

Prevalence of depression among diabetic patients attending the Armed Forces Hospital, Southern Region, Saudi Arabia: A prospective cross-sectional study

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ABSTRACT

Background: Depression associated with diabetes is one of major obstacles in diabetic patient management. This study aims to determine the prevalence of depression and its associated risk factors among diabetic patients of both types (I and II). **Materials and Methods:** A cross-sectional analytical study was conducted at Armed Forces Hospital, Southern Region, Kingdom of Saudi Arabia, among adult diabetic patients attending the diabetic center. An interview-validated questionnaire was utilized to collect data. It consists of three main parts: demographic data, diabetic assessment tool, and patient health questionnaire-9. **Results:** A total of 386 diabetic patients were included. The age of them ranged between 17 and 95 years with an arithmetic mean of 53.4 years and a standard deviation of ± 18.2 years. Almost two-thirds (62.2%) were males. The prevalence of depression among diabetic patients was 48.2%, mostly of mild (31.4%) or moderate severity (12.7%). Multivariate logistic regression analysis revealed that female diabetic patients were at almost double-fold risk of developing depression compared to males [adjusted odds ratio (AOR) = 2.73, 95% confidence interval (CI): 1.70–4.38], $P < 0.001$. Also, type II diabetic patients were at almost double-fold risk of developing depression compared to type I diabetic patients (AOR = 2.07, 95% CI: 1.16–3.67), $P = 0.013$. Patients with history of any social issue with the family, relatives, or friends were at about three-fold risk of developing depression compared to those without such history (AOR = 3.45, 95% CI: 2.11–5.66), $P < 0.001$. Patients who reported compliance to diet were at higher risk for developing depression compared to their peers (AOR = 2.57, 95% CI: 1.25–5.28), $P = 0.010$, while those compliant to physical activity about 150 min/week or more were at significant lower risk to develop depression (AOR = 0.56, 95% CI: 0.35–0.89), $P = 0.015$. Patients with nephropathy or neuropathy were more likely to have depression compared to their counterparts (AOR = 2.52, 95% CI: 1.33–4.80, $P = 0.005$ and AOR = 1.80, 95% CI: 1.11–2.90, $P = 0.016$, respectively). **Conclusion:** Depression is a very prevalent problem affecting diabetic patients, particularly those of type II, female patients, and those with nephropathy or neuropathy. Therefore, regular screening of diabetic patients for depression and referral of severe cases to psychiatric care are highly warranted.

Keywords: Depression, diabetes, prevalence, risk factors, Saudi Arabia

Introduction

Depression associated with diabetes is one of major obstacles in diabetic patient management. In Saudi Arabia, the prevalence of depression and anxiety disorders in 2017 was nearly 4.5%

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and 4.3%, respectively (World Health Organization, 2017).^[1] According to the Center of Disease Control and Prevention, people with diabetes are 2–3 times more likely to have depression than people without diabetes. Only 25% to 50% of people with diabetes who have depression get diagnosed and treated.^[2]

The term diabetes mellitus describes diseases of abnormal carbohydrate metabolism that are characterized by hyperglycemia. It is associated with a relative or absolute impairment in insulin secretion, along with varying degrees of peripheral resistance to the action of insulin.^[3]

In Saudi Arabia, the prevalence of diabetes in adults is 18.3% and the total cases of diabetes in adults are 4,275,200, as reported by International Diabetes Federation.^[4]

Most of studies were conducted in Jazan region, Saudi Arabia, and there are limitations in studies conducted in Asir region. Despite Jazan and Asir from the same zone (southern region), the precise prevalence of depression among diabetic patients in Asir region is unknown; in addition to our aim in getting estimation of depression among our patients, we need to provide evidence for decision-makers to implement effective interventions, such as screening and educational programs and add psychiatric care to improve outcome in our diabetic center.

This study aims to determine the prevalence of depression and its associated risk factors among diabetic patients attending King Fahad Armed Forces Hospital (KFAFH), Southern Region, Saudi Arabia.

Materials and Methods

Cross-sectional analytical study design was conducted at KFAFH, Southern Region, Kingdom of Saudi Arabia (KSA). It is considered as one of the greatest medical organizations, provides medical and health services (curative, preventive, diagnostic) in all medical specialties for employees of the Ministry of Defense in Southern Region, in addition to being a reference hospital, receives critical cases transferred by the military hospitals from Sharurah, Najran, Jizan, as well as reception cases transferred from civilian hospitals in the region, and provides open-heart surgery services, kidney transplant, and all other medical specialties similar to other available hospitals in the southern region.^[5]

Adult diabetic patients attending the diabetic center, KFAFH, Southern Region, throughout the study period provided that they had the eligibility criteria were invited to participate in the study. Inclusion criteria were adult patients (males or females and from all nationalities) with type 1 or 2 diabetes diagnosed more than 1 year ago, aged between 14 and 95 years, and capable of independent communication and giving informed verbal consent. Patients with gestational diabetes and history of psychiatric disease or on psychiatric medication diagnosed before diabetes were excluded.

Sample size was estimated using the Online Raosoft sample size calculator with the assumptions that the number of booking visits for both type 1 and type 2 of diabetes in diabetic center clinics per years is 6612 patients, the margin of error is 5%, the confidence level is 95%, and the response distribution is 50%. Accordingly, the estimated minimum required sample size was 364 patients.

At diabetic clinics in the KFAFH southern region diabetic center, the researcher chose the patients to answer the questionnaire depending on a convenience non-probability sampling technique.

An interview-validated questionnaire was utilized to collect data. It consists of three main parts: demographic data, diabetes assessment tool, and depression assessment tool (patient health questionnaire: utilized to collect data. chose the patients to answer the questionnaire dependber of a few minutes and rapidly scored by the researcher.^[6] Liu *et al.*^[7] reported that PHQ-9 had a good internal consistency ($\alpha = 0.80$) and test–retest reliability (intra-class correlation coefficient = 0.87). PHQ-9 has nine questions with a score ranging from 0 to 3 for each setting. The validated Arabic version was utilized in this study.^[8] Patients who scored between 0 and 4 were considered having no depression, 5–9 having mild, 10–14 having moderate, 15–16 having moderately severe, and 20–27 having severe depression.^[9]

The researcher sent the study proposal to the KFAFH-Southern Region ethical committee; then after getting the approval, the researcher got permission from the Diabetic Center director and participated patients through verbal consents, and the researcher explained the purpose of the study to all participants.

Statistical analysis

The data were collected and verified by hand and then coded before computerized data entry. The Statistical Package for Social Sciences (SPSS) software version 28.0 was used for data entry and analysis. Descriptive statistics [e.g. number, percentage, mean, range, standard deviation (SD)] and analytic statistics using Chi-square test and independent samples *t*-test were applied. Multivariate logistic regression analysis expressed as adjusted odds ratio (AOR) and its 95% confidence interval (CI) were adopted to control for confounders. *P* values <0.05 were considered as statistically significant throughout the study.

Results

A total of 386 Saudi diabetic patients were included in the study. Their demographic characteristics are summarized in Table 1. Their age ranged between 17 and 95 years with an arithmetic mean of 53.4 years and an SD of ± 18.2 years. Almost two-thirds (62.2%) were males. The majority of them (80.9%) were currently married and having children (81.1%). Only 14% were employed, whereas 45.8% were unemployed. Regarding their educational level, only 15.5% were college/higher educated.

Table 1: Demographic characteristics of the participants

	Frequency	Percentage
Gender		
Male	240	62.2
Female	146	37.8
Age in years		
Range	17-95	
Mean±standard deviation	53.4±18.2	
Marital status		
Single	60	15.5
Married	312	80.9
Divorced/separated	4	1.0
Widowed	10	2.6
Having children		
Yes	313	81.1
≤5	113	36.1
>5	200	63.9
No	73	18.9
Occupation		
Employed	54	14.0
Unemployed	177	45.8
Retired	155	40.2
Educational level		
No Formal education	87	22.5
Primary school	71	18.4
Intermediate school	59	15.3
Secondary school	109	28.3
College/higher	160	15.5
Income (Saudi Riyals/month)		
≤5000	175	45.4
5000-10000	134	34.7
>10000	77	19.9

Most of them (45.4%) reported a monthly income of 5000 SR or less.

Previous history of visiting a psychiatrist or psychologist was mentioned by 10.9% of the participants. Almost one-third of them (36.8%) had someone at home to take care of them. Histories of having any social issue with family, relatives, or friends and family history of depression, anxiety, or stress were reported by 31.6% and 17.9% of them, respectively. Current or ex-smoking states were reported by 6.5% and 3.9% of the participants, respectively. More than one-third of them (38.1%) were obese [body mass index (BMI) ≥30 kg/m²] and 31.7% had a high blood pressure (≥140/90 mm/Hg) [Table 2].

Type 2 diabetes represented 78% of patients. The duration of diabetes exceeded 10 years among 62.8% of patients. The HbA1c level exceeded 9% among 30.1% of them. A combination of oral hypoglycemia drugs and insulin was used in the current management of diabetes among 43.8% of patients. Compliance to medication, diet, and physical activity about 150 min/week or more were reported by 19.4%, 12.7%, and 63.5% of the participants, respectively, Table 3.

The commonest reported diabetic complications were erectile dysfunction among males (45.7%), peripheral neuropathy (34.7%), and diabetic retinopathy (28.5%) [Figure 1].

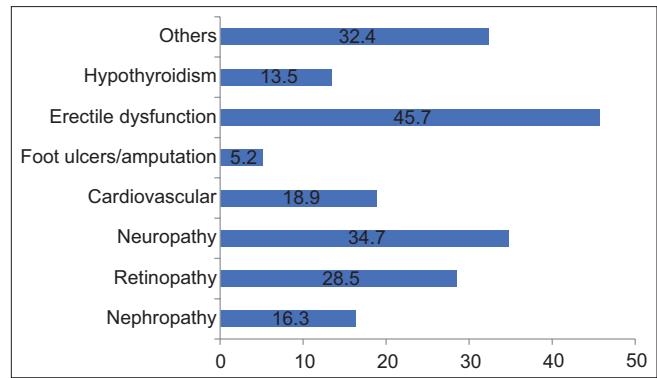


Figure 1: Diabetes complications among the participants

As demonstrated from Figure 2, the prevalence of depression among diabetic patients was 48.2%, mostly of mild (31.4%) or moderate severity (12.7%).

Female diabetic patients were more likely to have depression compared to male patients (61% vs 40.4%), $P < 0.001$. Patients who have children had a higher rate of depression compared to those without children (50.8% vs 37%), $P = 0.033$. Almost two-thirds (62.1%) of patients with no formal education compared to 41.7% of those with college/higher education expressed depression, $P = 0.026$. Other factors (age, marital status, number of children, occupation, and income) were not significantly associated with depression.

Patients with any social issue with the family, relatives, or friends were more likely to express depression compared to their peers (67.2% vs 39.4%), $P < 0.001$. Other studied factors (having someone at home to take care of patients, family history of depression, anxiety, or stress, smoking status, BMI, and blood pressure) were not significantly associated with depression among diabetic patients.

Type 2 diabetic patients were more likely to develop depression compared to type 1 diabetic patients (52.5% vs. 32.9%), $P = 0.001$. Almost two-thirds of patients who reported compliance with anti-diabetic medication or diet (62.7% and 65.3%, respectively) expressed depression compared to 44.7% and 45.7% of those who showed no compliance to medication and diet, respectively (P values were 0.005 and 0.010, respectively). Patients who did not show compliance to physical activity about 150 min/week or more were more likely to be depressed compared to their counterparts (61% vs 40.8%), $P < 0.001$. Diabetic patients with nephropathy ($P < 0.001$), neuropathy ($P < 0.001$), and other chronic diseases ($P = 0.019$) had a higher significant rate of depression compared to those without such complications. Other factors (duration of diabetes, HbA1c level, current diabetes management, retinopathy, cardiovascular diseases, diabetic foot, erectile dysfunction, and hypothyroidism) were not significantly associated with depression.

Multivariate logistic regression analysis revealed that female diabetic patients were at almost double-fold risk of developing depression compared to males (AOR = 2.73, 95% CI: 1.70–4.38),

Table 2: Social, psychiatric, and medical characteristics of the participants

	Frequency	Percentage
Previous history of visiting a psychiatrist or psychologist		
No	344	89.1
Yes	42	10.9
Before one month	7	16.6
Before 6 months	1	2.4
More than 6 months	34	81.0
Have someone at home to take care of you		
No	244	63.2
Yes	142	36.8
Have any social issue with your family, relatives, or friends		
No	264	68.4
Yes	122	31.6
Family history of depression, anxiety, or stress		
No	317	82.1
Yes	69	17.9
Smoking status		
Non-smoker	246	89.6
Current smoker	25	6.5
Ex-smoker	15	3.9
Body mass index (kg/m ²) (n=378)		
<18.5	10	2.6
18.5–24.9	94	24.9
25–29.9	130	34.4
30–34.9	103	27.2
35–39.9	32	8.5
≥40	9	2.4
Blood pressure (mm/Hg) (n=378)		
Normal <120/80	84	22.2
Borderline 121/81-139/89	174	46.1
High ≥140/90	120	31.7

$P < 0.001$. Also, type 2 diabetic patients were at almost double-fold risk of developing depression compared to type I diabetic patients (AOR = 2.07, 95% CI: 1.16–3.67), $P = 0.013$. Patients with history of any social issue with their family, relatives, or friends were at about three-fold risk of developing depression compared to those without such history (AOR = 3.45, 95% CI: 2.11–5.66), $P < 0.001$. Patients who reported compliance to diet were at higher risk for developing depression compared to their peers (AOR = 2.57, 95% CI: 1.25–5.28), $P = 0.010$, while those compliant to physical activity about 150 min/week or more were at significant lower risk to develop depression (AOR = 0.56, 95% CI: 0.35–0.89), $P = 0.015$. Patients with nephropathy or neuropathy were more likely to have depression compared to their counterparts (AOR = 2.52, 95% CI: 1.33–4.80, $P = 0.005$ and AOR = 1.80, 95% CI: 1.11–2.90, $P = 0.016$), respectively. Patients' history of having children, education, compliance to medications, and other chronic diseases were not significant associated with depression after controlling for confounding effect, Table 4.

Discussion

Researchers from different countries have explored the association between depression and diabetes.^[10-14] However,

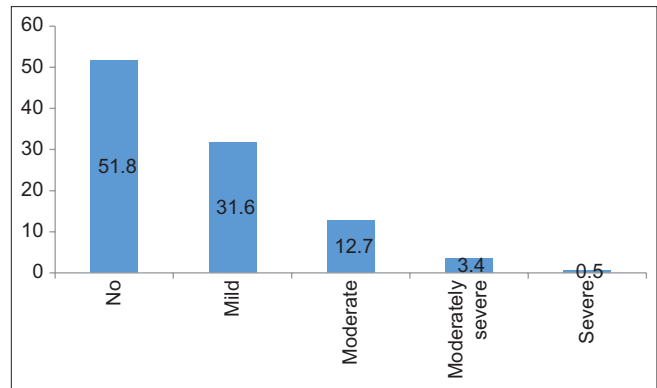


Figure 2: Prevalence and severity of depression among diabetic patients according to patient Health Questionnaire-9 (PHQ-9) tool

little is known about the magnitude of such association and its determinants among diabetic patients of both types in KSA, particularly in the Southern Region.

In the present study, the prevalence of depression among diabetic patients was 48.2%, mostly of mild (31.4%) or moderate severity (12.7%). This prevalence is comparable to what has been reported previously in Eastern province, Saudi Arabia (49.6%).^[15] However, it is higher than those reported previously in other Saudi studies carried out in Arar (37%),^[16] Al-Jouf Region (22.4%),^[17] Jazan city (37.6% and 40.6%),^[18,19] and Western Region (33.8%).^[20]

Overseas studies showed variable results. Some of them reported prevalence rates comparable to what has been reported in the current study as those carried out in Qatar (52.5%),^[21] Mexico (48.3%),^[22] and Ethiopia (47%).^[23] However, it is higher than those reported in Palestine (40%),^[24] Philippines (18.2% and 31%),^[25,26] United Arab of Emirates (12.5%),^[27] and Germany (10.2%).^[28] Comparison between the aforementioned studies either conducted locally, including the present one, or internationally should be taken with caution putting in consideration variations in the demographics of patients, conduction of the study among all diabetic patients or those of specific types, using different tools in defining depression and finally different cultures, even in the same country. However, the high rate of depression among diabetic patients reported in this study is not surprising as the link between depression and diabetes has been previously confirmed, despite being unclear. Different explanations have been mentioned in the literature, including the shared parallel biological processes that include insulin resistance, hypothalamic pituitary adrenal access, and circadian rhythm.^[29] Additionally, diabetic care needs long life, careful eating style, checking blood glucose, hypoglycemic and hyperglycemic adverse symptom monitoring, regular exercise, and complication monitoring, which often impact badly the quality of life of patients with diabetes. All those needs could lead to depression among those patients.^[16]

In accordance with others,^[24,30-36] female diabetic patients were at higher risk of developing depression compared to males in

this study. This could be explained by some factors such as lack of social support and being more sensitive constitutionally to adverse life events.^[33,34]

In the present study, type 2 diabetic patients were at higher risk for developing depression compared to type I diabetic patients. This

agrees with what has been reported by Gemeay EM *et al.* (2015) in Riyadh.^[35] However, it contradicts what has been observed by others who indicated that depression was more reported among type 1 DM than type 2 DM patients.^[16,36]

In the present study, patients with history of any social issue with their family, relatives, or friends were at higher risk of developing depression compared to those without such history. The same has been observed in other studies conducted in Saudi Arabia^[16,37,38] and Jordan.^[39]

Patients who reported compliance to diet were at higher risk for developing depression compared to their peers, while those compliant to physical activity about 150 min/week or more were at significant lower risk to develop depression. Compliance to diet might be associated with some degree of stress that might affect the psychological status of patients and leads to development of depression, while compliance to physical exercise has been proved by others to improve the psychological status of persons. Egede *et al.*^[40] suggested that a decreased compliance to diet, exercise, and medication was associated with depression among diabetic adults. Also, Alhunayni NM *et al.* (2020) documented an association between depression and poor compliance with diet and physical activity,^[16] and Al-Amer RA *et al.* (2011)^[39] reported an association between depression and having poor compliance with diet among diabetics, while Salinero-Fort MA *et al.* (2018)^[41] observed an association between low physical activity and a higher risk of depression among diabetic patients.

The current study revealed that patients with nephropathy or neuropathy were more likely to have depression compared to their counterparts. An association between development of diabetic complications in general and having depression has

Table 3: Diabetes-related characteristics of the participants

	Frequency	Percentage
Type of diabetes		
Type 1	85	22.0
Type 2	301	78.0
Duration of DM (years) (n=384)		
<1	7	1.8
1-10	136	35.4
>10	241	62.8
HBA1c level (n=375)		
<7	59	15.7
7-9	203	54.2
>9	113	30.1
Current diabetes management		
Oral hypoglycemic drugs.	116	30.1
Multiple daily insulin injections	101	26.2
Oral hypoglycemia drugs + insulin.	169	43.8
Compliance to medication		
No	311	80.6
Yes	75	19.4
Compliance to diet		
No	337	87.3
Yes	49	12.7
Compliance to physical activity about 150 min/week or more		
No	141	36.5
Yes	245	63.5

Table 4: Predictors of depression among diabetic patients: Multivariate logistic regression analysis

	B	SE	AOR	95% CI	P
Gender					
Male ^a	1.004	0.241	1.0	---	<0.001
Female			2.73	1.70-4.38	
Type of diabetes					
Type 1 ^a	0.726	0.293	1.0	---	0.013
Type 2			2.07	1.16-3.67	
Have any social issue with your family, relatives, or friends					
No ^a	1.239	0.252	1.0	---	<0.001
Yes			3.45	2.11-5.66	
Compliance to diet					
No ^a	0.943	0.368	1.0	---	0.010
Yes			2.57	1.25-5.28	
Compliance to physical activity about 150 min/week or more					
No ^a	-0.584	0.241	1.0	---	0.015
Yes			0.56	0.35-0.89	
Nephropathy					
No ^a	0.925	0.328	1.0	---	0.005
Yes			2.52	1.33-4.80	
Neuropathy					
No ^a	0.587	0.244	1.0	---	0.016
Yes			1.80	1.11-2.90	

SE=Standard error, AOR=Adjusted odds ratio, CI=Confidence interval. a: Reference category; B: Slope. Terms of having children, education, compliance to medications, and other chronic diseases were not significant and removed from the final regression model

been documented in several studies as those patients need more care that affects their quality of life.^[16,41,42] Furthermore, D'Amato C *et al.*^[43] documented that pain of diabetic peripheral neuropathy was the most significant predictor of depression compared to other diabetes complications.

The present study is not without limitations, including its cross-sectional design, as the causal relationship between exposures and outcome cannot be established. Additionally, diagnosis of depression was not clinical as it depended on utilizing the PHQ-9 screening tool. Finally, it is a single-center study which could impact the generalizability of findings. Despite those limitations, the study is important from a public health point of view as it explored the magnitude and determinants of the association between diabetes and depression that might affect the glycemic control among affected diabetic patients.

Conclusion

Depression is a very prevalent problem affecting diabetic patients, particularly those of type 2. Additionally, female patients, those with history of any social issue with their family, relatives, or friends; those who reported compliance to diet; those not compliant to physical activity about 150 min/week or more; and patients with nephropathy or neuropathy were more likely to have depression compared to their counterparts.

Based on the study's findings, the following are recommended:

- Regular screening of diabetic patients for depression and referral of severe cases to psychiatric care.
- Collaboration between diabetic team and psychiatric one as regards the management of diabetes including lifestyle modification
- Particular attention should be given to high-risk groups including females and patients with diabetic complications
- Further multi-centric study including diabetic patients from different disciplines is highly recommended.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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