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ORIGINAL ARTICLE

Prevalence and risk factors associated with erectile dysfunction among Bahraini men with diabetes mellitus

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Abstract

Background and objectives: Erectile dysfunction (ED) is a common complication in diabetes mellitus, affecting ≥50 % of men with diabetes, worldwide. This study assessed the prevalence and risk factors associated with ED in Bahraini men with type 1 and type 2 diabetes mellitus attending the Central diabetic or the Non-communicable disease (NCD) clinic in Primary Health Centers (PHC) in Bahrain.

Methods: Across-sectional study was conducted in men with type 1 and type 2 diabetes mellitus attending the Central diabetic or the NCD clinic in the PHCs in Bahrain, from June 2013 to September 2013. The study included 86 married diabetic participants. A modified Arabic version of the International Index of Erection Function was used in this study. Data were analyzed using SPSS 16 and $P< 0.05$ was considered statistically significant.

Results: Mean age of the participants was 53.47±9.57 years and the overall prevalence of ED was 74.4 %. The prevalence and severity of ED increased with age, from 55.6 % in patients <40 years of age to 83.3 % in patients aged 60–69 years ($P=0.028$). A significant relationship was found between ED and duration of diabetes, hypertension, and coronary heart disease ($P<0.05$). However, no significant relation was observed between the prevalence of ED and glycemic control, body mass index, dyslipidemia, and diabetes-related complications ($P>0.05$).

Conclusion: ED is highly prevalent among Bahraini men with diabetes and increases with age and duration of diabetes.

Keywords: Diabetes mellitus, erectile dysfunction, non-communicable diseases

Introduction

Diabetes mellitus (DM) affected 366 million people, worldwide, in 2011 and is expected to reach 552 million by 2030; the greatest increase in diabetes prevalence is expected to occur in the low and middle-income countries.[1] Diabetes is highly prevalent among both genders in member states of the World Health Organization (WHO) Eastern Mediterranean Region. Its prevalence in these countries ranges from 3.5 % to 30 %; six of the 10 countries with the highest prevalence of diabetes in the world are in this region: Bahrain, Kuwait, Lebanon, Oman, Saudi Arabia, and United Arab Emirates.[2] In 2010, the prevalence of type 2 DM among adults aged 20–79 years was 15.4 % in Bahrain.[1]

DM is a common serious chronic disease accompanied with microvascular and macrovascular complications. It is associated with accelerated large vessel atherosclerosis, microvascular arterial

disease, autonomic neuropathy, dyslipidemia, hypertension, and prominent endothelial dysfunction, all of which contribute to ED in patients with diabetes.[3] According to the definition by the National Institute of Health Consensus Development Panel on Impotence, ED is defined as the inability to achieve or maintain an erection sufficient for satisfactory sexual performance.[4] Common causes of erectile dysfunction include DM, hypertension, obesity, absence of physical exercise, and lower urinary tract symptoms.[5] ED is a benign disorder, however disrupted sexual health, if not treated, can lead to psychological trauma, frustration, low self-esteem ,and may increase the existing medical condition.[6]

There is a significant relation between DM and the development of ED, and the estimated prevalence of ED in patients with diabetes has been reported to range from 20 % to 70 %.Furthermore, men with DM are twice more inclined to develop ED, when compared to men without DM.[7] Approximately, 75 % of patients with diabetes experience consistent or recurrent ED, at least once during the disease.[7] ED is positively correlated with longer duration of diabetes and poor glycemic control.[8] The relative risk of ED in men with DM increases with coexisting cardiovascular disease, renal disease, diabetic foot, and retinal disease.[9] Furthermore, end-organ damage, secondary to hyperglycemia, can exacerbate the symptoms of ED.[8] ED can be considered as an early marker of cardiovascular risk and its severity in patients with diabetes may be associated with poor cardiovascular outcome. The presence of ED should alert the physician to screen for the cardiovascular diseases in these patients.[10] Therefore, the aim of this research was to assess the prevalence and risk factors associated with ED in men with type 1 and type 2 DM in Bahrain.

Materials & methods

This is a cross-sectional study including a total of 100 diabetic patients aged ≥30, regularly attending the Central diabetic clinic in Primary Health Centers (PHC) of five health regions in Bahrain. The study was conducted between June 2013 and September 2013. The patients were randomly selected by the nurse, based on the inclusion criteria i.e. married Bahraini male patients, history of type 1 or type 2 diabetes, and sexually active at least once during the four weeks before response to the questionnaire, patients were included in the study irrespective of age, duration of DM, and type of treatment. The exclusion criteria were records of prostate and pelvic surgeries, benign prostatic hypertrophy (BPH), prostate cancer, Peyronie's disease, sickle cell anemia (SCD), and presence of sexual disorders before the diagnosis of diabetes.

Patients consented to answer the modified Arabic version of the International Index of Erection Function (IIEF) questionnaire. The questionnaire included six questions through which ED was assessed. Each question was scored from 0 to 5; patients were classified according to severity of (IIEF) scores: no erectile dysfunction (26–30), mild (22–25), mild to moderate (17–21), moderate (11–16), and severe (1–10).Additionally, other risk factors were also assessed, including age, occupation, smoking status, type and duration of DM, glycosylated hemoglobin (HbA1c) level, hypertension, dyslipidemia, body mass index (BMI), and DM related complications (retinopathy, peripheral neuropathy, nephropathy, coronary heart disease and stroke) for a period of 14 weeks. Moreover, nurses explained that the information will be obtained from their personal medical record, and all information obtained would be strictly confidential.

Ethical approval was obtained from the local Ethical Committee in Bahrain in June 2013. The questionnaire was self-administered, and privacy were considered; participants were advised to complete all questions in the questionnaire, to be included in the study. Among the 100 randomly selected patients, 90 agreed to participate and only 86 patients met the inclusion criteria and 10 patientswere unwilling to participate.

The medical data of the subjects were collected from patients' medical record, which included patient's age, occupation, smoking history, type and duration of diabetes, BMI, HbA1c of the last 3 months, blood pressure (BP) record, lipid profile, and diabetic complications. The microvascular complications included the latest retinopathy, nephropathy, [albumin creatinine ratio (ACR) and estimated glomerular filtration function (e-GFR)], and the peripheral neuropathy screening

tests (monofilament test and Tuning fork). The macrovascular complications included history of coronary heart disease and history of stroke.

Patients were categorized into three groups (<5years, 5–10 years, and >10 years) based on the duration of diabetes. Moreover, control of diabetes was measured by the most recent reading of the HbA1c test. Participants were categorized in to four groups (<7 %, 7–7.9 %, 8–8.9 %, and ≥9 %) based on the HbA1c level. BP was measured for all subjects, and their medical records were checked for history of hypertension and antihypertensive medication. The hypertension was defined as outlined in the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7, 2004). Participants were categorized in to normal weight (18–24.9), overweight (25–29.9), and obese (≥30) based on their BMI.[22]

Pilot study

A pilot study was conducted before establishing the research. The aim was to check the acceptance of the questions, the clarity of the questions, and to measure the limitations of the questionnaire. Five men volunteered and answered the modified IIEF questionnaire. All the volunteers agreed that the questionnaire was acceptable, clear, and easy to answer.

Statistical analysis

Descriptive statistics were used to characterize the age, BMI, HbA1c level, total cholesterol, and triglyceride level of the subjects. *P* value <0.05 was considered significant. Data analysis was performed using the SPSS 16.

Results

A total of 86 men with DM participated in the study. Majority of the patients with diabetes had type 2 DM (91.9 %), whereas type 1 DM was observed in 8.1 %. The mean age was 53.47 years (range: 30–73 years) and the mean HbA1c level was 7.7 % (range: 4.2–14 %; Table 1).The prevalence of ED in Bahraini men with diabetes was 74.4 %.The overall prevalence of ED was 74.4 %, in which 15.1 %, 20.9 %, 22.1 %, and 16.3 % of the patients had severe, moderate, moderate–mild, and mild degree of ED, respectively ;whereas only 25.6 % of them had normal erectile function.

Type of DM and the prevalence of ED

There was no significant relationship between the type of DM and prevalence of ED ($P=0.344$).

Age and occupation distribution and the prevalence of ED

The age groups of the participants were: <40 years (10.5%), 40–49 years (17.4%), 50–59 years (36%), 60–69 years (34.9%), and ≥70 years (1.2%; Table 2). Overall, the prevalence and severity of ED increased with age, wherein 55.6% of the patients aged < 40 years had symptoms of ED, whereas, 66.7%, 83.3%, and 100% of the patients aged 40–49 years, 60–69 years, ≥ 70 years, respectively, had ED (Table 3). The study shows significant relation between age group and the prevalence of ED ($P=0.028$). Moreover, there was a significant relationship ($P=0.010$) between the status of the participant's occupation and the prevalence and severity of ED. The prevalence of ED was higher among the unemployed group (83.3%) in comparison to the employed group (65.9%).

Duration of DM and the prevalence of ED

There was a significant relation between duration of DM and the prevalence of ED ($P=0.001$). The prevalence of ED was 53.6%, 74.1%, and 93.5% in patients with duration of diabetes <5 years, 5–10 years, and >10 years, respectively (Table 3).

Table 1: Descriptive statistics

Parameters	Number	Range	Minimum	Maximum	Mean±SD
Age (years)	86	43	30	73	53.47±9.577
BMI (kg/m²)	86	21.6	23	44.6	29.77±5.005
HbA1c (%)	86	9.8	4.2	14	7.73±1.990
Total cholesterol (mg/dl)	86	4.6	2.6	7.2	4.25±0.946
Triglyceride (mg/dl)	86	3.5	0.5	4	1.755±0.838

HbA1c level and the prevalence of ED

The participants were categorized in to four groups according to the HbA1c level, <7% group (31.4%), 7–7.9% group (33.7%), 8–8.9% group (15.1%), and ≥9% (19.8%; Table 2). The prevalence of ED was higher in patients with HbA1c ≥9%, in comparison to patients with HbA1c <7% (100% vs. 55.6%; *P*= 0.074; Table 3)

Table 2: Clinical parameters and risk factors in patients with Diabetes

Parameters	n (%)
Type of DM	
Type 1 DM	7 (8.1)
Type 2 DM	79 (91.9)
Age (years)	
<40	9 (10.5)
40–49	15 (17.4)
50–59	31 (36)
60–69	30 (34.9)
≥70	1 (1.2)
Occupation	
Employed	44 (51.2)
Unemployed	42 (48.8)
Duration of DM (years)	
<5	28 (32.6)
5–10	27 (31.4)
>10	31 (36)
HbA1c (%)	
<7	27 (31.4)
7–7.9	29 (33.7)
8–8.9	13 (15.1)
≥9	17 (19.8)

DM, Diabetes mellitus; *HbA1c*, Glycosylated hemoglobin

Medical conditions and prevalence of ED

There was significant association between ED and other risk factors including hypertension, smoking, BMI, total cholesterol, and triglyceride level. The prevalence and severity of ED was higher among diabetic men with hypertension (80%) in comparison to men without hypertension (69.6%).However, ex-smokers had severe degree of ED (41.2%) compared to smoker group (7.1%) and nonsmoker group (7.5%; *P*=0.006) Moreover, prevalence of ED was high among the obese participants (80.6%), but statistically not significant(*P*=0.295)

Diabetes complications and prevalence of ED

The prevalence and severity of ED was compared in patients with diabetes and diabetes related complications and in those patients without the complications. The prevalence of ED was higher among patients with history of coronary artery disease (CAD; 100%) in comparison to those without the history of CAD (78%); 50% of the patients with CAD had severe degree of ED compared to 7.1% in the patients without CAD (*P*=0.001). However, other diabetes related complications had no significant association with ED (*P*>0.05).

Table 3: Prevalence and severity of erectile dysfunction based on type of diabetes mellitus, age, duration of diabetes mellitus, and glycemic control

Parameters	Severe ED (%)	Moderate ED (%)	Mild–moderate ED (%)	Mild ED (%)	No ED (%)	*P* value
Type of DM						
Type 1 DM	0	0	28.6	28.6	42.9	0.344
Type 2 DM	16.5	22.8	21.5	15.2	24.1	
Age (years)						
<40	0	0	11.1	44.4	44.4	
40–49	0	13.3	33.3	20.0	33.3	
50–59	9.7	25.8	29.0	25.8	25.8	0.028
60–69	33.3	23.3	13.3	13.3	16.7	
≥70	0	100	0	0	0	
Duration of DM (years)						
<5	0	10.7	25.0	17.9	46.4	
5–10	7.4	22.2	29.6	14.8	25.9	0.001
>10	35.5	29.0	12.9	16.1	6.5	
HbA1c (%)						
<7	18.5	11.1	14.8	11.1	44.4	
7–7.9	17.2	13.8	24.1	24.1	20.7	0.074
8–8.9	0	38.5	23.1	7.7	30.8	
≥9	17.6	35.3	29.4	17.6	0	

ED, Erectile dysfunction; *DM*, Diabetes mellitus; *HbA1c*, Glycosylated hemoglobin

Table 4: Prevalence and severity of erectile dysfunction and hypertension

Risk factor	Severe ED (%)	Moderate ED (%)	Mild–moderate ED (%)	Mild ED (%)	No ED (%)	*P* value
Hypertension						
No	4.3	23.9	26.1	15.2	30.4	0.046
Yes	27.5	17.5	17.5	17.5	20.0	

Discussion

The prevalence of ED in Bahraini patients with diabetes (74.4%) falls within the upper range of ED prevalence recognized in the men with diabetes (25–75%).[6] However, the prevalence rate of ED in the current study is higher than the prevalence rate of ED reported by some published studies. In a study conducted in Saudi, the overall prevalence of ED among Saudi patients with diabetes was 6.1%,[11] while other studies found lower prevalence rates, 62% among Jordanian patients with diabetes and 64% among patients with diabetes attending treatment clinics in Kingston in Jamaica.[12,7] The difference in the prevalence rates can be explained by the difference in the populations studied, the methods used to measure the prevalence, and the research instruments.[12] Additionally, collecting data by self-administered questionnaires or interviews can lead to different results.[13]

The association between type of diabetes and prevalence of ED is controversial. Some studies observed that men with type 1 DM were significantly at a higher risk of developing ED compared to men with type 2 DM.[6] Another study observed that the type of diabetes does not affect the onset of ED.[14]In the current study subjects with type 1 DM were at a lower risk of ED (57.1%) compared to the subjects with type 2 DM (75.9%), however, this was not statistically significant.

Data analysis showed that the prevalence and severity of ED in Bahraini men with diabetes increased significantly with age ($P=0.028$). This association between ED and age is in accordance with the other studies; a study in Jamaica reported the prevalence of ED as 90% in men aged 70–75 years.[7] Another Saudi study showed that the prevalence of ED increases with age from 26.5% in patients <40 years of age to 91% in the patients aged ≥70 years.[12]

The relation between duration of diabetes and the prevalence of ED is well defined: longer duration of diabetes is associated with higher prevalence of ED, and it is considered as an independent risk factor of ED in men with diabetes.[10] In the current study, a positive association between the duration of DM and the prevalence of ED was observed in Bahraini patients with diabetes ($P=0.001$), prevalence of ED was reported (53.6%) in patients with <5 years of duration of DM, (74.1%) in patients with 5–10 years history of DM and this prevalence increased (93.5%) in patients with >10 years history of DM. Other researchers also reported an increase in the prevalence of ED with increasing duration of DM,[7] wherein duration of DM in diabetic Jamaican patients was associated with higher prevalence in patients with >10 years of DM (54.2%; $P<0.001$). Additionally, a Jordanian study showed a significant association between presence of ED and duration of DM, wherein 79% of patients with duration of >10 years had ED ($P<0.001$).[12] Another study reported that patients with a history of diabetes of greater than 10 years were 3 times likely to report ED as those with a history of less than 5 years.[11] The association between the prevalence of ED and duration of DM can be attributed to mainly the vascular complications.[15]

The relation between the prevalence of ED and HbA1c level did not reach the statistical significance in the current study. Several studies suggested that HbA1c levels are positively associated with ED severity; a Jordanian study observed that the prevalence and severity of ED increases with poor HbA1c control,[12] and another Saudi study reported that men with diabetes and patients with poor metabolic control were 12.2 times more susceptible to ED when compared to patients with diabetes and a good metabolic control.[11]

A higher incidence of erectile dysfunction was common among patients with diabetes with hypertension (80%) in comparison to patients with diabetes without hypertension (69.6%) ($P=0.046$). Several studies[11, 12, 16,17] reported similar associations between hypertension and ED. In these studies, hypertension was considered as an important risk factor for developing ED in men with diabetes; this is due to the pathophysiology of hypertension, especially when it coexists with diabetes. Additionally, the several therapeutic agents used to control hypertension could play a role in increasing the incidence of ED.[18]

Many epidemiological and experimental studies have shown a significant association between smoking and ED as it considered as a risk factor for atherosclerosis, which is the predominant predisposing factor for vasculogenic ED in men with diabetes.[10,19] On the other hand, a study conducted in Japan did not confirm this relationship.[16] In the present study, current smokers were not associated with a higher prevalence of ED. However, ex-smokers were observed to have a severe degree of ED (42.1%) compared to smokers (7.1%; $P=0.006$).

Other risk factors were also examined in the current study, including obesity and dyslipidemia, both of which are considered as risk factors that are associated with penile arterial insufficiency and, later cause endothelial dysfunction that can lead to arteriogenic erectile dysfunction.[5] Although, current study found no significant relationship between the prevalence of ED and BMI or dyslipidemia, other studies confirmed this relation and found a significant association and considered these as independent risk factors for ED among men with diabetes.[12,20] Additionally, another study on newly diagnosed DM reported significant association between ED and BMI, suggesting that BMI is an independent factor associated with ED.[21]

The prevalence of ED in men with DM increases with coexisting macrovascular or microvascular complications, including cardiovascular diseases.[6] A study conducted in Saudi reported 53% of patients with diabetes and ED had one or more diabetes related complication compared to 20.5% patients with no ED.[11] Another study conducted in Jordon

showed a significant association between ED and CAD, retinopathy, and peripheral neuropathy.[12] Furthermore, another study conducted in Japan found that microangiopathy is associated with a greater risk for ED.[16] In the current study, macrovascular complications included CAD (18.6%) and cerebrovascular disease (2.3%), while, the microvascular complications included diabetic peripheral neuropathy (5.8%), diabetic nephropathy (16.3% for abnormal ACR reading and 10.5% for abnormal e-GFR reading), and diabetic retinopathy (11.6%). The study showed that the prevalence and severity of ED were higher among patients with diabetes related complications, however did not reach statistical significance ($P>0.05$), except the relation between prevalence of ED and CAD, which was statistically significant (P=0.001). This finding may be due to small sample size and missing data in some cases. Further studies with a bigger sample are recommended to evaluate the effect of diabetes related complication on ED among diabetic patients.

Additionally, several epidemiological studies reported that ED is a marker of cardiovascular disease. A meta-analysis of 12 prospective cohort studies provided strong evidence that ED is indeed significantly and independently associated with increased risk of coronary heart disease.[5] This association between coronary heart disease and ED was confirmed in a study reported that ED is a potent predictor of adverse cardiovascular events in high risk cardiovascular patients.[22] In the current study, all patients with diabetes and coronary heart disease (18.6%) had ED, and 50% of them had severe degree of ED. As ED is a strong predictor of coronary heart disease and that the development of symptomatic erectile dysfunction might precede the occurrence of a cardiovascular event by 2–3 years, it is strongly recommended that all men with diabetes along with ED, who are free from any cardiac symptoms, should be considered to be cardiac patients, until proven otherwise.

The results of the study should be interpreted in the context of several possible limitations. Its cross-sectional nature does not allow making inference about cause and effect. Additionally, the small sample size was unable to get a significant relation between ED and some of the risk factors, including diabetic related complications. However, the major strength of this study includes the use of validated measures of sexual dysfunction.

Conclusion

This is the first study in Bahrain in this regard. The result of this study indicated that ED is highly prevalent among Bahraini men with diabetes and increases with age and duration of DM. There was significant association between hypertension, occupational status, and CAD with the prevalence of ED. However, small sample size in this study might not be adequate for generalization. Further studies with large sample size are recommended to be conducted. Nevertheless, the findings in this study can guide the physicians to undertake early screening and treatment in subjects who fall in the high-risk group.

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