

The prevalence of depression among patients with diabetic foot ulcers at King Khalid University Hospital, Riyadh, Saudi Arabia

Alaa Aljamili¹, Lina Alyousif², Mazen Barhoush³, Reema Almasoud⁴

¹Department of Family Medicine, Ministry of Health, Riyadh, Saudi Arabia, ²Department of Family Medicine, King Saud University, Riyadh, Saudi Arabia, ³Department of Medicine, King Saud University, Riyadh, Saudi Arabia, ⁴Department of Medicine, College of Medicine, King Saud University, Riyadh, Saudi Arabia

ABSTRACT

Background and Aim: The prevalence rates of depression and anxiety among diabetic patients with diabetic foot ulcers (DFU) vary from one study to the other. We aimed to determine the prevalence of depression and the associated risk factors among patients with DFU. **Methods:** We conducted a cross-sectional study using a self-reported questionnaire on adult patients aged 18 years old and above with DFU at our institution. We used the 9-item Patient Health Questionnaire to evaluate the presence of depressive symptoms. **Results:** A total of 75 patients, 56 (74.7%) males and 19 (25.3%) females, participated in the study; 33 (44.0%) were more than 60 years old. The prevalence of moderate to severe depression among our patients was 35 (46.7%). Patients who had DFU for more than 1 year had a higher proportion of moderate to severe depression ($P = 0.032$). There were no significant differences in the proportion of patients who had depression according to age groups ($P = 0.456$), gender ($P = 0.095$), level of education ($P = 0.145$), employment ($P = 0.514$), type of diabetes ($P = 0.561$), duration of diabetes ($P = 0.704$), level of HbA1c ($P = 0.525$), smoking history ($P = 0.163$), and previous history of DFU ($P = 0.713$). Logistic regression analysis showed that patients who had DFU for more than 1 year were three times more at risk to have moderate to severe depression ($P = 0.049$). **Conclusion:** Patients with DFU have a high frequency of moderate to severe depression regardless of age, gender, or other sociodemographic characteristics, with patients with long-standing DFU having triple the risk of depression as those with freshly diagnosed DFU. Diabetic persons should be thoroughly assessed to reduce the diabetes result, and preventative actions and patient education about DFU are crucial.

Keywords: Depression, diabetes, diabetic foot ulcer, prevalence, risk factors

Introduction

Diabetes mellitus usually results in diabetic foot ulcers (DFUs), which pose subsequent disruptions in the patients' daily lives.^[1,2] Regardless of financial status and location, it is associated with amputation and life-threatening consequences.^[3,4] Additionally,

DFU management places a significant financial burden on the health-care systems of every nation in the world. Ancillary costs are mostly related to lost revenue brought on by impairment and untimely deaths.^[5,6]

Unquantifiable costs including pain, distress, loss, and emotional load, particularly anxiety and depression, are also linked to DFUs and have a negative impact on patients' living quality.^[7,8] Additionally, the psychological strain that DFU bears is attributed to a number of factors, including physical limitations and problems in daily life, heavy reliance on others, the potential of

Address for correspondence: Dr. Alaa Aljamili, Department of Family Medicine, Ministry of Health, P.O. Box 12746, Riyadh, Saudi Arabia. E-mail: Alaaaljamili@gmail.com

Received: 14-11-2023

Revised: 30-05-2024

Accepted: 24-06-2024

Published: 18-10-2024

Access this article online

Quick Response Code:



Website:
<http://journals.lww.com/JFMPC>

DOI:
10.4103/jfmpe.jfmpe_1824_23

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Aljamili A, Alyousif L, Barhoush M, Almasoud R. The prevalence of depression among patients with diabetic foot ulcers at King Khalid University Hospital, Riyadh, Saudi Arabia. J Family Med Prim Care 2024;13:4699-705.

losing a limb, increased hospital care necessities, and the loss of independence that comes with the disease.^[9,10]

It is not uncommon for diabetic foot patients to experience both depression and anxiety, and several previous researches emphasized how each one contributes to the other.^[11,4,7-11] Depression raises the incidence of diabetic complications, slows the healing of wounds, and triples the chance of death within 18 months of developing a first foot ulcer in people with diabetes mellitus.^[12] The fact that depression is linked to a higher likelihood of developing DFU compared to persons with diabetes and no depression is notable. Depression may come as a reaction to DFU foot ulceration.^[12-16]

The prevalence rates of depression and anxiety among diabetic patients with DFUs varied from one study to the other. In a study conducted among Jordanian patients with DFUs, the incidence of depression according to the 9-item Patient Health Questionnaire (PHQ-9) scale was 82.9% with mild, moderate, moderately severe, and severe consisting of 25%, 25.5%, 18.5%, and 13.9% of the population studied, respectively.^[17] Another study showed that the 1-, 3-, and 5-year incidence rates of depression were 10.1%, 20.4%, and 29.5%, respectively, in the limb-saving group and 4.5%, 8.2%, and 11.5%, respectively, in the amputation group.^[8] Furthermore, a study that used the Hospital Anxiety and Depression Scale (HADS) to assess the level of anxiety and depression among diabetic foot patients found that 37.5% of the 120 patients in the studied sample have moderate anxiety, and 36.6% of the study participants have moderate depression. Contingency correlation analysis showed that anxiety and depression have a significant correlation with the number of hospital admissions, duration of current admission, and previous amputation.^[18] In Saudi Arabia, a study showed the prevalence rate of anxiety was 37.7% and that of depression was 39.6%,^[11] whereas another study showed a prevalence of 19.6% and 24.9% for anxiety and depression, respectively.^[19]

To the best of our knowledge, there is still a dearth of information on the effects of anxiety and perceived social support on depression in DFU patients. In order to better understand the levels of depression, anxiety, and felt social support in DFU, the risk factors for developing depression, as well as the effects of anxiety and perceived social support on depression, this cross-sectional study set out to investigate these topics.

This study's findings are highly pertinent to the practice of primary care physicians, who are often the first point of contact for diabetic patients. By understanding the high prevalence and risk factors associated with depression among patients with diabetic foot ulcers, primary care physicians can better identify and manage these comorbid conditions early. Integrating mental health assessments, such as the PHQ-9, into routine diabetes care allows for timely interventions that can mitigate the adverse effects of depression on wound healing and overall health outcomes.^[8,18,20] Additionally, primary care physicians can play a crucial role in educating patients about the psychological impacts of DFU, promoting preventive

measures, and coordinating multidisciplinary care that includes mental health support and social services. This holistic approach not only improves the quality of life for patients but also reduces the burden on healthcare systems by preventing complications and hospitalizations.

Methods

We conducted a cross-sectional study using a structured questionnaire that was self-reported by patients with DFU at the diabetic foot clinic, Diabetes Center, King Khalid University Hospital, King Saud University in Riyadh, Saudi Arabia. Adult patients aged 18 years old and above of both genders were invited to participate in the study. Patients were informed of the purpose of the study, and informed consent was secured from each patient. Patients aged less than 18 years old and those who were not willing to participate were excluded from the study.

Sample size was calculated based on the formula: sample size = $Z_{1-\alpha/2}^2 p(1-p)/d^2$, where $Z_{1-\alpha/2}$ is standard normal variate [at 5% type 1 error ($P < 0.05$) or 1% type 1 error ($P < 0.01$)], p is the expected proportion in population, and d is the absolute error or precision. Using a standard normal variate at 5% (i.e. 1.96), an expected proportion of 5% (very few patients attending the clinic), and a precision of 5%, the calculated sample size was 75 patients.

The sociodemographic and medical information of the patients would be included in the questionnaire. PHQ-9 was used to evaluate depressive symptoms (PHQ-9). The PHQ is a self-report tool that was based on the DSM-IV criteria for depressive episodes from the American Psychiatric Association and offered both a diagnosis of major depressive syndrome and a continuous severity score.^[21] Participants rated how frequently they have had depressive thoughts or feelings over the past 2 weeks. The scale ranged from 0 (not at all) to 3 (nearly every day) for an overall score between 0 and 27. In general medical outpatients and among those with diabetes, validation studies have demonstrated excellent agreement between the self-report PHQ and a clinician-structured interview. The PHQ-9 score was summed up and interpreted as 0 (no depression), 1–9 (minimal to mild depression), and ≥ 10 (moderate to severe depression).^[21]

The Statistical Package for Social Sciences (SPSS) version 26.0 was used to examine the data (IBM-SPSS Inc., Armonk, New York, USA). Significant differences in the proportion and test of associations were determined using the Chi-square test and Fisher exact test. Logistic regression analysis was done to determine the factors associated with increased risk for depression. Statistical significance was determined by a P value of less than 0.05.

Institutional approval to conduct the study was obtained from the Institutional Review Board of King Saud university in Riyadh, Saudi Arabia (IRB no. E-23-7579). In addition, patients' consent was approved before the recruitment process.

Results

A total of 75 patients were recruited in this study. As shown in Table 1, the demographic profile of 75 diabetic patients with DFUs indicates that a majority were male (74.7%), with 44.0% being over 60 years old. Most patients had type II diabetes (80.0%) and less than a college education (72.0%). Employment status was nearly evenly split, with 44.0% employed and 56.0% unemployed. The duration of diabetes was predominantly over 10 years (84.0%). Treatment methods varied, with 13.3% on oral hypoglycemic drugs, 32.0% on insulin injections, and 54.7% on a combination of both [Table 1].

The HbA1c levels were higher than 7% in 69.4% of patients. A history of smoking was reported by 34.7%, and 69.3% had a previous history of DFUs. Regarding the duration of the current DFU, 69.3% had it for less than 1 year, while 17.3% had it for

Table 1: Demographic profile of 75 diabetic patients with DFU

Characteristics	n (%)
Gender	
Male	56 (74.7%)
Female	19 (25.3%)
Age groups	
18–60 years old	42 (56.0%)
>60 years old	33 (44.0%)
Diabetes type	
Type I	15 (20.0%)
Type II	60 (80.0%)
Level of education	
Less than a college education	54 (72.0%)
College degree or more	21 (28.0%)
Employment	
Employed	33 (44.0%)
Unemployed	42 (56.0%)
Duration of diabetes	
<5 years	2 (2.7%)
5–10 years	10 (13.3%)
>10 years	63 (84.0%)
Treatment of diabetes	
Oral hypoglycemic drugs	10 (13.3%)
Insulin injections	24 (32.0%)
Mixed oral and insulin	41 (54.7%)
HbA1c level	
<7%	23 (30.6%)
7% and more	52 (69.4%)
Smoking history	
Yes	26 (34.7%)
No	49 (65.3%)
Previous history of DFU	
Yes	52 (69.3%)
No	23 (30.7%)
Duration of current DFU	
<1 year	52 (69.3%)
1–3 years	13 (17.3%)
>3 years	10 (13.3%)
History of antidepressant medication use	
Yes	13 (17.3%)
No	62 (82.7%)

1–3 years, and 13.3% for more than 3 years. Only 17.3% reported using antidepressant medication [Table 1].

A larger proportion of the patients responded that they have not at all experienced little interest or pleasure in doing things (n = 38, 50.7%), feeling down, depressed, or hopeless (n = 33, 44.0%); trouble falling asleep or sleeping too much (n = 33, 44.0%); poor appetite or overeating (n = 40, 53.3%); feeling guilty or bad about themselves (n = 50, 66.7%); trouble with concentration (n = 38, 50.7%); moving or speaking slowly or opposite (n = 45, 60.0%); and have not at all experienced suicidal thoughts or harming self (n = 61, 81.3%) [Table 2].

The proportion of patients who felt down, depressed, and hopeless was significantly higher among patients who had less than a college degree holder compared to those who had a bachelor's degree or more (63.0% vs 38.1%, $P = 0.046$). Suicidal thoughts or harming the self was more prevalent among patients at the age group of 30–60 (21.4% vs 15.2% of patients aged >60 years), among females (21.1% vs 17.9% males), among patients who had less than a college degree holder (22.2% vs 9.5%), and among those who were employed (21.2% vs 16.7%), although the differences in the proportion did not reach statistical significance ($P > 0.05$) [Table 3].

There were no significant differences in the proportion in the responses according to duration of diabetes and blood sugar control ($P > 0.05$). A higher proportion of smokers significantly reported trouble in concentration compared to nonsmokers (73.1% vs 36.7%, $P = 0.003$). Patients who had DFU for more than 1 year posted a higher proportion of moving or speaking slowly compared to those who had DFU for less than a year (56.5% vs 32.7%, $P = 0.046$). The proportion of suicidal thoughts was significantly higher among smokers compared to nonsmokers (34.6% vs 12.2%, $P = 0.048$) as well as among patients who had DFU for more than a year (34.8% vs 11.5%, $P = 0.022$) [Table 4].

The prevalence of depression among our patients was 46.7% (35 patients), and 40 (53.3%) had no depression. Patients who had DFU for more than 1 year had a higher proportion of moderate to severe depression ($P = 0.045$). There were no significant differences in the proportion of patients who had depression according to age groups ($P = 0.456$), gender ($P = 0.095$), level of education ($P = 0.145$), employment ($P = 0.514$), type of diabetes ($P = 0.561$), duration of diabetes ($P = 0.704$), level of HbA1c ($P = 0.525$), smoking history ($P = 0.163$), and previous history of DFU ($P = 0.713$). Binary logistic regression analysis showed that patients who had DFU for more than 1 year were 3 times more at risk to have moderate to severe depression ($P = 0.035$) [Table 5].

Discussion

The high prevalence of depression among patients with DFU is of significant concern to primary care providers and family

Table 2: Responses of all 75 patients to the PHQ-9 questions

PHQ-9 questions: Over the past 2 weeks, how often you have experienced:	Not at all	Several days only	More than half of the days	Everyday
Little interest or pleasure in doing things	38 (50.7%)	22 (29.3%)	9 (12.0%)	6 (8.0%)
Feeling down, depressed, or hopeless	33 (44.0%)	27 (36.0%)	10 (13.3%)	5 (6.7%)
Trouble falling or staying asleep or sleeping too much	33 (44.0%)	13 (17.3%)	16 (21.3%)	13 (17.3%)
Feeling tired or having little energy	22 (29.3%)	27 (36.0%)	11 (14.7%)	15 (20.0%)
Poor appetite or overeating	40 (53.3%)	11 (14.7%)	12 (16.0%)	12 (16.0%)
Feeling guilty or bad about yourself	50 (66.7%)	15 (20.0%)	5 (6.7%)	5 (6.7%)
Trouble with concentration	38 (50.7%)	21 (28.0%)	8 (10.7%)	8 (10.7%)
Moving or speaking slowly or the opposite being restless and move a lot	45 (60.0%)	12 (16.0%)	9 (12.0%)	9 (12.0%)
Suicidal thoughts or harming self	61 (81.3%)	8 (10.7%)	2 (2.7%)	4 (5.3%)

Table 3: Proportion of responses to questions according to age groups, gender, educational level, and employment among 75 patients with DFU

PHQ-9 questions: Over the past 2 weeks, how often you have experienced:	Age groups		Gender		Education level		Employment	
	30-60 n=42	>60 n=33	Male n=56	Female n=19	< college n=54	Bachelor degree and more n=21	Employed n=33	Unemployed n=42
Little interest or pleasure in doing things								
Yes	20 (47.6%)	17 (51.5%)	25 (44.6%)	12 (63.2%)	29 (53.7%)	8 (38.1%)	15 (45.5%)	22 (52.4%)
No	22 (54.2%)	16 (48.5%)	31 (55.4%)	7 (36.8%)	25 (46.3%)	13 (61.9%)	18 (47.6%)	20 (47.6%)
	P=0.459		P=0.129		P=0.169		P=0.359	
Feeling down, depressed or hopeless								
Yes	22 (52.4%)	20 (60.6%)	29 (51.8%)	13 (68.4%)	34 (63.0%)	8 (38.1%)	20 (60.6%)	22 (52.4%)
No	20 (47.6%)	13 (39.4%)	27 (48.2%)	6 (31.6%)	20 (37.0%)	13 (61.9%)	13 (39.4%)	20 (47.6%)
	P=0.317		P=0.160		P=0.046		P=0.317	
Trouble falling or staying asleep or sleeping too much								
Yes	23 (54.8%)	19 (57.6%)	29 (51.8%)	13 (68.4%)	31 (57.4%)	11 (52.4%)	17 (51.5%)	25 (59.5%)
No	19 (45.2%)	14 (42.4%)	27 (48.2%)	6 (31.6%)	23 (42.6%)	10 (47.6%)	16 (48.5%)	17 (40.5%)
	P=0.497		P=0.160		P=0.445		P=0.323	
Feeling tired or having little energy								
Yes	28 (66.7%)	25 (75.8%)	37 (66.1%)	16 (84.2%)	39 (72.2%)	14 (66.7%)	23 (69.7%)	30 (71.4%)
No	14 (33.3%)	8 (24.2%)	19 (33.9%)	3 (15.8%)	15 (27.8%)	7 (33.3%)	10 (30.3%)	12 (28.6%)
	P=0.275		P=0.111		P=0.417		P=0.535	
Poor appetite or overeating								
Yes	17 (40.5%)	18 (54.5%)	23 (41.1%)	12 (63.2%)	24 (44.4%)	11 (52.4%)	12 (36.4%)	23 (54.8%)
No	25 (59.5%)	15 (45.5%)	33 (58.9%)	7 (36.8%)	30 (55.6%)	10 (47.6%)	21 (63.6%)	19 (45.2%)
	P=0.164		P=0.081		P=0.359		P=0.088	
Feeling guilty or bad about yourself								
Yes	16 (38.1%)	9 (27.3%)	16 (28.6%)	9 (47.4%)	17 (31.5%)	8 (38.1%)	13 (39.4%)	12 (28.6%)
No	25 (61.9%)	24 (72.7%)	40 (71.4%)	10 (52.6%)	37 (68.5%)	13 (61.9%)	20 (60.6%)	30 (71.4%)
	P=0.230		P=0.112		P=0.388		P=0.229	
Trouble with concentration								
Yes	18 (42.9%)	19 (57.6%)	30 (53.6%)	7 (36.8%)	28 (51.9%)	9 (42.9%)	15 (45.5%)	22 (52.4%)
No	24 (57.1%)	14 (42.4%)	26 (46.4%)	12 (63.2%)	26 (48.1%)	12 (57.1%)	18 (54.5%)	20 (47.6%)
	P=0.151		P=0.160		P=0.330		P=0.359	
Moving or speaking slowly								
Yes	16 (38.1%)	14 (42.4%)	19 (33.9%)	11 (57.9%)	22 (40.7%)	8 (38.1%)	11 (33.3%)	19 (45.2%)
No	26 (61.9%)	19 (57.6%)	37 (66.1%)	8 (42.1%)	32 (59.3%)	13 (61.9%)	22 (66.7%)	23 (54.8%)
	P=0.443		P=0.059		P=0.524		P=0.210	
Suicidal thoughts or harming self								
Yes	9 (21.4%)	5 (15.2%)	10 (17.9%)	4 (21.1%)	12 (22.2%)	2 (9.5%)	7 (21.2%)	7 (16.7%)
No	5 (15.2%)	28 (84.8%)	46 (82.1%)	15 (78.9%)	42 (77.8%)	19 (90.5%)	26 (78.8%)	35 (83.3%)
	P=0.350		P=0.498		P=0.176		P=0.417	

physicians, who are often at the forefront of managing chronic conditions like diabetes. Understanding the interplay between DFU and mental health is critical as it impacts not only the

physical outcomes but also the overall well-being of patients. By incorporating regular mental health screenings and holistic management plans, primary care physicians can better address the

Table 4: Proportion of responses to questions according to duration of DM, HbA1c level, and duration of current DFU among 75 patients with DFU

PHQ-9 questions: Over the past 2 weeks, how often you have experienced:	Duration of DM		Blood sugar control		Smoking		Duration of current DFU	
	≤10 years n=12	>10 years n=63	controlled n=24	uncontrolled n=51	smoker n=26	Non-smoker n=49	≤1 year (newly diagnosed) n=52	>1 year n=23
Little interest or pleasure in doing things								
Yes	6 (50.0%)	31 (49.2%)	13 (54.2%)	24 (47.1%)	15 (57.7%)	22 (44.9%)	22 (42.3%)	15 (65.2%)
No	6 (50.0%)	32 (50.8%)	11 (45.8%)	27 (52.9%)	11 (42.3%)	27 (55.1%)	30 (57.7%)	8 (34.8%)
	P=0.603		P=0.372		P=0.209		P=0.057	
Feeling down, depressed or hopeless								
Yes	9 (75.0%)	33 (52.4%)	14 (58.3%)	28 (54.9%)	15 (57.7%)	27 (55.1%)	26 (50.0%)	16 (69.6%)
No	3 (25.0%)	30 (47.6%)	10 (41.7%)	23 (45.1%)	11 (42.3%)	22 (44.9%)	26 (50.0%)	7 (30.4%)
	P=0.129		P=0.490		P=0.513		P=0.092	
Trouble falling or staying asleep or sleeping too much								14 (60.9%)
Yes	7 (58.3%)	35 (55.6%)	12 (50.0%)	30 (58.8%)	16 (61.5%)	26 (53.1%)	28 (53.8%)	9 (39.1%)
No	5 (41.7%)	28 (44.4%)	12 (50.0%)	21 (41.2%)	10 (38.5%)	23 (46.9%)	24 (46.2%)	
	P=0.559		P=0.319		P=0.324		P=0.379	
Feeling tired or having little energy								
Yes	8 (66.7%)	45 (71.4%)	16 (66.7%)	37 (72.5%)	19 (73.1%)	34 (69.4%)	35 (67.3%)	18 (78.3%)
No	4 (33.3%)	18 (28.6%)	8 (33.3%)	14 (27.5%)	7 (26.9%)	15 (30.6%)	17 (32.7%)	5 (21.7%)
	P=0.492		P=0.397		P=0.478		P=0.249	
Poor appetite or overeating								
Yes	6 (50.0%)	29 (46.0%)	9 (37.5%)	26 (51.0%)	13 (50.0%)	22 (44.9%)	24 (46.2%)	11 (47.8%)
No	6 (50.0%)	34 (54.0%)	15 (62.5%)	25 (49.0%)	13 (50.0%)	27 (55.1%)	28 (53.8%)	12 (52.2%)
	P=0.523		P=0.200		P=0.429		P=0.546	
Feeling guilty or bad about yourself								
Yes	4 (33.3%)	21 (33.3%)	7 (29.2%)	18 (64.7%)	10 (38.5%)	15 (30.6%)	16 (30.8%)	9 (39.1%)
No	8 (66.7%)	42 (66.7%)	17 (70.8%)	33 (64.7%)	16 (61.5%)	34 (69.4%)	36 (69.2%)	14 (60.9%)
	P=0.639		P=0.401		P=0.332		P=0.326	
Trouble with concentration								
Yes	6 (50.0%)	31 (49.2%)	11 (45.8%)	26 (51.0%)	19 (73.1%)	18 (36.7%)	25 (48.1%)	12 (52.2%)
No	6 (50.0%)	32 (50.8%)	13 (54.2%)	25 (49.0%)	7 (26.9%)	31 (63.3%)	27 (51.9%)	11 (47.8%)
	P=0.603		P=0.433		P=0.003		P=0.469	
Moving or speaking slowly								
Yes	2 (16.7%)	28 (44.4%)	8 (33.3%)	22 (43.1%)	11 (42.3%)	19 (38.8%)	17 (32.7%)	13 (56.5%)
No	10 (83.3%)	35 (55.6%)	16 (66.7%)	29 (56.9%)	15 (57.7%)	30 (61.2%)	35 (67.3%)	10 (43.5%)
	P=0.066		P=0.291		P=0.478		P=0.046	
Suicidal thoughts or harming self								
Yes	2 (16.7%)	12 (19.0%)	3 (12.5%)	11 (21.6%)	9 (34.6%)	6 (12.2%)	6 (11.5%)	8 (34.8%)
No	10 (83.3%)	51 (81.0%)	21 (87.5%)	40 (78.4%)	17 (65.4%)	43 (87.8%)	46 (88.5%)	15 (65.2%)
	P=0.605		P=0.273		P=0.048		P=0.022	

multifaceted needs of diabetic patients, ultimately improving both mental and physical health outcomes. This study underscores the necessity for primary care providers to adopt a proactive approach in recognizing and managing depression in patients with DFU, thereby enhancing the quality of care and patient outcomes in primary care settings.

The study aimed to determine the prevalence and the risk of depression among patients with DFU in our institution. We found that 46.7% of our patients had moderate to severe depression. Furthermore, we found that patients who had longer duration of DFU regardless of the duration of diabetes had three times the risk for depression among patients with diabetes.

Our results are in line with earlier cohort studies of individuals with commonly occurring DFUs, which have shown that

depression is linked to larger and more severe foot ulcers at presentation as well as delayed healing and increased recurrence of foot ulcers.^[22,23] Similar to our findings, a meta-analysis from 11 relevant studies conducted in Europe, Asia, and North America in 2022 revealed a prevalence rate of 26% to 85%.^[7]

Impaired glycemic control and duration of diabetes are two additional possible mediators of the link between depression and DFUs.^[24-27] We did not discover a statistically significant correlation between HbA1c level and the length of diabetes with depression, in contrast to these investigations. In our study, we discovered that the prevalence of depression was 85.7% in patients with diabetes for more than 10 years and that HbA1c made very little difference in the prevalence of moderate to severe depression. The geographical location and patient access to healthcare services targeted at eliminating inequities as well

Table 5: Proportion of patients with no depression, mild depression, and moderate to severe depression based on the PHQ-9

Variables	No depression	Mild depression	Moderate to severe depression	ps	OR	95% CI	P
Age groups							
<60	4 (9.5%)	24 (57.1%)	14 (33.3%)	0.939	Ref.	0.431 – 3.068	0.780
60 and above	3 (9.1%)	20 (60.6%)	10 (30.3%)		1.150		
Gender							
Male	7 (12.5%)	33 (58.9%)	16 (28.6%)	0.245	Ref.	0.618-5.352	0.278
Female	0	11 (57.9%)	8 (42.1%)		1.818		
Education							
Less college	6 (11.1%)	30 (55.6%)	18 (33.3%)	0.690	Ref.	0.415 – 3.766	0.692
Bachelor and more	1 (4.8%)	14 (66.7%)	6 (28.6%)		1.250		
Employment							
Unemployed	4 (9.5%)	24 (57.1%)	14 (33.3%)	0.939	Ref.	0.326 – 2.320	0.780
Employed	3 (9.1%)	20 (60.6%)	10 (30.3%)		0.870		
Diabetes type							
Type I	1 (6.7%)	9 (60.0%)	5 (33.3%)	0.924	Ref.	0.278 – 3.088	0.902
Type II	6 (10.0%)	35 (58.3%)	19 (31.7%)		0.927		
Duration of diabetes							
<10 years	1 (8.3%)	8 (66.7%)	3 (25.0%)	0.388	Ref.	0.367 – 6.130	0.572
≥10 years	6 (9.5%)	36 (57.1%)	21 (33.3%)		1.500		
HbA1c level							
<7	2 (8.3%)	15 (62.5%)	7 (29.2%)	0.931	Ref.	0.423 – 3.489	0.718
>7	5 (9.8%)	29 (56.9%)	17 (33.3%)		1.214		
Smoking							
Yes	1 (3.8%)	13 (50.0%)	12 (46.2%)	0.151	Ref.	0.963 – 7.250	0.059
No	6 (12.2%)	31 (63.3%)	12 (24.5%)		2.643		
Previous DFU							
Yes	6 (11.5%)	28 (53.8%)	18 (34.6%)	0.479	Ref.	0.503 – 4.471	0.467
No	1 (4.3%)	16 (69.6%)	6 (26.1%)		1.500		
Duration of DFU							
≤1 year	5 (9.6%)	34 (65.4%)	13 (25.0%)	0.049	Ref.	Ref.	0.043
>1 year	2 (8.7%)	10 (43.5%)	4 (47.8%)		1.883	1.020 – 3.478	

as ongoing health education, promotion, and care that enhances patients' quality of life may have an impact on the inconsistent outcomes that contrast earlier studies.^[24]

We also discovered, in line with other studies, that men and people with lower levels of education had a higher prevalence of moderate to severe depression.^[24,25,28] However, we found no discernible correlation between gender, education level, and the prevalence of depression. This is most likely a result of the study's limited sample size. We anticipated that a bigger sample size would make the link more pronounced. The strong correlation between the length of DFU and depression is the study's main finding. We discovered that among patients with DFU for a longer period of time, there was a 34.8% frequency of suicidal ideation or self-harm. This is further supported by the fact that patients with DFU who had it for a longer time than those who only recently received a diagnosis had a 3 times higher risk of depression. In numerous earlier investigations, independent of age or gender, it was discovered that macrovascular complications of diabetes, including DFU, were substantially related with depression, suicidal thoughts, and all-cause mortality, including death.^[29,30] Therefore, regular psychological evaluations for diabetic patients are absolutely crucial. Early detection of depression may enable the patient to manage their mental illness better, reducing the likelihood of suicidal thoughts and other negative effects.^[29,30]

Our study has limitations as well. One could be the numerous inconsequential relationships between the prevalence of depression and patient variables as a result of the very small sample size. Second, because patient characteristics, such as depression and other covariates, were only recorded at baseline, we were unable to completely assess mediation by the covariates or explore how changes in depression may have affected the incidence of incident foot ulcers. Our results, however, have confirmed earlier research on the higher incidence of depression among individuals with long-standing DFU. Although we were unable to directly examine it, there is certainly a bidirectional association between depression and diabetic foot problems. Finally, the fact that this was a study conducted by a single institution in a specific geographical region may have limited the generalizability of our conclusions.

Conclusion

Regardless of age, gender, or other sociodemographic factors, patients with DFU have a high incidence of moderate to severe depression, with patients with long-standing DFU having triple the risk of depression as those with recently diagnosed DFU. To lessen this diabetes consequence, diabetic individuals should be rigorously examined, and prophylactic measures and patient education regarding DFU are essential. Due to their increased likelihood of developing the disease, patients who have had

DFU should also undergo thorough screening and psychological evaluation for depression.

Ethical approvals

Institutional approval to conduct the study was obtained from the Institutional Review Board of King Saud university in Riyadh, Saudi Arabia (IRB no. E-23-7579).

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- Brooks BM, Shih CD, Brooks BM, Tower DE, Tran TT, Simon JE, *et al.* The diabetic foot-pain-depression cycle. *J Am Podiatr Med Assoc* 2023;113:22-126.
- Ferreira G, Faria S, Carvalho A, Pereira MG. Relaxation intervention to improve diabetic foot ulcer healing: Results from a pilot randomized controlled study. *Wound Repair Regen* 2023;31:528-41.
- Diabetes Canada Clinical Practice Guidelines Expert Working Group; Robinson DJ, Hanson K, Jain AB, Kichler JC, Mehta G, Melamed OC, *et al.*; Diabetes Canada Clinical Practice Guidelines Steering Committee; Bajaj HS, Barnes T, Gilbert J, Honshorst K, Houlden R, Kim J, *et al.* Diabetes and mental health. *Can J Diabetes* 2023;47:308-44.
- Hussain A. Recognising the impact of diabetes on mental health. *Diabetes Res Clin Pract* 2023;206:111028.
- Jodheea-Jutton A, Hindocha S, Bhaw-Luximon A. Health economics of diabetic foot ulcer and recent trends to accelerate treatment. *Foot (Edinb)* 2022;101909.
- Hopkins RB, Burke N, Harlock J, Jegathisawaran J, Goeree R. Economic burden of illness associated with diabetic foot ulcers in Canada. *BMC Health Serv Res* 2015;15:13.
- Jiang FH, Liu XM, Yu HR, Qian Y, Chen HL. The incidence of depression in patients with diabetic foot ulcers: A systematic review and meta-analysis. *Int J Low Extrem Wounds* 2022;21:161-73.
- Chun DI, Kim J, Kang EM, An CY, Min TH, Kim S, *et al.* Does amputation negatively influence the incidence of depression in diabetic foot patients? A population-based nationwide study. *Appl Sci* 2022;12:1653.
- Polikandrioti M. Quality of life in diabetic foot ulcer, grade 3: Associated demographic factors. *Folia Med (Plovdiv)* 2022;64:229-39.
- Mairghani M. IDF21-0233 health-related quality of life in patients with diabetic foot ulcers in the Arab World: A systematic review. *Diabetes Res Clin Pract* 2022;186:109428.
- Ahmad A, Abujbara M, Jaddou H, Younes NA, Ajlouni K. Anxiety and depression among adult patients with diabetic foot: Prevalence and associated factors. *J Clin Med Res* 2018;10:411-8.
- Pearson S, Nash T, Ireland V. Depression symptoms in people with diabetes attending outpatient podiatry clinics for the treatment of foot ulcers. *J Foot Ankle Res* 2014;7:47.
- Williams L, Rutter CM, Katon WJ, Reiber GE, Ciechanowski P, Heckbert SR, *et al.* Depression and incident diabetic foot ulcers: A prospective cohort study. *Am J Med* 2010;123:748-54.
- Wang X, Cai L, Qian J, Peng J. Social support moderates stress effects on depression. *Int J Ment Health Syst* 2014;8:41.
- Ren P, Qin X, Zhang Y, Zhang R. Is social support a cause or consequence of depression? A longitudinal study of adolescents. *Front Psychol* 2018;9:1634.
- Laopoulou F, Kelesi M, Fasoi Z, Vasilopoulos G, Polikandrioti M. Perceived social support in individuals with diabetic foot ulcers: A cross-sectional survey. *J Wound Ostomy Continence Nurs* 2020;47:65-71.
- Abeer M, Gharaibeh B. Prevalence of depression and its associated factors among Jordanian diabetic foot patients. *Int J Med Res Health Sci* 2019;8:43-52.
- Salman AD, Bakey SJ. Detection the level of anxiety and depression among diabetic foot patients at Al-Najaf Al-Ashraf Teaching Hospitals. *Indian Forensic Med Toxicol* 2021;15:3208-17.
- Alosaimi FD, Labani R, Almasoud N, Alhelali N, Althawadi L, AlJahani DM. Associations of foot ulceration with quality of life and psychosocial determinants among patients with diabetes; A case-control study. *J Foot Ankle Res* 2019;12:57.
- Eldesouky MS, Elwasify MA, Ibrahim EI. Psychological aspects of patients with diabetic neuropathic foot. *Egypt J Hosp Med* 2022;89:4938-44.
- van Steenberg-Weijenburg KM, de Vroeghe L, Ploeger RR, Brals JW, Vloedveld MG, Veneman TF, *et al.* Validation of the PHQ-9 as a screening instrument for depression in diabetes patients in specialized outpatient clinics. *BMC Health Serv Res* 2010;10:235.
- Ismail K, Winkley K, Stahl D, Chalder T, Edmonds M. A cohort study of people with diabetes and their first foot ulcer: The role of depression on mortality. *Diabetes Care* 2007;30:1473-9.
- Monami M, Longo R, Desideri CM, Masotti G, Marchionni N, Mannucci E. The diabetic person beyond a foot ulcer: Healing, recurrence, and depressive symptoms. *J Am Podiatr Med Assoc* 2008;98:130-6.
- Al-Ayed M, Moosa SR, Robert AA, Al Dawish M. Anxiety, depression and their associated risk factors among patients with diabetic foot ulcer: A two center cross-sectional study in Jordan and Saudi Arabia. *Diabetes Metab Syndr* 2021;15:237-42.
- Polikandrioti M, Vasilopoulos G, Koutelekos I, Panoutsopoulos G, Gerogianni G, Babatsikou F, *et al.* Quality of life in diabetic foot ulcer: Associated factors and the impact of anxiety/depression and adherence to self-care. *Int J Low Extrem Wounds* 2020;19:165-79.
- Katon W, Von Korff M, Ciechanowski P, Russo J, Lin E, Simon G, *et al.* Behavioral and clinical factors associated with depression among individuals with diabetes. *Diabetes Care* 2004;27:914-20.
- Lustman PJ, Clouse RE, Ciechanowski PS, Hirsch IB, Freedland KE. Depression-related hyperglycemia in type 1 diabetes: A mediational approach. *Psychosom Med* 2005;67:195-9.
- Alzughbi T, Badedi M, Darraj H, Hummadi A, Jaddoh S, Solan Y, *et al.* Diabetes-related distress and depression in Saudis with type 2 diabetes. *Psychol Res Behav Manag* 2020;13:453-8.
- Wu CS, Hsu LY, Wang SH. Association of depression and diabetes complications and mortality: A population-based cohort study. *Epidemiol Psychiatr Sci* 2020;29:e96.
- Tsirigotis S. Depression in diabetic foot ulcers. *Health Res J* 2020;6:105-6.