

Erectile Dysfunction and Depression Prevalence Among Male Patients with Type II Diabetes

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Background and Objective: Patients with Type 2 Diabetes (T2D) are at substantial risk for developing erectile dysfunction (ED). The primary goal of this study was to assess the prevalence of ED and depression among T2D patients and the associated risk factors.

Methods: A cross-sectional study was conducted for adult T2D patients who had a routine clinic visit between January–August 2023. Structured questionnaires formed with two validated questionnaires – the International Index of Erectile Function short form (IIEF-5) and Patient Health Questionnaire (PHQ-9) – were used to screen for ED and depression, respectively.

Results: A total of 478 male patients with T2D with a mean age of 59.2 ± 10.8 years, mostly married, with long standing T2D were included. Hyperlipidemia followed by hypertension were the most reported comorbidities. Of the patients, 61.3% had reported no depression and were less likely to have ED or severe ED ($p < 0.001$) and more likely to be physically active and to report no smoking ($p < 0.0001$) when compared to those with depression. Fifty-two percent of the patients reported moderate and severe ED and those were older in age ($p = 0.031$), had longer duration of T2D diagnosis ($p = 0.005$), were more likely to have any comorbidities ($p < 0.05$), were less likely to have a university degree and higher income (both $p < 0.001$), were less likely to be on oral hypoglycemic agents (OHA) ($p < 0.001$), had worse glycemic control parameters ($p = 0.463$), were more likely to have positive urine microalbuminuria ($p = 0.019$), and were less likely to be physically active ($p = 0.048$) when compared to patients with no or milder degree of ED.

Conclusion: ED is highly prevalent in our study sample, with half of the patients having moderate to severe ED and being more likely to have depression. Older age, long-standing T2D, comorbidities, socioeconomic disadvantage, and sedentary lifestyle were all significantly associated with ED.

Keywords: erectile dysfunction, ED, diabetes, T2D, depression, risk factors

Introduction

According to the International Diabetes Federation (IDF), there are 537 million people living with Diabetes Mellitus (DM) worldwide. Furthermore, the total number of people living with DM is projected to rise to 643 million by 2030 and 783 million by 2045.¹ In Saudi Arabia, it is alarming to know that one-fourth of the adult population is affected by type II diabetes (T2D), which is predicted to be doubled by 2030.²

T2D poses a significant risk for the affected population and leads to serious complications that can affect their lives and these complications are divided into macrovascular and microvascular. The most common macrovascular complication in a recent study is acute myocardial infarction followed by stroke incident and lastly peripheral vascular disease, while nephropathy was the most commonly prevalent microvascular complication followed by retinopathy and neuropathy.^{3,4}

Erectile dysfunction (ED) affects up to 75% of men worldwide and this condition is characterized by the inability to achieve or keep an erection adequate for sexual intercourse.⁵ Furthermore, the prevalence of ED varies as a recent epidemiological study conducted across eight countries showed that up to 45% of men aged 40 years or older reported

ED.⁶ The prevalence of ED among married men in Saudi Arabia is almost 10%.⁷ Many factors can be associated with ED, such as age and medical condition, low education level, low socioeconomic status, and physical activity.^{8,9} It is also worth noting that accurately estimating the prevalence and burden of ED is crucial since the condition is often underdiagnosed and undertreated.¹⁰

Depression is a prevalent mental health condition that affects approximately 3.8% of the population according to recent statistics, with nearly 280 million people worldwide affected by depression.^{11,12} In Saudi Arabia, over one-third of adults suffer from depression, posing a significant burden.¹³

Depression and ED have many shared points. Recognizing these similarities can lead to better understanding and more effective treatments. There have been studies showing that exposure to ED triples the risk of depression.¹⁴ About 30% of ED can be caused by psychological factors.¹⁵ It is common for individuals with DM to also experience depression as multiple studies have shown that having one condition can increase the risk of developing the other with a likelihood of a bi-directional relationship.^{16–18}

This study was motivated by the scarcity of studies on ED and high prevalence of DM in Taif city. We conducted this study to estimate the prevalence of ED and depression among individuals with T2D. We also evaluated the associated risk factors such as age, socioeconomic status, educational level, physical activity, duration of T2D, comorbidities, treatment modality, and several glycemetic and cardio-renal markers.

Methods

A cross-sectional study was conducted at Prince Mansour Armed Forces hospital in Taif, Saudi Arabia between January–August 2023 with a total of 478 patients. Researchers interviewed all male patients with T2D who attended the clinics during this period. Patients who underwent prostatectomy, those who were diagnosed with cancer, those with an existing history of psychiatric illness, female patients, those younger than 18 years old, and those who refused to take part were excluded. Regarding ethical approval, our proposal was approved by the Armed Forces Hospital in Taif City (No: REC. 2022–632). Informed verbal consent was obtained from each patient who took part in the study, which was approved by the ethical committee. All participants provided informed consent, per the Declaration of Helsinki. We ensured voluntary participation and privacy was kept as we named each patient by using medical record numbers (MRN).

Data was collected through structured questionnaires consisting of four sections. The first section for demographic data includes MRN, age, marital status, level of education, monthly income, and lifestyle data. Monthly incomes were considered high if more than 10,000 Saudi Riyals (SR) per month while those who earned less than 5,000 SR monthly were considered as having low income. The second section was formed with two validated questionnaires – the International Index of Erectile Function short form (IIEF-5) and Patient Health Questionnaire (PHQ-9). IIEF-5 is a tool used to screen ED with five questions with a maximum score of 25. Scores of 1–7 indicate severe ED, 8–11 indicate moderate ED, 12–16 indicate mild-to-moderate ED, 17–21 indicate mild ED, and 22–25 indicate no ED. The PHQ-9 was used as a screening tool for depression, and is scored from 1–27, scores of 1–4 indicate minimal depression, 5–9 indicate mild depression, 10–14 indicate moderate depression, 15–19 indicate moderately severe depression, and 20–27 indicate severe depression. The last two sections consist of patient's body mass index (BMI), treatment modalities, physical activity data, and laboratory data, including glomerular filtration rate (GFR), which was calculated using the Modification of Diet in Renal Disease formula (MDRD).

Data was collected in a Microsoft Excel spreadsheet, and then imported to and analyzed using the Statistical Package for the Social Sciences (SPSS) software version 25. The qualitative data are presented as numbers and percentages. The quantitative data are given as means and standard deviation (mean \pm SD). The Chi-square test was used to study the relationship between variables, and the *t*-test was used to compare means.

Result

A total of 478 male patients with T2D, with a mean age of 59.2 ± 10.8 years, mostly married, with long standing T2D, with high school or less degree, and overweight on average were included (Table 1). Hyperlipidemia, followed by hypertension and retinopathy, were the most reported comorbidities. Almost half of the patients had moderate or severe ED based on IIEF-5 score, were not depressed based on PHQ-9 score, were on oral hypoglycemic agents (OHA) only

Table 1 Baseline Characteristics of the Whole Cross-Sectional Study

Baseline Characteristics (N = 478)	
Patient's profile	
Mean age (years)	59.2 ± 10.8
Mean diabetes duration (years)	14.6 ± 10.1
Mean BMI (Kg/m ²)	29.5 ± 5.7
Hypertension (%)	42.1
Hyperlipidemia (%)	58.4
Stroke (%)	2.1
Retinopathy (%)	19.0
International index of erectile function (IIEF-5) short form	
Mean total point score (points)	11.5 ± 6.7
No erectile dysfunction (%)	9.4
Mild erectile dysfunction (%)	15.1
Mild-to-moderate erectile dysfunction (%)	23.5
Moderate erectile dysfunction (%)	18.7
Severe erectile dysfunction (%)	33.3
Patient Health Questionnaire-9 (PHQ-9)	
Mean total score (points)	4.9 ± 3.6
No depression (%)	61.3
Mild depression (%)	29.5
Moderate depression (%)	8.2
Moderately Severe depression (%)	1.0
Socioeconomic status	
Married (%)	97.5
Single (%)	1.6
Divorced (%)	0.9
High school or less (%)	81.3
Bachelor's degree (%)	18.2
Master's degree or higher (%)	0.5
More than 10,000 SR (%)	17.1
Between 5,000–10,000 SR (%)	38.8
Less than 5,000 SR (%)	44.1
Active cigarette smoking (%)	18.3
Sedentary lifestyle (%)	46.2

(Continued)

Table 1 (Continued).

Baseline Characteristics (N = 478)	
Exercise \leq 150 min/week (%)	24.2
Exercise 150–300 min/week (%)	19.9
Exercise >300 min/week (%)	9.7
Management plan and medications	
Diet only (%)	2.1
Oral hypoglycemic agents only (%)	52.3
Insulin only (%)	17.8
Combined oral hypoglycemic agents and insulin (%)	27.8
Metformin (%)	72.1
Sulfonylurea (%)	22.4
DPP-4 inhibitors (%)	2.7
SGLT-2 inhibitors (%)	1.0
Thiazolidinediones (%)	1.7
Long acting (%)	45.1
Rapid acting + long-acting insulin (%)	31.2
Premixed insulin (%)	23.7
Statin (%)	59.5
Beta-Blockers (%)	22.0
ACE inhibitors/ARB blockers (%)	30.6
Diuretic (%)	8.0
Laboratory data	
HbA1c (%)	7.9 \pm 1.6
Positive urine microalbuminuria (%)	16.3
Fasting blood glucose (mmol/L)	9.4 \pm 11.3
Total cholesterol (mmol/L)	4.2 \pm 1.0
LDL (mmol/L)	2.4 \pm 0.9
HDL (mmol/L)	1.1 \pm 0.8
Triglyceride (mmol/L)	1.8 \pm 1.4
GFR (mL/min)	78.9 \pm 21.3
Creatinine (mmol/L)	91.5 \pm 25.1

Abbreviations: BMI, body mass index; DPP-4 inhibitors, Inhibitors of dipeptidyl peptidase 4; SGLT-2 inhibitors, Sodium-glucose cotransporter-2 Inhibitors; LDL, low density lipoprotein; HDL, high density lipoprotein; GFR, glomerular filtration rate.

and reported a sedentary lifestyle. Metformin followed by sulfonylurea were the most used OHA. Long-acting insulin followed by multiple daily injections were the most used insulin regimens. The mean HbA1c and fasting glucose were uncontrolled while the mean fasting lipid panel was at goal.

No depression was reported by 61.3% of the patients (Table 2). When compared to those with depression, those without depression were older ($p = 0.223$), had a shorter duration of T2D diagnosis ($p = 0.136$), were more likely to be married ($p =$

Table 2 Baseline Characteristics Based on the PHQ-9 Patient Depression Questionnaire

	No Depression	Depressed	p-value
Patient's profile			
Patients number (%)	61.3	38.7	N/a
Mean age (years)	61.4 ± 10.5	56.0 ± 14.0	0.223
Mean diabetes duration (years)	16.0 ± 8.8	19.9 ± 13.0	0.136
Mean BMI (Kg/m ²)	31.8 ± 8.7	30.3 ± 5.6	0.622
Hypertension (%)	42.1	41.9	0.968
Hyperlipidemia (%)	58.9	57.5	0.766
Stroke (%)	2.4	1.6	0.559
Retinopathy (%)	18.8	19.4	0.889
Socioeconomic status			
Married (%)	98.1	96.7	0.648
Single (%)	0.8	1.1	
Divorced (%)	1.1	2.2	
High school or less (%)	82.4	79.6	0.349
Bachelor's degree (%)	16.8	20.4	
Master's degree or higher (%)	0.8	0.0	
More than 10,000 SR (%)	19.2	14.2	0.498
Between 5,000–10,000 SR (%)	34.8	39.4	
Less than 5,000 SR (%)	42.4	46.5	
Patients' management plan and medications			
Diet only (%)	1.7	2.7	0.210
Oral hypoglycemic agents only (%)	54.5	48.9	
Insulin only (%)	15.1	22.0	
Combined oral hypoglycemic agents and insulin (%)	2.8	26.3	
Metformin (%)	75.0	67.6	0.078
Sulfonylurea (%)	21.9	23.3	0.735
DPP-4 inhibitors (%)	2.7	2.7	0.988
SGLT-2 inhibitors (%)	1.7	0.0	0.074
Thiazolidinediones (%)	2.1	1.1	0.420

(Continued)

Table 2 (Continued).

	No Depression	Depressed	p-value
Long acting (%)	52.4	34.8	0.012
Rapid acting + long-acting insulin (%)	23.8	41.6	
Premixed insulin (%)	23.8	23.6	
Statin (%)	60.6	57.8	0.547
Beta-Blockers (%)	23.3	20.0	0.398
ACE inhibitors/ARB blockers (%)	30.5	30.8	0.939
Diuretic (%)	8.6	7.0	0.546
Patients with erectile dysfunction			
Mean total IIEF-5 score (points)	9.3 ± 6.4	9.8 ± 5.5	0.856
No erectile dysfunction (%)	12	5.4	<0.001
Mild erectile dysfunction (%)	17.8	10.8	
Mild to moderate erectile dysfunction (%)	20.9	27.6	
Moderate to severe erectile dysfunction (%)	13.7	26.5	
Severe erectile dysfunction (%)	35.6	29.7	
Patients' laboratory data			
HbA1c (%)	7.8 ± 1.6	7.8 ± 2.1	0.955
Urine microalbuminuria +ve (%)	14.9	18.7	0.286
Fasting blood glucose (mmol/L)	11.4 ± 17.6	8.0 ± 3.1	0.575
Total cholesterol (mmol/L)	4.1 ± 1.0	4.2 ± 0.5	0.892
LDL (mmol/L)	2.5 ± 0.8	2.5 ± 0.8	0.813
HDL (mmol/L)	0.9 ± 0.2	1.0 ± 0.4	0.737
Triglyceride (mmol/L)	1.6 ± 0.8	2.7 ± 1.7	0.094
GFR (mL/min)	88.4 ± 19.9	81.9 ± 24.4	0.425
Creatinine (mmol/L)	81.3 ± 19.3	90.2 ± 22.9	0.254
Lifestyle data			
Sedentary lifestyle (%)	37.3	60	<0.0001
Exercise less than 150 minutes per week (%)	26.5	20.5	
Exercise 150–300 minutes per week (%)	25.1	11.9	
Exercise more than 300 minutes per week (%)	11.1	7.6	
Active cigarette smoking (%)	13.2	26.1	<0.001

Abbreviations: BMI, body mass index; DPP-4 inhibitors, Inhibitors of dipeptidyl peptidase 4; SGLT-2 inhibitors, Sodium-glucose cotransporter-2 Inhibitors; LDL, low density lipoprotein; HDL, high density lipoprotein; GFR, glomerular filtration rate.

0.648), were less likely to have university degree ($p = 0.349$), reported a higher income ($p = 0.498$), were less likely to be on an insulin regimen ($p = 0.210$), were more likely to be on metformin and statin ($p = 0.074$ and 0.547 , respectively), were more likely to be on basal insulin rather than multiple daily insulin injection ($p = 0.012$), were less likely to have ED or severe ED ($p < 0.001$), had comparable glycemic and laboratory metabolic results ($P = \text{non-significant}$), and were more likely to be physically active and to report no smoking ($p < 0.0001$).

Moderate or severe ED was reported by 52% of the patients (Table 3). When compared to patients with moderate or severe ED, those with no or less degree of ED were younger in age ($p = 0.031$), had a shorter duration of T2D diagnosis ($p = 0.005$), had a lower BMI ($p = 0.295$), were less likely to have any comorbidities ($p < 0.05$), were more likely to have a university degree and higher income (both $p < 0.001$), were more likely to be on OHA and, if on an insulin regimen, to take multiple daily insulin injections ($p < 0.001$ and 0.013 , respectively), were less likely to be on statin or beta-blockers or anti-hypertensive medications (both $p < 0.001$), had a lower mean PHQ-9 score ($p = 0.357$), had better glycemic control parameters ($p > 0.05$), were less likely to have positive urine microalbuminuria ($p = 0.019$), were more likely to be physically active ($p = 0.048$), and were more likely to report active smoking ($p = 0.087$).

Partial correlation adjusting for age, comorbidities, socioeconomic status, treatment modalities, and lifestyle factors showed a non-significant negative correlation between IIEF-5 score and each of the following: PHQ-9 score ($r = -0.217$,

Table 3 Baseline Characteristics Based on the International Index of Erectile Function Short Form

	No, Mild, Mild/ Moderate Erectile Dysfunction	Moderate and Severe erectile Dysfunction	p-value
Patient's Profile			
Patients number (%)	48	52	N/a
Mean age (years)	54.6 ± 12.4	63.0 ± 10.0	0.031
Mean diabetes duration (years)	10.9 ± 7.5	20.1 ± 9.7	0.005
Mean BMI (Kg/m ²)	29.5 ± 4.6	32.4 ± 9.3	0.295
Hypertension (%)	28.8	54.0	<0.001
Hyperlipidemia (%)	47.6	68.5	<0.001
Stroke (%)	0.0	3.6	0.004
Retinopathy (%)	10.9	26.2	<0.001
Socioeconomic status			
Married (%)	96.3	98.7	0.278
Single (%)	2.3	0.9	
Divorced (%)	1.4	0.4	
High school or less (%)	69.7	92.9	<0.001
Bachelor's degree (%)	29.4	7.1	
Master's degree or higher (%)	0.9	0.0	
More than 10,000 SR (%)	28.5	3.6	<0.001
Between 5,000–10,000 SR (%)	38.2	39.1	
Less than 5,000 SR (%)	33.3	57.2	

(Continued)

Table 3 (Continued).

	No, Mild, Mild/ Moderate Erectile Dysfunction	Moderate and Severe erectile Dysfunction	p-value
Patients' management plan and medications			
Diet only (%)	4.4	0.0	<0.001
Oral hypoglycemic agents only (%)	60.7	44.4	
Insulin only (%)	14.4	21.0	
Combined oral hypoglycemic agents and insulin (%)	20.5	34.7	
Metformin (%)	73.8	70.4	0.415
Sulfonylurea (%)	23.1	21.9	0.738
DPP-4 inhibitors (%)	3.5	2.0	0.322
SGLT-2 inhibitors (%)	0.4	1.6	0.206
Thiazolidinediones (%)	2.2	1.2	0.411
Long acting (%)	33.3	51.8	0.013
Rapid acting + long-acting insulin (%)	42.3	24.8	
Premixed insulin (%)	24.4	23.4	
Statin (%)	46.7	71.3	<0.001
Beta-Blockers (%)	12.7	30.8	<0.001
ACE inhibitors/ARB blockers (%)	23.6	36.8	0.002
Diuretic (%)	3.9	11.7	0.002
PHQ-9 Patient depression Questionnaire			
Mean total score (points)	4.8 ± 3.7	5.0 ± 3.5	0.357
No depression (%)	64.6	58.5	0.092
Mild depression (%)	27.9	30.6	
Moderate depression (%)	5.7	10.5	
Moderately Severe depression (%)	1.7	0.4	
Patients' laboratory data			
HbA1c (%)	7.6 ± 1.9	8.0 ± 1.6	0.463
Urine microalbuminuria +ve (%)	12.1	20.3	0.019
Fasting blood glucose (mmol/L)	7.8 ± 2.2	12.0 ± 19.0	0.434
Total cholesterol (mmol/L)	4.2±1.0	4.1 ± 0.9	0.715
LDL (mmol/L)	2.5+0.8	2.5 ± 0.8	0.917
HDL (mmol/L)	1.0+0.3	0.9 ± 0.2	0.104
Triglyceride (mmol/L)	1.9 ± 1.2	1.9 ± 1.1	0.960

(Continued)

Table 3 (Continued).

	No, Mild, Mild/ Moderate Erectile Dysfunction	Moderate and Severe erectile Dysfunction	p-value
GFR (mL/min)	83.2 ± 20.9	88.6 ± 21.0	0.448
Creatinine (mmol/L)	88.9 ± 24.8	80.6 ± 17.3	0.232
Lifestyle data			
Sedentary lifestyle (%)	41	51.2	0.048
Exercise less than 150 minutes per week (%)	23.8	24.6	
Exercise 150–300 minutes per week (%)	22.9	16.8	
Exercise more than 300 minutes per week (%)	12.3	7.4	
Active cigarette smoking (%)	21.2	15.2	0.087

Abbreviations: BMI, body mass index; DPP-4 inhibitors, Inhibitors of dipeptidyl peptidase 4; SGLT2 inhibitors, Sodium-glucose cotransporter-2 Inhibitors; LDL, low density lipoprotein; HDL, high density lipoprotein; GFR, glomerular filtration rate.

$p = 0.547$), duration of T2D ($r = -0.430$, $p = 0.215$), positive urine microalbuminuria ($r = -0.476$, $p = 0.196$), and HbA1c ($r = -0.454$, $p = 0.188$).

Discussion

Our study showed that more than half of the included patients had moderate-to-severe and severe ED, while only 9.4% had no ED. An earlier study in the southern region of Saudi Arabia showed that 89% of the T2D patients had some form of ED.¹⁹ Another Chinese study showed that the prevalence of moderate and severe ED was 68% among patients with T2D.²⁰ A more recent Greek study showed that the prevalence of moderate-to-severe and severe ED was 36.5%.²¹ The observed variation in prevalence is related to the ED assessment tools and the ED severity classification but most of the above study showed that different degrees of ED are very commonly prevalent in T2D patients.

Of the patients included in the study, 38.7% had depression and were significantly less likely to be on complex insulin regimen. A recent metanalysis showed that insulin therapy was associated with a 42% increased risk of depression, which concurs with our findings.²² Those with depression were more likely to report active smoking, which concurs with earlier studies that showed similar findings.^{23,24} In our study we showed those without depression were more likely to have no or a less severe form of ED compared to those with depression. Multiple studies showed similar findings with a possibility of bidirectional relationship between both T2D and depression.^{14,25,26}

Longer T2D duration has been shown to increase the risk of ED in our study and earlier studies.^{27,28} A higher level of education and monthly income were associated with less risk of ED in our study, but an earlier study showed no impact of educational level on seeking medical attention or compliance to ED treatment.²⁹ Recent analysis showed that patients with low income were more likely to report ED.³⁰ Along with other traditional risk factors, socioeconomic disadvantages are an important risk factor. Sedentary lifestyle in our study and previously published studies were associated with ED.^{31,32} Maintaining an active lifestyle is not only shown to improve erection but rather could be a treatment modality comparable to sildenafil benefit.^{33,34}

Although we showed a non-significant negative correlation between HbA1c and IIEF-5 score, poor glycemic control has been shown to be associated with ED incident and severity in multiple earlier studies.^{35–37} The lack of significance in our study could be due to the sample size. Also, patients with a severe form of ED in our study were more likely to have positive urine microalbuminuria, which concurs with earlier studies.^{38,39} Lastly, both ED and positive urine microalbuminuria were associated with future risk of adverse cardiovascular events.^{40,41}

The strengths of this study includes evaluation of various risk factors that affect erectile function, and it is the first study in Taif city, while the limitations include it being a single center study and the study design.

Conclusion

ED is highly prevalent in our study sample, with half of the patients having moderate-to-severe ED. Older age, long-standing T2D, comorbidities, socioeconomic disadvantage, and sedentary lifestyle were all significantly associated with ED. Adjusting for potential confounders showed a non-significant negative correlation between IIEF-5 score and both PHQ-9 score and HbA1c. Also, more than one-third of the sample were depressed and those were significantly more likely to have ED or severe ED and to report smoking and were less likely to be physically active when compared to those without depression.

Acknowledgment

We would like to thank the ethical committee of the armed forces hospital at Al-Taif city and the interviewed patients for helping us in this project.

Funding

There is no funding to report.

Disclosure

The authors report no conflicts of interest in this work.

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