists of 5 questions each of them is scored on five – point ordinal score where the lower values represent poor erectile function. Patients with score less than 22 were considered to have erectile dysfunction.<sup>7</sup> All patients filled the Arabic version of IIEF-5 questionnaire by themselves.

### 3. Statistical methodology

Data were analyzed using Statistical Package for Social Science (SPSS) software computer program version 15, (IBM Corp, IBM SPSS Statistics for Windows, Version 15.0 Armonk, NY:IBM Corp. Chicago, USA) Quantitative data were described using mean and standard deviation. Significance level (P) value was P less than or equal to 0.05.

### 4. Results

The mean age, Glycosylated hemoglobin, BMI and uACR were statistically significantly higher in group 1 compared with group 2. Total Serum testosterone level was statistically significantly lower in group 1 compared with group 2 (Table 1). Total serum testosterone level was significantly negatively correlated with the duration of diabetes, HbA1c, BMI and uACR (Table 2).

Only duration of diabetes, HbA1c and uACR were independently negatively correlated with total serum testosterone level (Table 3).

**Table 3**  
Linear regression for the studied parameters affecting total serum testosterone.

Parameter	Total Serum testosterone (ng/dl)		
	B	SE	P
Age (years)	0.049	0.056	.509
Duration of diabetes (years)	27.430	12.87	.036
Body mass index (kg/m <sup>2</sup> )	0.619	0.50	.240
Glycated hemoglobin (%)	0.076	0.018	.004
Urinary albumin creatinine ratio (mg/g/cr)	0.080	0.002	.002

B: Unstandardized coefficient.

SE: Stander error.

\* Statistically significant at P ≤ .05.

### 5. Discussion

Diabetes mellitus is a major health problem worldwide. The association between hypogonadism and diabetes mellitus has recently received substantial attention.<sup>8</sup>

The present study reported that the age of the patients with ED was significantly higher than the age of those without ED. The is similar to cross sectional study by Giuliano et al.<sup>9</sup> on population of 7689 patients in Italy [including 3563 patients with DM] confirmed the relation between increasing age and increasing prevalence of ED. The same results obtained from other studies.<sup>10,11</sup>

On the other hand, studies conducted by Ghazi et al.<sup>8</sup> and Romeo et al.<sup>12</sup> did not consider age as a risk factor for ED.

The result of the current study showed that diabetic patients with ED had significantly longer duration of diabetes when compared to those without ED and that total testosterone level was independently negatively correlated with the duration of diabetes. This is in agreement with an observational study on total of 5477 Chinese men with type 2 DM by Yang et al.<sup>13</sup> found that the duration of DM was significantly associated with the presence and severity of ED.

Comparably, a study on 3980 diabetic men aged 30–69 years was performed by Selim et al.<sup>14</sup> reported that the frequency of ED increased with duration of DM, ranging from 44.6% for DM lasting <5 years to 88.9% for DM > 20 years and that patients with ED had a longer duration of DM than those without ED.

Similar to our study, Al Hayek et al.<sup>15</sup> and Corona et al.<sup>16</sup> reported that the prevalence of low testosterone was higher in patients with a longer duration of DM. Also, another study on 123 men with T2 DM by shaheen et al.<sup>17</sup> showed a negative correlation between serum testosterone and duration of diabetes. On the other hand Dhindsa et al.<sup>1</sup> and Mirzae et al.<sup>19</sup> reported no significant correlation between hypogonadism and duration of diabetes.

In the present study group 1 patients had significantly higher BMI than group 2 patients. Also there was a significant negative correlation between BMI and testosterone level. A large study on ED, the Health Professionals Follow up Study [HPF5] which included 22,086 United States men from 40 to 75 years old has found BMI was inversely associated with the risk of ED development.<sup>20</sup> Another study by Hofstra et al.<sup>21</sup> on 160 obese men, the

final analysis showed that more forty percent of those with morbid obesity had low serum testosterone.

The results of our study showed that patients with ED had significantly higher HbA1c when compared to patients without ED and HbA1c was found to be independently negatively correlated with testosterone level. These results in agreement with a study by Rabijewski et al.<sup>22</sup> reported significant negative correlation between HbA1c and testosterone concentration in type 2 DM. Moreover Aboelanga and ElShaway.<sup>23</sup> reported that HbA1c was a significant predictor for total testosterone in type 2 diabetic patients and risk factor for male hypogonadism.

Chronic hyperglycemia induces derangement on vascular and neuronal cells including hemodynamic alteration, endothelial dysfunction, accumulation of advanced glycated end products and activation of inflammatory cells either by generating toxic and reactive metabolites or altering intracellular signaling pathways which can suppress release of pituitary gonadotrophins in states of hyperglycemia.<sup>24</sup>

In our study uACR was significantly higher in group 1 compared to group 2 and it was independently statistically significantly negatively correlated with total serum testosterone. In agreement with the results reported by Chuang et al.<sup>25</sup> who conducted a study on 455 patients to evaluate the association of albuminuria as a risk factor for ED in men with T<sub>2</sub> DM. They found that albuminuria was an important risk factor for ED in men with diabetes after adjustment of age and diabetes mellitus duration. Similarly Yu et al.<sup>26</sup> in a study conducted on 313 patients with T<sub>2</sub> DM have also reported higher prevalence of albuminuria and that higher uACR associated with ED severity.

The explanation of this relation between hypogonadism and albuminuria is not well established. However, albuminuria is considered as a marker of vascular endothelial damage and chronic low grade inflammation.<sup>27</sup> It is postulated that albuminuria might be a marker for microvascular affection of hypothalamus in diabetic patients which will lead to disturbed release of gonadotropic releasing hormones causing hypogonadism.<sup>23</sup>

The present study showed that patients with ED had significantly lower total serum testosterone levels than those without ED. In agreement with the results reported by Ghazi et al.<sup>8</sup> who found that 94% of type 2 diabetic patients with low serum testosterone had ED versus 61% for the patients with normal serum testosterone. Similarly, El Saghier et al.<sup>28</sup> reported that patients with ED had lower testosterone than those without ED and that 85.7% of T<sub>2</sub> DM patients with low serum testosterone had ED versus 31% of those with normal testosterone.

This hypogonadal state may be due to hypogonadotrophic hypogonadism which is mostly secondary to chronic disease such as T<sub>2</sub> DM which could be associated with impaired function of hypothalamic Pituitary testicular axis.<sup>18</sup>

## 6. Conclusion

Type 2 diabetic patients with erectile dysfunction have high prevalence of low serum testosterone level which significantly negatively correlated with duration of diabetes, HbA1c and uACR. So such risk factors should be considered and may play an important role in erectile dysfunction in type 2 diabetic patients.

## Financial support and Sponsorship

Nil.

## Conflict of interest

There are no conflicts of interest.

## Source of support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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